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The Problem of Modal Upgrading in Aristotle's Apodictic Syllogistic

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This is another contribution to the unending controversy over the two Barbaras. My approach to the problem is hopefully quite new: I wish to view the issue through the prism of modal upgrading. Modal upgrading occurs when a subject term that has only been predicated of assertorically in the premises of a syllogism is predicated of apodictically either: i) in the syllogism's conclusion, or; ii) in some proposition that is derived from either the premises of the syllogism alone or the premises in combination with other propositions that do not refer to the proposition's subject term. I call the proposition after it has been upgraded the upgraded proposition.

When it is the conclusion that is the upgraded proposition, it is obviously a different predicate being predicated of the proposition's subject than was predicated in the premises. Aristotle endorses this kind of upgrading; it is effectively what happens in any valid mixed modal syllogism when the minor premise is not apodictic (e.g., Barbara LXL).

In other cases the upgraded proposition is not a conclusion but still follows from the premises alone. In these cases it is the same predicate being predicated of the same subject in the upgraded proposition as in the premises, although the quantities of the propositions are different (one is universal, another particular); e.g., the upgrading of "All C are B" to "Some C is necessarily B". Aristotle rejects this kind of upgrading and takes its occurrence as sufficient to deny the validity of the given syllogism (e.g., Barbara XLL).

I will describe a third type where both the predicate and subject remain the same and the quantity of the proposition remains the same as in the premise, e.g., the upgrading of "All C are B" to "All C are necessarily B". In these cases it will turn out that the upgraded proposition is not derived from the premises alone, or at least, not syllogistically from the premises alone. This kind of upgrading too is reason for denying the validity of any syllogism from which the upgraded proposition follows as a consequence. I will show that Barbara LXL entails this kind of modal upgrading and should be rejected for this reason.

Armed with this notion of modal upgrading I want to attack the problem of the two Barbaras in Aristotle's apodictic syllogistic. Aristotle himself endorses mixed modal Barbara when the major is necessary and the minor is assertoric, thereby endorsing the first kind of modal upgrading, but rejects Barbara when the minor is necessary and the major is assertoric on the grounds that it leads to the second kind of modal upgrading. Theophrastus endorses the *peioram rule* which rejects both Barbaras on the grounds that the conclusion can only be as strong as the weakest premise. Łukasiewicz endorses both Barbaras. I will argue that *both* Barbaras lead to unacceptable modal upgrading and should be taken to be invalid for that reason. Hence, I agree with Theophrastus about the two Barbaras; however, I do not endorse the *peioram rule* because I think that the negative mixed modal syllogisms generally avoid this problem and is mostly correct.

1. *What is modal upgrading?*

In this paper I want to discuss the phenomenon of *modal upgrading*. There is what I will call "weak modal upgrading" and "strong modal upgrading". In weak modal upgrading a

subject term to which some predicate term is said to belong assertorically in a syllogism's premises is shown in the syllogism's conclusion to be such that a different predicate term is said to belong to it necessarily. There is, then, an upgrading from something belonging assertorically to something else belonging necessarily for the same subject term; for example, All C are B is upgraded to All C are necessarily A. Strong modal upgrading is similar except that it is not a different predicate term that is said to belong necessarily but the same predicate term; for example, All B are A is upgraded to Some B are necessarily A or to All B are necessarily A.

Aristotle would accept weak modal upgrading as a corollary of the mixed modal syllogism Barbara LXL, viz.,

All B are necessarily A
All C are B
Therefore, all C are necessarily A

The minor term, to which the middle term is said to belong assertorically in the minor premise, has the major term said to belong necessarily to it in the conclusion (30a15-23). In summary: "All C are B" is weakly modally upgraded to "All C are necessarily A".

That Aristotle would not accept strong modal upgrading is shown in his proof that the mixed modal syllogism Barbara XLL is not valid, viz.

All B are A
All C are necessarily B
Therefore, all C are necessarily A

Observe that modal upgrading does not occur in the syllogism itself, there being no subject term that is at the same time subject of both an assertoric and an apodictic predication; C is the only term that occurs twice as subject, and on both occasions the predication is apodictic. This, however, is what Aristotle says about it (30a25-8):

> [I]f the major premiss is not necessary, but the minor is necessary, the conclusion will not be necessary. For if it were, it would result both through the first figure and through the third that A belongs necessarily to some B. But this is false; for B may be such that it is possible that A should belong to none of it. Further, an example also makes it clear that the conclusion not be necessary, e.g. if A were movement, B animal, C man: man is an animal necessarily, but an animal does not move necessarily, nor does man.

The modal upgrading is from the major premise "All B are A" to "Some B is necessarily A". This is strong because the same terms are involved, although the quantity of the proposition

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has changed from "All" to "Some". We can show that "Some B is necessarily A" is true if the conclusion of Barbara XLL is true by the third-figure modal syllogism Darapti LLL:

All C are necessarily A	(our original conclusion)
All C are necessarily B	(our original minor premise)
Therefore, some B is necessarily A	

Since "All B are A" is only assertoric, it ought to be possible also that no B is A, but this is inconsistent with some B being necessarily A. Because he rejects this modal upgrading, Aristotle rejects Barbara XLL.

There would be an even stronger upgrading were necessary belonging a reflexive relation, that is to say, if for all A, A belongs necessarily to A. Then we would upgrade with the same terms and the same quantity through Barbara LXL:

All A are necessarily A
All C are A
Therefore, all C are necessarily A

As Storrs-McCall (1963, 50) aptly describes, this amounts to "the collapse of all modal distinctions whatsoever"; there would not be anything that belongs without belonging necessarily. Likewise, I will call this case "modal collapse". The moral is that necessary belonging cannot be a reflexive relation.

I will now describe a case weaker than modal collapse which I will call "partial modal collapse". Unlike the strong modal upgrading in Barbara XLL, it does not depend on the premises alone. Unlike modal collapse, it does not imply that when A belongs to B it does so necessarily. What it implies is that under certain conditions, if A does belong to B necessarily, B will belong necessarily to whatever it belongs to. In other words, from

All B are necessarily A
All C are B

it will not only follow (by Barbara LXL) that

All C are necessarily A

which is the familiar and so-far accepted case of weak modal upgrading, but, under certain conditions, it will also follow that

All C are necessarily B

which is a case of strong (and thus illegitimate) modal upgrading where the terms and the quantity remain the same (i.e., from "All C are B" to "All C are necessarily B"). This kind of upgrading I call "partial modal collapse".

