

ARISTOTLE'S MODAL ONTOLOGY

By

MARK WILLIAM DICKSON

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Department of Philosophy

The University of British Columbia
Vancouver, Canada

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Abstract

Modal logic is concerned with the logic of necessity and possibility. The central problem of modal ontology is summed up in the following question, "What are the ontological commitments of the user of modal terminology?" This thesis is primarily about the ontological commitments that Aristotle made when he employed modal terms. Aristotle's modal ontology is here analysed in conjunction with four modal problems. My primary objective is to clarify some of the discussions of Aristotle's modal ontology that have been advanced by certain twentieth century philosophers.

The first problem to be considered is the famous 'sea battle' argument of *De Interpretatione* 9. Here is a summary of the problem: If it is currently true that there will be a sea battle tomorrow, then in some sense it is inevitable that there will in fact be a sea battle; if predictions are true, is not a form of determinism being supported? One analysis in particular is studied at length, namely that of Jaakko Hintikka. Hintikka holds that the sea battle argument is best interpreted if the metaphysical principle of plenitude is attributed to Aristotle. The principle of plenitude effectively merges modality with temporality; what is necessarily the case is always true, and vice versa.

Hintikka also interprets Aristotle's stand on the 'Master Argument' of Diodorus in light of the attribution of the principle of plenitude to Aristotle. Diodorus' argument is the second of the four problems that this essay considers. Unlike Aristotle, Diodorus appears to have favored a strong version of determinism. According to Hintikka, Diodorus actually strove to prove the principle of plenitude (as opposed to assuming it, as Aristotle presumably did).

I am very sceptical regarding Hintikka's interpretations of these two problems. The sea battle argument is not adequately answered by the solution which Hintikka sees Aristotle adopting. Alternative answers are relatively easy to come by. The evidence cited by Hintikka for ascribing the principle of plenitude is, it is shown, somewhat inconclusive. As for the Master Argument, there is a great deal of paucity in regards to textual evidence. Hintikka himself virtually concedes this point. (Thus, whereas I feel it to be incumbent to offer an alternative interpretation of the sea battle argument, I do not share this attitude towards the Master Argument.)

The third and fourth problems play a key role in twentieth century analytic philosophy. Both were first formulated by W.V. Quine in the forties. These problems

are somewhat subtle and will not be explained further. Suffice it to say that an analysis of Aristotle's works by Alan Code reveals that the Stagirite had an answer to Quine's criticisms of modal logic.

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Chapter One-Four Modal Problems in Aristotle

A cursory reading of some of Aristotle's works reveals that Aristotle thought of modal operators in a way which was radically different from the modern view of such operators. It is clear to many that Aristotle believed modal and temporal operators to be heavily interconnected. But the precise relation between the two kinds of operators is opaque. The chief aim of this essay is to reject and endorse various proposals of what these views amounted to. This will be accomplished by analyzing the effects of these proposals on four problems. The analysis given concerns two problems dating from Aristotle's time as well as two problems which were formulated by Quine.¹ More generally, I am interested in the lessons to be learned regarding Aristotle's modal ontology from studying four different (modal) questions.

A critical evaluation of J. Hintikka's interpretation of Aristotle's stand on two arguments will introduce the first set of problems. Both arguments are concerned with determinism as well as modality. The interpretation, then, of Aristotle's stand says much about the metaphysical theses which

Aristotle was, at least occasionally, prepared to defend. The first of the two arguments is the famous 'Sea Battle' one given by Aristotle in chapter 9 of his *De Interpretatione*. Briefly, *De Int.* 9 argues that fatalism is vindicated if a certain logical principle is left unrestricted. Precisely what the logical principle is which Aristotle wishes to constrain is an open question. Hintikka attempts to identify the principle and its attendant restraint in *Time and Necessity*. The second argument concerned with determinism is known as the 'Master Argument' of Diodorus. The Megarians supported the contentions of Diodorus who held that a form of determinism was tenable. Aristotle, like many modern philosophers, rejected any non-trivial version of determinism.²