The problem here is that although the fact that necessary belonging is not symmetrical means that it is not a theorem that if "All B are necessarily A" then "All A are necessarily B", it cannot be ruled out either that both may be true, and if they are, we get the same consequences as if the relation were reflexive. Under the conditions where both are true it can be shown in several ways that partial modal collapse is the consequence. The simplest way to show this is that if necessary belonging is transitive then "All B are necessarily A" and "All A are necessarily B" it follows that "All B are necessarily B" (and that "All A are necessarily A") and we get the same results as if necessary belonging were reflexive. We can also show it by combining "All A are necessarily B" with our original conclusion "All C are necessarily A" as follows:

All A are necessarily B
All C are necessarily A
Therefore, all C are necessarily B

This is the pure modal syllogism Barbara LLL. The moral now seems to be that if "All B are necessarily A" then, if partial modal collapse is to be avoided, it *cannot* be true that "All A are necessarily B". The relation of necessary belonging must be not only irreflexive but anti-symmetric.

Partial modal collapse does not follow from the initial premises alone but the initial premises with the addition of "All A are necessarily B"; this, along with the fact that the proposition has the same predicate and quantity, is what makes it the strong kind of modal upgrading I described above. Unfortunately, any strategy to rule out "All A are necessarily B" is going to be inconsistent with Aristotle's use of conversion and ekthesis. For if all B are necessarily A, it follows by conversion that some A is necessarily B, and then under circumstances where A is co-extensive with B it is difficult to see how it can fail to be the case that all A are necessarily B, and if A is not co-extensive with B we can always take terms that *will* be co-extensive with B and derive "All B are necessarily B" using that term. A collapse-making proposition can always be derived from the initial premises by conversion and ekthesis, though it cannot be derived syllogistically from those premises.

So, Barbara LXL has partial modal collapse as a consequence: whatever belongs, belongs necessarily to whatever it belongs to as long as something necessarily belongs to it. It

is this "as long as . . ." that differentiates this from the obviously unacceptable modal collapse that would result were necessary belonging a reflexive relation. As such, it is not so obviously unacceptable, and a number of recent accounts of Aristotle's modal syllogistic endorse this kind of modal upgrading. It is to these accounts that I now turn.

2. *Is partial modal collapse acceptable?*

It may be thought that what I have said so far is not very interesting. After all, the validity of Barbara LXL has been problematic from the start; Aristotle's pupil Theophrastus denied its validity, arguing that the very same terms that serve to show the invalidity of Barbara XLL work just as well for Barbara LXL, that is to say:

All men are necessarily animals
All moving things are men
Therefore, all moving things are necessarily animals

It is possible that all moving things are men, but it does not seem possible that all moving things are necessarily animals, because then it would follow by conversion that some animal necessarily moves, and Aristotle quite specifically says when proving the invalidity of Barbara XLL that no animal or man moves necessarily.

We can see from this example that partial modal collapse might actually be seen as some kind of solution to this problem. The problem with this example, it might be said, is simply that the minor premise "All moving things are men" is false, or to be more precise it is incompatible with the truth of the major premise "All men are necessarily animals", for from them we can infer a conclusion "All moving things are necessarily animals" that those making this case would say is false, and obviously so. (I would argue that this conclusion could be true, and likewise both premises, but it would be question-begging at this point to insist on it.) What cannot be denied is that if we change the accidental term "moving thing" into an essence term like "Greeks" we get Barbara LLL:

All men are necessarily animals
All Greeks are necessarily men
Therefore, all Greeks are necessarily animals

The validity of Barbara LXL is preserved by making semantic restrictions on what terms can be used in the premises. Barbara LXL is just a coyer version of Barbara LLL hiding the apodicticity of its minor premise under its petticoats. Note that under these semantic

restrictions this kind of modal upgrading of the minor premise is true independently of the conditions I said were necessary for partial modal collapse; instead, all that is required is that the terms be of a certain kind.

Malink (2013) offers this kind of account and at (2013, 122) he explicitly endorses partial modal collapse: "[E]very subject of an essential predication is predicated essentially of everything of which it is predicated. In other words, if there is an A that is predicated essentially of B, then B is predicated essentially of everything of which it is predicated". Without going through his argument, his idea is that all the terms must be essence terms, and any true predication of an essence term must be an essential and hence necessary predication. Rini (2011) also notes that if all the terms are what she calls "red" terms (which are effectively the same as Malink's essence terms) Barbara LXL will imply Barbara LLL and be valid.[1] Taking a slightly different route, van Rijen (1989) produces much the same results by assuming that all the terms are "homogenous", even going further than Malink by embracing "All A are necessarily A" as a logical truth (given that trivially A is homogeneous with A). Thom (1996) also embraces the reflexivity of necessary belonging, at least for certain kinds of terms. Not everyone, then, finds "modal collapse" to be as "dire" as Storrs-McCall does, and as I have earlier presented it to be. Malink does reject reflexivity and modal collapse, but embraces partial modal collapse. Whether or not these consequences are as dire as I have presented them depends in a large part on the independent plausibility of making semantic restrictions of one kind or another (i.e., essence terms for Malink, homogeneous terms for van Rijen). But I will argue that it is misguided to make these kinds of semantic restrictions on the terms.

I will now give several objections to making such restrictions. None, perhaps, will be thought compelling by Malink and Rini. But collectively they will show how much the modal

[1] Rini's claim is one of sufficiency, not necessity. The only term that Rini seems to take as "red" in order for Barbara LXL to be valid is the major term. In other words, she considers that for a necessary predication to be true the term predicated must be a "red" term. Unlike Malink, she does not require the minor or middle terms to be red, and so for her Barbara LXL does not in general imply Barbara LLL as it does for Malink. The reason for this is that, again unlike Malink, Rini takes necessity to modify the term, whereas Malink takes it to modify the copula. By taking it as a term, Barbara LXL becomes a trivial substitution-instance of Barbara XXX. However, I don't see how this is going to rule out Theophrastus' counter-example, since in the counter-example the only term that is not "red" is moving, and this does not appear as a predicate in a necessary predication (in fact, it does not appear as a predicate at all). Furthermore, at (2011, 78) she notes that Aristotle does use accidental terms in the subject position of true apodictic premises, so presumably she believes that the minor premise "All moving things are men" in the counter-example could be true. This being so, although she mentions Theophrastus briefly at (2011, 74 n.2) I am not sure how she would respond to him except by simply accepting the conclusion that all moving things are necessarily animals.

syllogistic differs from the assertoric syllogistic once we allow for semantic restrictions on the terms, and point out that no such differences are advertised by Aristotle.

The first is that the modal syllogistic is not purely formal—you cannot tell, without looking at the terms, whether both premises can be true at once, or whether the conclusion follows. This is not a new objection: as Rini notes, Barnes objects that there is no sign of any classification of predicates in the text. In response, Rini concedes this for the assertoric syllogistic, but claims that the modal syllogistic is different (Rini 2011, 3). But if there is this difference, isn't this something we would expect Aristotle to say? Yet Aristotle says nothing. There is no textual evidence at all that Aristotle places semantic restrictions on the terms he uses, and in fact, when Aristotle gives terms (e.g., for proofs of invalidity like that in Barbara XLL) Aristotle regularly includes accidental terms (e.g., moving), suggesting that he does not make such restrictions since if Barbara XLL is only meant to work with essence terms, showing that it is invalid in a case where one of the terms is not an essence term is not going to prove what Aristotle wants. Semantic restrictions are read into the modal syllogistic with the aim, commendable in itself, of getting it to work. Instead of textual evidence there is a kind of inference to the best explanation: if the only way that we can explain why Aristotle endorses and rejects the moods and figures of the modal syllogistic that he does is to make semantic restrictions on the terms, that in itself, Malink and Rini could argue, is good reason for thinking that Aristotle was making such restrictions.

My second point is that if we take all terms and all predications as essential, as Malink demands, then what we have is in a certain sense epistemologically circular. The kind of propositions that the premises and conclusion must be, on Malink's view, are propositions that we can tell to be true or false simply by looking at the terms. In fact, this is true also if the propositions include accidental terms, because Malink would not allow any apodictic propositions that include accidental terms to be true [which, following the line of thought of the previous paragraph, makes it odd that Aristotle should include such terms when giving counter-examples (and this is why Rini, unlike Malink, allows for some accidental terms in some positions)]. Why, then, try to show that the conclusion is true by deriving it from true premises, especially when the truth of those premises are known in exactly the same way? Why not simply look at the terms in the conclusion? This does not, of course, mean that there is not the required logical relation between the premises and the conclusion: I am only questioning Aristotle's motivation for the modal syllogistic under the semantic restriction proposed.

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My third and fourth points are points of technical detail. Normally when we examine a syllogism we are allowed to suppose that both premises are true. But according to Malink that is not so, and if the minor premise is not an essential predication then it is false, in which case it is of course not surprising that the conclusion should also be false. This third point is, admittedly, much the same as my first. But here is my fourth point: on Malink's view, it is not only that the conclusion can be false, it *must* be false when the reason for the minor premise's falsity is an accidental subject term. Whereas in the assertoric syllogistic a syllogism may have false premises and a true conclusion, this is not always the case in the modal syllogistic; if the minor premise is false and its falsity is due to an accidental term, then the conclusion must be false.[2] Again, Malink would probably accept this; again, I would argue that this is something you would expect Aristotle to advertise.

[2] Let me spell out the difference between the assertoric and the apodictic syllogisms in cases where some of the premises are false. In both kinds of syllogism, a true conclusion may follow from both premises being false. This is intuitively obvious: just take a true conclusion and invent a middle term for which neither premise is true. In the assertoric syllogism the converse is also true, that is to say, whenever both premises are false (but concludent) a conclusion may validly be drawn from them which may (or may not) be true. This is only sometimes the case with the apodictic syllogistic, depending on how the false premise is false; if it is false because it includes an accidental term, then the conclusion will also be false unless the accidental term is the middle term (I will come back to this).

In the assertoric syllogistic a true conclusion is still possible irrespective of how the minor premise is false; for example, both

All men are animals
All horses are men
Therefore, all horses are animals

and (replacing the minor term with an accidental term)

All men are animals
All moving things are men
Therefore, all moving things are animals

are valid assertoric syllogisms with true major premises, false minor premises and (we can suppose) true conclusions. Again, this reflects the fact that the assertoric syllogistic is formal and so indifferent as to how a premise is false.

In the modal syllogistic these come out differently depending on how the minor premise is false:

All men are necessarily animals
All horses are necessarily men
Therefore, all horses are necessarily animals

is analogous to the assertoric syllogism with the same terms, but making the same replacement in this syllogism as we did in the assertoric syllogism we get the syllogism

All men are necessarily animals
All moving things are necessarily men
Therefore, all moving things are necessarily animals

My fifth objection is more contentious and is the subject of the next section. I believe that Aristotle takes explanations, and modal syllogisms, to be extensional. In other words, any term in a syllogism can be replaced by another term with the same extension without loss, even to the extent that an essence or "red" term can be replaced by an accidental or "green" term.[3] If this is right, it is possible to have true apodictic propositions with either or both terms accidental, which makes a nonsense of any kind of semantic restriction.[4] It would also explain why, when Aristotle gives terms, he does not spurn accidental terms or consider the apodictic propositions that include them to be false by definition. In fact, I do not see Aristotle anywhere recognising the kind of things we describe as intensionality or referential opacity. For him, both belief contexts and modal contexts are extensional.

3. *Are modal syllogisms extensional?*

Before considering modal syllogisms, let us just consider an ordinary syllogism:

You know the one approaching/the veiled man
Coriscus is the one approaching/the veiled man
Therefore, you know Coriscus

This syllogism is identified in the *Sophistical Refutations* as a fallacy of accident; the problem, it is said, is that the predications are not essential. Let us then consider the apodictic syllogism

Necessarily you know the one approaching/the veiled man
Coriscus is necessarily the one approaching/the veiled man

---

and here both the minor premise and the conclusion turn out to be false by definition on Malink's view of apodictic propositions.

In summary: if one of the extreme terms is an accidental term, the conclusion must be false, because it contains an accidental term and all apodictic propositions containing accidental terms are false. This extends to the case where both premises are false: if the major premise is false and contains an accidental major term, then, even if the minor premise is also false, you cannot have a true conclusion. If it is the middle term that is the accidental term, then the conclusion (since the middle term does not appear in it) can be true.

[3] Just to make clear, when substituting one term for another all the occurrences of the term in the syllogism must be substituted. In a syllogism every term occurs twice, and obviously if you only replace one of them you will have a fallacy of four terms and not a syllogism at all.

When it comes to scientific explanations I do not think that Aristotle can achieve full referential transparency or thinks that he does, but I do believe that he wants and thinks he can achieve transparency in the minor term. Aristotle wants to gain knowledge about things, not about the terms used to describe them. If this is right the minor term can be anything, even an accidental term.

[4] If this is right then even Rini's more modest restriction that the predicate term of an apodictic proposition must be "red" is false.