Various readings of how Aristotle understood deterministic positions have been put forward.³ There is much more debate about what Aristotle thought the sea battle argument achieved than there is about his stand on the Master argument. There are several reasons for this unequal balance of attention. Foremost among these is that scholars have access to the original version of the argument in *De Int.* 9. The Master argument, on the other hand, exists only in secondary literature. A related point is that Aristotle seems to have considered

the sea battle argument to involve more weighty philosophical problems than the argument of Diodorus. One of the most appealing aspects of Hintikka's reading is the extent to which he sees the two arguments as provoking a consistent response from Aristotle.

Central to the interpretation of Hintikka (which is explained throughout I) is his insistence that Aristotle's view of modality is heavily influenced by the latter's use of the principle of plenitude. This metaphysical thesis was perhaps best formulated by the Stagirite himself in Bk. II of *On Generation and Corruption*: "...a thing is eternal if it is of necessity; and if it is eternal, it is by necessity." ⁴ The principle of plenitude, then, holds that the distinction made between temporality and modality is an illusory one. The corresponding metalinguistic formulation would be that for any sentence *p*, *p* is necessarily true iff for any time *t*, *p* is true at *t*. The principle of plenitude is, by modern standards, a very bizarre way to account for modality. The model theoretic account of modality (possible worlds semantics) of Kripke and others is at considerable variance with this principle. Though something is always true in the actual world in no way means, for the possible worlds theorist, that it is necessarily true (true in all worlds). If Aristotle

did adhere to the principle of plenitude, it would be reflected in his stand on modal and deterministic issues. Different events are necessary and fated to come to pass for Aristotle than for the modern modal logician.

I consider Kripke's model theoretic account of 1963 to be both elegant and metaphysically satisfactory.⁵ In a landmark paper, Kripke treated possible worlds as primitive points. Possible worlds had hitherto been treated as state descriptions, an approach which was popularized by Carnap. This new approach to modality brought about many technical improvements. For example, the question of what the term 'possible world' means no longer obstructs (or needs to obstruct) the student of modality. Strong criticisms, it is true, have been directed at the applications that Kripke has made of his account.⁶ But Kripke's approach is, by itself, very tenable. Like other treatments of modality, Kripke's makes room for an ontological distinction between temporal points (however construed) and possibles. Any violation of this result is metaphysically unsatisfactory for any adherent of the model theoretic account of modality. There are at least two pressing questions here. The first is whether or not Aristotle was committed to the principle of plenitude. In chapter

V of Time and Necessity, Hintikka argues most persuasively that Aristotle was indeed a firm adherent.

The salient points of the debate (if it can be called one) between Hintikka and A.O. Lovejoy will be summarized in chapter one. Lovejoy held that Aristotle explicitly opposed the principle of plenitude. In general, I will side with Hintikka's claim that Lovejoy took advantage of vague sections of Aristotle's text to support his position. Furthermore, there are numerous examples of unambiguous Aristotelean text which show the Stagirite to have favored the principle.

The second question which needs to be answered assumes that Aristotle did make (at least limited) use of the principle of plenitude. What difference would the adherence to such a metaphysical thesis make? This question is raised in the second, third and fourth chapters. In particular, what impact would the principle of plenitude have on Aristotle's position on the deterministic issues with which he was concerned? Does, to be more direct, the principle of plenitude aid in either the formulation of the problems involved or the solutions which Aristotle seems to offer? In this section I will rely in part on R. Sorabji's commentary, *Necessity, Cause and Blame*, which offers a fine critique

of Hintikka's account. Sorabji contends that though Aristotle employs the principle of plenitude, any interpretation which is based exclusively on Aristotle's acceptance of the principle is inadequate.⁷ Much of what Sorabji has to say is, I think, totally correct. I have, however, criticisms of Hintikka's interpretation which are separate from those of Sorabji.