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Therefore, necessarily you know Coriscus

or, since it better illustrates the form Barbara LLL,

The one approaching/the veiled man, necessarily you know
Coriscus is necessarily the one approaching/the veiled man
Therefore, Coriscus, necessarily you know

Setting aside worries about whether these premises are actually true, this argument is presumably not fallacious. Yet we tend to have the intuition that this is no improvement on the non-modal syllogism—even if Coriscus is necessarily and not just contingently the one approaching, we still do not know this, and since we do not know that Coriscus is the one approaching, the conclusion is just as false in this case (Schreiber 2003, 122). This intuition is influenced by the thought that knowledge/belief contexts are intensional.

I do not think that intensionality is the cause of the fallacy here; if we add the premise that you know that Coriscus is the one approaching, then it doesn't matter at all whether things belong essentially or accidentally. Thus, I think that all the contexts are referentially transparent in this example. In a sense, you *do* know Coriscus even if you do not know that Coriscus is the one approaching.

Let us formulate a kind of modal syllogism with "know" in place of necessity. Barbara KKK would be

The one approaching/the veiled man, you know
You know that Coriscus is the one approaching/the veiled man
Therefore, Coriscus, you know

Here you do know that Coriscus is the one approaching so this would be valid even if the contexts were not referentially transparent (and even if none of the predications are essential, as is the case here). Barbara KXK would be

The one approaching/the veiled man, you know
Coriscus is the one approaching/the veiled man
Therefore, Coriscus, you know

On analogy with Barbara LXL, I think that Aristotle should think that Barbara KXK should be valid as well. The reasoning is analogous too: if C belongs to B then there is some C and some B that are identical, and the same properties – such as A belonging to it by necessity, or being known – must hold of what is identical. Failures to preserve truth after substitution of identicals are only apparent, and that includes substitution into modal propositions. The

intuitions that lead us to postulate referentially opaque contexts only mislead us, in Aristotle's view.

Now, however, I have a problem. After all, Aristotle introduces this example as a fallacy, and I have just argued that not only is the conclusion true (when taken transparently) but that the argument is valid! It would seem that I am committed to denying that this is a fallacy at all. Given that "Coriscus is the one approaching" is true, why is it a mistake to conclude that you know Coriscus, if this is referentially transparent? It seems that you do know Coriscus, and that this is so irrespective of whether it is an essential or an accidental predicate of Coriscus that he is the one approaching.

The difference then must be this: if being the one approaching were an essential predicate then it would always be true that if you know Coriscus then you know the one approaching, but if it is an accidental predicate then it is not always true, but true only while Coriscus is, in fact, approaching, before or after which it is false; "the one approaching" cannot *always* be substituted *salve veritate* for "Coriscus". Similarly if the one approaching is not always such that you know them. The problem comes in the use of an accidental predicate to refer to whatever it is that has it. Although this particular instance of the argument has true premises and a true conclusion, and every instance in which the conclusion is false there will also be a premise that is false (which implies that it is semantically valid), not every instance or token of the argument will have true premises, and for this reason the syllogism fails to be *apodictic*. While we may say of propositions that they are true-at-a-time and of arguments that they are sound-at-a-time, apodicticity requires each and every instance of the argument to render its conclusion necessarily (in the sense of a necessary consequence) true.

On this analysis, for the syllogism to be apodictic (in the sense above of having no unsound tokens) both premises must be apodictic, which is to say that

The one approaching/the veiled man, necessarily you know
Coriscus is necessarily the one approaching/the veiled man
Therefore, Coriscus, necessarily you know

is not fallacious (*contra* Schreiber). But I am not quite sure that this analysis is right, or at least that it is Aristotle's, because Aristotle would seemingly also allow the Barbara LXL version of this argument:

The one approaching/the veiled man, necessarily you know
Coriscus is the one approaching/the veiled man
Therefore, necessarily Coriscus, you know

If so, it does not matter for Aristotle that it is an accident of Coriscus that he be the one approaching; it only matters that it is necessary of the one approaching that he is known, that is to say, the major premise and not the minor. When there is such a necessary connection between the middle term and the major term, it follows that in attributing the middle term to something (i.e., the minor term) you are *eo ipso* attributing the major term to it.[5] And you can see why if modal contexts are extensional: identicals must always have the same properties. (In the end, I think that Aristotle settles for having referential transparency in the minor term – the term that gives what we are trying to explain something about – and requires the major premise to express an intensional connection between terms; explanations are in this case only partly extensional, while modal syllogisms themselves may still be fully extensional.) However, this conflicts with my claim that there should not be any false tokens of a premise. Call this the *False Token Problem*.

The important point for the purposes of this paper is not how best to understand the fallacy of accident, but to point out that if we take modal syllogisms to be as extensional as we take assertoric syllogisms to be, then this makes sense of why Aristotle is so keen to endorse Barbara LXL, and the reason why he deals with the example of fallacy of accident in the way he does – not as we would do as involving opaque contexts, but as lacking a required kind of predication – seems to support the view that he does take modal syllogisms to be extensional.

Perhaps further textual evidence that Aristotle endorses an unrestricted extensionality comes in *Physics* I.7 where he discusses sentences with the word "becoming". For he says there that "A man becomes musical" and "What is not-musical becomes musical" express the same facts. Now, arguably "what is not-musical becomes musical" is an apodictic proposition, or at least "whatever becomes musical is not-musical" is such. This is the familiar kind of "Hesperus is Hesperus" and "Hesperus is Phosphorus" problem that is familiar to us and that we tend to

[5] In the Port Royal Logic, *all* syllogistic inferences are taken to be like this, that is to say, in attributing the major term one is explicating part of the meaning of the middle term. This is implausible as a general account because it implies that all major premises are necessary. Also, I doubt that all necessary connections are explicative in this sense. In a case like the one here where the major premise is necessary, though, this does seem to be the way we should conceive of the inference. Perhaps these 'explicative' inferences are co-extensive with the class of demonstrative inferences; when Aristotle talks about demonstration in *Posterior Analytics* I.6 he talks about the "mediating link" being necessary, by which I think he is referring to the link between the middle and major terms, which amounts to saying that the major premise must be necessary. However, most scholars would not count the inference as demonstrative unless the minor premise were also necessary, appealing to textual evidence in other parts of I.6 and in I.4, in which case demonstrative inferences are a proper subset of the inferences I am considering here. I am not so convinced that the minor premises of demonstrations need to be necessary, but it is outside the scope of this paper to argue the point.

solve by saying that Hesperus and Phosphorus have the same reference but different senses. Aristotle himself says that although numerically identical the man and the not-musical are different in form (190a13-21). Nonetheless, if it is necessary that what is not-musical becomes musical then it also seems to be necessary that a man becomes musical (and that Hesperus is Phosphorus); otherwise, they would express different facts. This means that there seem to be some properties that belong necessarily although they might not have done; it is a metaphysical necessity of the world described by the sentence that the man is becoming musical. This seems to suggest that sentences with "becoming" are extensional. This does not alter the fact that whilst the man persists through the change from not-musical to musical, the not-musical perishes.