For example, the evaluation in chapter two of Hintikka's explanation of the restricted principle of *De Int.* 9 is, as far as I know, wholly new. Hintikka believes this principle to be a sophisticated amalgamation of the necessity operator and the law of excluded middle (LEM). It has the following form:

(1) necessarily $p \vee$ necessarily not- p .

(In that (1) is a modal law of excluded middle, it is referred to in the text as the MLEM.) Sorabji does not explicitly state why (1) is a faulty reading of the principle being restricted by Aristotle. Hintikka's case for the MLEM is, admittedly, most persuasive. Nevertheless, I am convinced that there are reasons, both philosophical and philological, against it.⁸

I do not put much emphasis upon the latter category. There are few philological observations in this thesis; there is only one that originates with me. The point in

question concerns Aristotle's formulations of the law of excluded middle. In brief, I have found that many of Aristotle's comments concerning the law of excluded middle (and other tautologies) employ the verb 'to be'. This observation is significant because it does serious damage to Hintikka's claim that the Stagirite did not draw a conscious distinction between the law of excluded middle and the principle of bivalence.

Hintikka relies, far too heavily in my opinion, on this claim to demonstrate the falsity of the 'traditional' interpretation (see Glossary) of Aristotle's sea battle argument. Like Sorabji, I believe the traditional interpretation, which, among other things, is that the problem of future truth is central to the sea battle argument, is the most plausible account yet given. There are other, closely connected, criticisms of Hintikka's account of *De Int.* 9. His difficulties stem in part from his view that the traditional interpretation is focussed **solely** upon the problem of future truth. Another source of trouble is Hintikka's insistence that the problem of future truth is only concerned with the evaluation of the truth-value of sentences that are located in the present. These two mistakes, I argue, contribute in a big way to Hintikka's ascription to Aristotle of the MLEM as the logical

principle being constrained.

I do not intend to show in this essay that Hintikka's views on how to construe Aristotle's metaphysics of modality are totally without merit. Indeed, there is much in Hintikka's work on Aristotle with which I find myself in near total agreement. For example, it seems correct that in *De Int.* 9, Aristotle is concerned about the truth-value of predictions which were made in the past. Yet the modal theses that Hintikka ascribes to Aristotle, and hence the assumptions Hintikka makes regarding the argument in *De Int.* 9, are, from my point of view, most odd. He prefers to rely on the principle of plenitude and holds that the problem of future truth was never a very serious difficulty for Aristotle. Hintikka's method for generating Aristotle's puzzle seems wrong to me on several grounds. Hintikka's treatment of Aristotle's position on the Master Argument, in contrast, is much more tenable. My own view regarding *De Int.* 9 is defended during the second chapter. My defense of the traditional interpretation is new in only a few areas, and on the whole, it is consistent with other treatments.

The analysis that I prefer concludes by limiting

the principle of bivalence. I maintain that Aristotle was arguing for a restriction of what I call the modal principle of bivalence which is simply

(MPB) it is necessary that every sentence p is true
or false.

Since it is possible that the principle of bivalence is false, it is clearly false that this principle constitutes a necessary truth. Aristotle, I hold, was arguing for the implausibility of (MPB) on the basis that if the (MPB) were conjoined with predictions, whether they are made in the past or not, then determinism will be supported.

Again, the second problem to be studied is concerned with Hintikka's views regarding Aristotle's critique of the Master Argument of Diodorus. Hintikka believes that his interpretation of Aristotle on the sea battle is entirely consistent with his interpretation of Aristotle on the Master Argument. By the same token, many of the objections that demonstrate the implausibility of Hintikka's first account do the same to his second. Independent problems also plague Hintikka's interpretation of Aristotle on the Master Argument.