Now, it may be thought that an extensionality unrestricted to types of terms might be inconsistent with what Aristotle says with respect to Barbara XLL. The problem is twofold:

1) A proposition in which one or both terms are accidental cannot for that reason be said to be false—it may be true. Its truth or falsity is a substantive fact about the world. But in his proof of Barbara XLL's invalidity Aristotle says "an animal does not move necessarily, nor does man", which seems to imply that it is plainly true that an animal does not move necessarily and plainly false that an animal does move necessarily. These do not seem to be treated as substantive facts, yet if I am right it is perfectly possible that an animal move necessarily: all that is required is that the animal be identical with something that does move necessarily.

2) More fundamentally, we would expect Barbara XLL to be valid! After all, if in the minor premise B is said to belong necessarily to C, and all Bs are A, then we should be able to substitute A for B and prove that all C is necessarily A. In fact, there have been those, like Łukasiewicz, who have endorsed both Barbaras as a result of this kind of extensionalist reasoning.[6]

I will take these in turn.

As for (1), it should be noted that if it is plainly true that a man does not move necessarily, then it is plainly false that "Some man moves necessarily". Thus, Aristotle is normally taken to be giving an ordinary counter-example with true premises and a false conclusion. But what Aristotle says is that "man is an animal necessarily, but an animal does not move necessarily, nor does man". That animal moves necessarily is the upgraded

[6] See Patterson (1995, 76-80) for further discussion.

proposition. Why mention this here if this argument is just meant to be a counter-example with an obviously false conclusion? The point seems to be that the original premises did not say that animal moved necessarily, and since man is necessarily animal, and since it does not follow from the premises that animal moves necessarily, then it must also not follow that some species of animal, e.g., man, moves necessarily. It is not that either of these propositions *must* be false; if it were, the fact that the major premise is upgraded would not matter a jot—the fact that from "All animals are moving" it could be deduced that "All animals are necessarily moving" involves an upgrade from the assertoric to the necessary would matter less than the simple fact that from a truth could be deduced a falsity, should we assume that "All animals are necessarily moving" is straightforwardly false.

Hence, if this were what Aristotle intended, the argument that we would get with these terms would be a straightforward *reductio* kind of argument, an argument with an impossible conclusion, with modal upgrading a mere sideshow. But, as Ross says, Aristotle does not present it as this kind of *reductio*. Ross refers to Alexander of Aphrodisias (128.31-129.7) and it is worth quoting what Alexander says in full:

> It should be noted that he does not say that it is impossible for A to hold of some B by necessity. For nothing prevents what holds of all of something from also holding of some of it by necessity. But since the holding of all is not necessary, holding of some of something by necessity is not directly contained in holding of all of it. For it is possible that it holds of all of it in such a way that it is also possible that it holds of none. For a universal affirmative unqualified proposition is not prevented from being true in this way.

If it is not impossible for A to hold of some B by necessity, it is not impossible for moving to hold of some man by necessity. It is the modal upgrading that is the problem: the major premise "All B are A" is strongly upgraded to "Some B is necessarily A" which rules out it being possible that A holds of B in "in such a way that it is also possible that it holds of none". So, Aristotle's bare statement that man does not move necessarily gives a false impression that is dispelled when we look at the detail.

Now, it could be objected that although in general it is the modal upgrading that makes this figure invalid, in order to illustrate why this is problematic Aristotle chooses terms for which the argument does in fact turn into an ordinary *reductio*. I agree that my alternative reading is not compelling. But it is at least plausible, or at least becomes plausible as soon as we believe that in Barbara LXL Aristotle does intend the minor premise to be *merely* assertoric and not just an apodictic proposition in disguise. It is also worth adding that once we accept such statements as necessary, there is no longer any great surprise that Aristotle allows for the

conversion of "All B are necessarily A" and "Some B is necessarily A" into "Some A is necessarily B" because such statements can be true if read extensionally.[7] Our reasons for endorsing Barbara LXL and for endorsing these rules of conversion are the same.

As for (2) I think that deep down Aristotle probably does want to endorse Barbara XLL, only, noticing the problem of strong modal upgrading, he realises that he can't. He fails to notice that modal upgrading occurs in Barbara LXL too, probably because the crucial premise "All A are necessarily B" is not derived syllogistically from the premises but by a combination of conversion and ekthesis.

4. *Partial modal collapse again*

If I am right about extensionality, then Malink and Rini are wrong about placing semantic restrictions on the modal syllogistic and, even more fundamentally perhaps, wrong to assume that an apodictic proposition with an accidental term in the 'wrong' place must for that reason be false. Partial modal collapse, which is acceptable under such restrictions, is unacceptable without such restrictions.

Conclusion: both Barbaras are invalid because leading to unacceptable forms of modal upgrading. To put it another way, weak modal upgrading is only apparently weak, since it itself is upgraded to partial modal collapse. Obviously, the two mixed modal Dariis will also be invalid for the same reason. So will any mixed modal syllogism that reduces to a mixed modal Darii, namely the third-figure syllogisms Datisi, Darapti, and Disamis.

At this point we might expect a complete collapse of mixed modals and universal adoption of Theophrastus's *peioram* rule that the conclusion cannot have a stronger modality than the weakest premise; if one premise is assertoric, the conclusion must also be assertoric. However, the *peioram* rule seems to apply only to the affirmative mixed modals. Aristotle seems to be right in his judgments about the negative first-figure mixed modals Celarent LXL (which is judged to be valid) and Celarent XLL (which is judged to be invalid).

Here is Celarent LXL:

No B is necessarily A

[7] The main reason for thinking such necessary propositions cannot be true comes from inferring from the fact that they are necessary to the fact that they are not contingent, and Aristotle would say, for example, that it is contingent of animals that they move. I deny this inference, and again insist that it is natural to deny it if we accept Barbara LXL, for the assertoric proposition may be the actualization of a potentiality, and so the necessary belonging of the major term will also depend on a potentiality's being actualized while it is still possible that the opposing potentiality were actualized. Claiming that propositions may be simultaneously necessary and contingent leads to complications that cannot be essayed here, but will be raised again in further footnotes.

All C are B
Therefore, no C is necessarily A

This does not seem to lead to any kind of strong modal upgrading and seems to be valid.

Here is Celarent XLL:

No B is A
All C are necessarily B
Therefore, no C is necessarily A

This is invalid.

Ferio LXL is subalternate to Celarent LXL and is valid for the same reason as Celarent LXL is. Ferio XLL is subalternate to Celarent XLL and is invalid for the same reason as Celarent XLL is.

This completes the first figure mixed modal syllogisms. As I have shown, Aristotle is right about the negative syllogisms but wrong about the affirmative syllogisms.

This being the case, we would expect second and third-figure mixed modal syllogisms that reduce to Celarent LXL or Ferio LXL to be valid and those that reduce to Celarent XLL or Ferio XLL to be invalid.

In the second figure Cesare LXL and Camestres XLL reduce to Celarent LXL and are valid. Cesare XLL and Camestres LXL reduce to Celarent XLL and are invalid. Festino XLL reduces to Ferio LXL and is valid. Festino LXL reduces to Ferio XLL and is invalid. All the reductions rely on converting the universal negative, i.e., the modal conversion rule that if "No B is necessarily A" then "No A is necessarily B". As long as this conversion rule is valid, Aristotle's judgments on these moods also holds.

In the third figure Ferison LXL and Felapton LXL reduce to Ferio LXL and are valid. Here the conversion needed is an ordinary assertoric conversion of the minor premise from "Some C is B" or "All C are B" respectively to "Some B is C". Ferison XLL and Felapton XLL reduce to Ferio XLL and are invalid.

On the basis that negative mixed modal syllogisms have so far turned out to have one valid instance and one invalid instance, we would expect the same to be true of the second-figure mood Baroco and the third-figure mood Bocardo. Unfortunately, these cannot be proved by conversion. Here is a proof of Baroco XLL by *reductio*:

1. All A are B
2. Some C is necessarily not B
3. Some C is necessarily not A
4. All C are possibly A from (3) reductio

5.	All A are possibly B	from (1) belonging→possibly belonging
6.	All C are possibly B	from (5,4) by Barbara MMM
7.	Contradiction!	(6) and (2) are incompatible

The minor premise "Some C is necessarily not B" is not consistent with "All C are possibly B". Therefore, it is inconsistent with what we took as the reductio, i.e., "All C are possibly A". Since "All C are possibly A" is false the original conclusion "Some C is necessarily not A" is true. The only syllogism we have relied on here is the uncontroversial Barbara MMM:

All B are possibly A
All C are possibly B
Therefore, all C are possibly A

Unfortunately, Aristotle thinks that Baroco XLL is invalid. What makes this doubly puzzling is that he thinks that Baroco LLL is valid.[8] Yet, as can be seen from the proof, the even weaker major premise that "All B are possibly A" is sufficient for the conclusion, which is to say that Baroco MLL is equally valid (as Aristotle recognizes) and can be proved by the same proof. One can only suppose that Aristotle has made a mistake (as many commentators have observed).[9]

[8] Aristotle does not actually give a proof but says that is proof by ekthesis. Probably, he shies away from a *reductio* proof because it involves propositions concerning possibility that he has not discussed at this point in the *Prior Analytics*. Patterson (1995, 73) gives a proof of Baroco LLL by ekthesis and is further discussed by Rini (2011, 81).

[9] This was my initial impression but now I am not so sure because of what I have already said about modal *reductio* arguments. Suppose, for the sake of argument, that sometimes both "All B are necessarily A" and "Some B is possibly not A" are both true. I know that this in violation of the Principle of Non-Contradiction, but just suppose. This would be surprisingly consistent with Aristotle's practice in his proofs of mixed modal syllogisms. Cases where the necessary statement is concluded from other necessary statements, that is to say, in pure modal syllogisms, will *not* be cases of this kind (although I admit I am not sure why), and so in the proofs that the conclusion does indeed follow from those necessary premises, in assuming for *reductio* that the conclusion is false it is valid to assume its 'contradictory' is true. For example, in the case of Baroco LLL, we can prove its validity by assuming that the falsity of the conclusion is identical with the truth of its contradictory, and showing that when the contradictory of the conclusion is true this results in inconsistency. But in a mixed modal syllogism where one premise is merely assertoric, then the conclusion *may* be a case of such a kind that although it *is* valid to assume from the fact that the conclusion is false that its contradictory is true, it is not valid to infer that the conjunction of this with the original premise produces a contradiction—whether it does or not depends on whether the assertoric premise is true as a necessity or as the actualisation of a contingency: if it is true as a necessity this case collapses into a case of Baroco LLL, but if it is true as the actualisation of a contingency, then *ex suppositione* it is possible that the conclusion and its contradictory are both true. This would explain why you cannot give the same *reductio* proof in the case of Baroco XLL as in Baroco LLL. [If what I am suggesting is true, then these 'contradictories' – viz., the conclusion and what is taken for *reductio* – behave logically like sub-contraries, which is to say that they can both be true but cannot both be false, in which case from the falsity of one (i.e., the conclusion)

Baroco LXL is invalid as Aristotle says. Go through the *reductio* again: the assertoric "Some C is not B" is perfectly consistent with "All C are possibly B".[10]

Bocardo is more difficult. Even Bocardo LLL is difficult. Here is Bocardo LLL:

Some A is necessarily not B
All A are necessarily C
Therefore, some C are necessarily not B

The proposition for *reductio* would once again be "All C are possibly B" but it is not obvious how we can combine this with another premise to produce a contradiction. Malink (2013, 183) offers the following proof by ekthesis (modified slightly):

1.	Some A is necessarily not B	
2.	All A are necessarily C	
3.	All D are A	from (1) by ekthesis [D is the subset of As that are necessarily not B]
4.	No D is necessarily B	from (1) by ekthesis
5.	All D are necessarily C	from (2,3) by Barbara LXL
6.	Some C is necessarily not B	from (4,5) by Felapton LLL

The problem with this proof, from my point of view, is the appeal to Barbara LXL at (5), which I obviously believe to be invalid. This, in itself, does not mean that Bocardo LLL is

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it can be validly inferred that the other (i.e., the *reductio*) is true. If so, taking the sub-contrary as *reductio* is in itself valid. The problem is not at this stage but at the final stage when what is cited as a contradiction is not logically contradictory, and so it cannot in general be deduced from this that the thesis is true. I am proposing that in the case of pure modal syllogisms there is a genuine contradiction here, but that in mixed modal syllogisms this cannot be assumed, or, as works out nearly the same, that in pure modal syllogisms the *reductio* is a genuine contradictory.]

Strange, I know, but there is also this to consider: when Aristotle uses *reductio* proofs to prove the validity of syllogisms with possible conclusions (i.e., the valid XQM figures) Aristotle does *not* assume the conclusion's contradictory for *reductio* but what appears to be its *contrary*, though in fact I think what Aristotle intends in these places is the external negation of the conclusion; that is to say, the *reductio* of "All C are possibly A" in the proof of Barbara XQM for example is not taken to be the contradictory "Some C is necessarily A" or even – as is closer to the text – its apparent contrary "No C is necessarily A" but the external negation "Not(All C are possibly A)". Aristotle's practice in these places seems to indicate some reluctance to assume contradictories for *reductio*.

I have an idea of why Aristotle may want to deny the Principle of Non-Contradiction for these cases, but defending this is an issue for another time. And I certainly do not claim that Aristotle says anything like this in the *Prior Analytics*. I only note the remarkable consistency of his practice with this assumption, and how it would explain things in the modal syllogistic that are otherwise extremely puzzling, e.g., his claim that Baroco LLL is valid but that both Baroco XLL and Baroco LXL are invalid.

[10] Note that the proof of Baroco LXX works much the same as the proof of Baroco XLL. It is now an apodictic major premise that is downgraded to a possibility in (5) and (4) now predicates belonging instead of a possibility. Now (6) is derived by Barbara MXM. This agrees with Aristotle's judgment on this mood.

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invalid. However, we can generate a partial modal collapse here as we did in Barbara LXL. Suppose that all C are necessarily A as well as that all A are necessarily C. Then we have:

All C are necessarily A
All D are necessarily C [this is (5) from the previous proof]
Therefore, all D are necessarily A

"All D are A", which we got from the original premises by ekthesis, has been modally upgraded to "All D are necessarily A". I think this result is just as unacceptable here as before. Bocardo LLL is thus invalid. Hence, the mixed modal Bocardos are equally invalid. The symmetry is broken: not all negative mixed modals are as Aristotle claims (overlooking his mistake, if it is one, over Baroco XLL).

It is surprising that the problem of partial modal collapse in Barbara LXL has so far gone unremarked. Thom comes tantalizingly close to realising the problem, inadvertently providing another argument against the validity of Barbara LXL, and one that I think that Malink might find harder to ignore than the one I have so far given. Thom observes that an proof similar to the one given against the validity of Barbara XLL could also be given against Barbara XLX, and yet Barbara XLX is surely valid since it is implied by Barbara XXX. His argument is:

All B are A
All C are necessarily B
Therefore, all C are A (by Barbara XLX)

but

All C are A
All C are necessarily B
Therefore, some B is necessarily A (by Darapti XLL)

As with Barbara XLL, "All B are A" has been strongly modally upgraded to "Some B is necessarily A", the difference between the proofs being that in Barbara XLL it is Darapti LLL that is used in the proof, while in Barbara XLX it is Darapti XLL. Thom then presents a trilemma: either Barbara XLX is not valid, or Darapti XLL is not valid, or Aristotle's proof of the invalidity of Barbara XLL does not work. It does not seem conceivable that Barbara XLX could not be valid, and Aristotle endorses Darapti XLL, so Thom concludes that although Barbara XLL *is* invalid, Aristotle's attempted proof *does not* show this; if it did, it would also prove that Barbara XLX is invalid, and Barbara XLX is valid (Thom 1996, 124-5).

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It should be obvious where I think the problem here is: Darapti XLL is *not* valid, whereas Darapti LLL is, and this is why Barbara XLX is valid and Barbara XLL is not. We can now construct a hypothetical syllogism: if Barbara LXL were valid, Darii LXL would also be valid; if Darii LXL were valid, Darapti XLL would be valid; and if Darapti XLL were valid, Barbara XLX would be invalid. Yet Barbara XLX is not invalid but valid. Therefore, Darapti XLL is not valid but invalid, and so equally are Darii LXL and Barbara LXL. Thom took the wrong option.

This is my second argument against the validity of Barbara LXL, namely that it is inconsistent with the validity of Barbara XLX. The weak point is perhaps the derivation of Darapti XLL from Darii LXL because it requires converting the conclusion. First of all, we have to reverse the order of the premises of Darapti XLL to give

All C are necessarily B
All C are A

from which in turn we can get Darii LXL by converting the minor premise, giving

All C are necessarily B
Some A is C

From this what follows is that some A is necessarily B, and not that some B is necessarily A, which is what we want. To get the right conclusion we have to use Aristotle's rule of modal conversion that if some A is necessarily B then some B is necessarily A.

Interestingly, Rini (2011, 95-97) also rejects Darapti XLL, arguing that what Aristotle argues for in the text is only the unconverted conclusion "Some A is necessarily B", noting that Aristotle does not in the text (31a31-33) perform the conversion to "Some B is necessarily A".[11] For Rini, such a conversion would be invalid, since she makes it a restriction on valid conversions that the subject term is not an accidental term, and this is not guaranteed by the truth of the premises. She gives as a counter-example:

Every man is moving
Every man is a necessary animal
Some animal is necessarily moving

[11] Strictly speaking, what Aristotle argues for then is not Darapti according to Rini (nor is it even a syllogism, since in syllogisms the conclusion is always the predication of the major term to the minor term) but a valid non-syllogistic argument for a necessary consequence of the same premises as in Darapti.

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According to Rini, the premises are true but the conclusion is false, although "Some moving thing is a necessary animal" is true.

Let's look again at Barbara XLX:

All B are A
All C are necessarily B
Therefore, all C are A

The argument was that if we make the conclusion "All C are A" the assertoric major premise of Darapti XLL, we could draw the conclusion "Some B is necessarily A" which is a strong modal upgrading of "All B are A". If Rini is right, then we cannot draw this conclusion, but only the unconverted conclusion "Some A is necessarily B". Note that even for Malink there are no semantic restrictions on at least the assertoric propositions in Barbara XLX; A, at least, might be an accidental term without invalidating the syllogism, and when such a term is the subject term of an affirmative apodictic proposition, while (unlike Malink) Rini allows that the proposition might be true, Rini would disallow the proposition's modal conversion. So "Some A is necessarily B" should not be converted.

Could we then avoid this second argument by adopting something like Rini's restriction on modal conversion? I don't think so. If "All B are A" is compatible with its being possible that no B are A, it is also compatible with its being possible that no A are B (by conversion of the universal negative), and this is incompatible with the conclusion of Rini's alternative for Darapti "Some A is necessarily B". Hence, there is still an unacceptable strong modal upgrading. Rini is right to reject Darapti, but does not reject it for the right reasons; once rejected for the right reasons, Darii LXL, Barbara LXL, and the entire affirmative half of the mixed modal syllogisms goes with it. They are all invalid.

There is also another problem with Darapti XLL: you can derive Darii XLL from it, which Aristotle rejects for the same reason that he rejects Barbara XLL. Since, as we have shown, we can derive Darapti XLL from Darii LXL, it follows that from the purportedly valid Darii LXL we can derive the invalid Darii XLL. Obviously, this must be impossible; since Darii XLL is invalid, Darii LXL must be invalid too.

The derivation is given in Johnston (1990). Here again is Darapti XLL:

All C are A
All C are necessarily B
Therefore, some B is necessarily A

Converting the minor premise gives us:

All C are A
Some B is necessarily C
Therefore, some B is necessarily A

which is the invalid Darii XLL. However, from the same premises, converting the major and swapping the major and minor premises gives us:

All C are necessarily B
Some A is C
Therefore, some A is necessarily B

and then converting the conclusion gives us "Some B is necessarily A", which is Darii LXL. So, if Darii LXL is valid, then also Darapti XLL is valid, and if Darapti XLL is valid, so is Darii XLL. But Darii XLL is invalid. Therefore, so also is Darii LXL, and Barbara LXL goes with it. There is a general problem here: because in the third figure the middle term is in the same position in both premises, we can always reverse the order of the premises and then convert the conclusion to give either an XLL form or an LXL form.

Van Rijen also contains a proof of Darii XLL that, although it does not derive Darii XLL from Darii LXL, uses Darii LXL at one point in the proof. After converting the minor premise of Darii XLL to "Some B is necessarily C" use ekthesis to produce the two propositions "All D are B" and "All D are necessarily C" . Thus:

1.	All B are A	
2.	Some C is necessarily B	
3.	Some B is necessarily C	from (2) by conversion
4.	All D are B	
5.	All D are necessarily C	

The proof then proceeds:

6.	All D are A	from (1) and (4) by Barbara XXX
7.	Some A is D	from (6) by conversion
8.	Some A is necessarily C	from (5) and (7) by Darii LXL
9.	Some C is necessarily A	from (8) by conversion

(8) is the conclusion that we want. Clearly, if Darii LXX is invalid some part of the proof must be invalid. It cannot be Barbara XXX. It is not likely to be ekthesis or conversion. We have to reject Darii LXL.

1. Conclusion

The argument of this paper is this:

1. Barbara LXL leads to partial modal collapse.

2. Partial modal collapse is unacceptable.
3. Therefore, endorsing Barbara LXL leads to unacceptable consequences.
4. Therefore, Barbara LXL is invalid.
5. Therefore, its subaltern mood Darii LXL is invalid.
6. Therefore, everything that reduces to Darii LXL is invalid, viz., in the third-figure, the moods Darapti, Disamis, and Datisi.
7. Additionally, Bocardo LLL is invalid.
8. Therefore, Bocardo LXL and Bocardo XLL are also invalid.

There are, I suppose, a number of ways of responding to my argument. Malink might take this to support the semantic restrictions that he wants to place on the terms; after all, if the only way to save the modal syllogistic is to make such restrictions, isn't that a fairly good reason for making them, and even good reason for thinking that Aristotle made them? So far, my main objection to this has been my conviction that Aristotle intends the modal syllogistic, just like the assertoric syllogistic, to be extensional. However, the fact that Aristotle fails to make the modal syllogistic extensional, plus the outstanding *False Token Problem*, might give us doubts whether this was something he ever intended in the first place. As for Thom's argument Malink must, like Thom, think that Aristotle's purported proof of the invalidity of Barbara XLL is invalid. It is not clear how he would respond to the problem of the proofs given above for the validity of the invalid Darii XLL.

However, I now have a new objection. Note that Malink applies his restrictions across the board, that is to say, every true apodictic proposition posits a necessary connection between non-accidental terms. But it is worth observing that this is not required in the *negative* part of the modal syllogistic. For the most part (the possible exceptions being Baroco LXL and Bocardo LLL) the negative mixed modal syllogistic works as Aristotle describes and without the need of any such restrictions; accidental terms create no problems at all in the negative part of the modal syllogistic but only in the affirmative part. So restricting the terms in the negative part seems unmotivated.[12]

Another anticipated response is to reject the conversion rule for affirmative apodictic propositions. After all, didn't I say that it was this conversion rule that was inconsistent with the possibility that necessary belonging was anti-symmetric? Isn't this one more reason on the already considerable pile for rejecting this much-disputed conversion rule, or for restricting it in something like the way Rini does? If we cannot derive "Some A is necessarily B" by

[12] I can anticipate one move that Malink might make, and that is that the conversion of "No B is necessarily A" to "No A is necessarily B" is not valid unless we restrict the terms. This might, I suppose, motivate the restriction in Cesare and Camestres and other places which rely on the conversion rule. It still does not motivate it in Celarent itself. Anyway, I reject such a restriction.

conversion from "All B are necessarily A" is there any reason to suppose that "All A are necessarily B" can be true when A and B are co-extensive?

My response to this is that rejecting the rule would be necessary but nowhere near sufficient. You would have to come up with a semantics of "All B are necessarily A" such that "All A are necessarily B" cannot be true. They would have to be logically inconsistent. But if you did develop such a semantics you would then have to deal with the fact that in definitions both of these propositions appear to be true: man is necessarily a rational animal, and a rational animal is necessarily a man.

Aristotle's modal syllogistic is not, perhaps, the "realm of darkness" reported. The negative part of the modal syllogistic is reasonably well lit, with just a couple of errors. The affirmative part is largely plain wrong. But I think that I have an explanation for why it is as it is: Aristotle simply failed to notice that Barbara LXL leads to a modal upgrading just as much as Barbara XLL, and he failed to notice it because, unlike Barbara XLL, the apodictic proposition to which the assertoric proposition is upgraded does not follow syllogistically from the premises. To save Barbara LXL and the rest of the affirmative modal syllogistic, you must avoid the very possibility that "All A is necessarily A"; so, if "All B is necessarily A", you must avoid the very possibility that "All A is necessarily B". Otherwise the consequence is partial modal collapse: whatever belongs, belongs necessarily to whatever it belongs to as long as something necessarily belongs to it. Malink might find this consequence palatable but I do not.

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