As stated at the outset, four main problems will be studied. The last two, which are familiar to

philosophers of language, were introduced by Quine in his paper "Reference and Modality". The first is the problem of the substitutivity of identicals (SI) and the second is the problem of existential generalization (EG). These two problems were used by Quine as criticisms of modal logic. Alan Code, in his "Aristotle's Response to Quine's Objections to Modal Logic", shows that the problems of (SI) and (EG) can be aimed at accounts of temporal change as well. It is my contention that these two problems can be dealt with by the procedure which is outlined by Code.

The solution favored by Code requires a certain degree of language engineering. Individual concepts, which form part of Frege's intensional ontology, play an important role in the solution. Individual concepts are functions from (usually, but not always) the domain of possible worlds to the domain of objects which constitute each world. Briefly, Code holds that the problems of (SI) and (EG) can be dealt with if the reference points of possible worlds are replaced by ones of times. I agree with Code's solution, but in a thoroughly qualified way.

I agree with the view that the problems of (SI) and (EG) can be solved with Code's answer. The modified

individual concepts which Code invokes are both strong and elegant. But I take exception with Code's subsequent attempt to attribute this solution to Aristotle. Code's arguments for attributing the solution to Aristotle rely too much on the thesis that modal operators are interchangeable with their temporal counterparts. This thesis is the principle of plenitude. Whereas chapters two and three are more concerned with undermining the contributive role played by this principle, chapter four shows a more specific fault with the principle, namely, that it simply was not an unrestricted metaphysical thesis from Aristotle's point of view.⁹

Following the criticism of Hintikka's interpretation, it might be thought that the principle of plenitude is superfluous when tackling any of the problems which Aristotle may have been faced with. I doubt the accuracy of this view, for the solution endorsed by Code of the problems of (SI) and (EG) is suggested by the view that the principle is a viable one. However, if my criticisms in chapter eight are correct, the solution would not have been available to Aristotle.

An interesting byproduct of this thesis is the discovery that Aristotle was interested in some of the problems which are the predominant concerns of modern

philosophy. Examples include his concern about scope ambiguities (see the Appendix for my analysis) and his own formulation of the (SI) problem. Russell is perhaps the best-known philosopher of our time to dismiss, rather hastily, Aristotle's achievements.

Some comment on the programme of this essay is required. My principal intention here is test various hypotheses of which metaphysical tools were available to Aristotle. Such a mandate need not confine one to a study of Aristotle's text; more recent problems can and should be discussed. Furthermore, I am less interested in the doctrines which Aristotle definitely advanced than in showing what alternatives were open to him in responding to a host of problems.

The historical side of this essay lies in the attribution to Aristotle of the peculiar thesis of the principle of plenitude. But this is more a point of departure than an all-consuming interest. After establishing that Aristotle did treat modal and temporal operators as (merely) partially interchangeable, the question to be answered is how the principle bears on both the sea battle argument and Aristotle's analysis of the argument of Diodorus. Hintikka's treatment of these problems stresses the importance of the principle while

both Sorabji and I doubt its relevance.

One of the more interesting results of this essay is that interpretations based on the principle are both unnecessary and false. However, the principle of plenitude does serve a illuminating (and thus useful) role when the problems in II are being treated.¹⁰

Part I: Hintikka on Aristotle's Modal Ontology

Chapter Two-Hintikka versus Lovejoy on the Principle of Plenitude

This essay began with the observation that Aristotle's use of modal operators was at considerable variance with that of modern philosophers. The importance of correctly interpreting Aristotle's metaphysical theses of modality lies in their impact on various problems. Jaakko Hintikka contends that the most important of these theses is, to repeat, the principle of plenitude. In this section, the arguments for and against Aristotle's endorsement of this thesis will be reviewed. It will be concluded that Aristotle was indeed an advocate of the principle of plenitude. (There are, however, legitimate doubts as to the extent, and hence the importance, of this advocacy.) Following this will be an evaluation of Hintikka's less modest claim that the sea-battle argument and Aristotle's position on the Master argument can best be understood by first assuming Aristotle's support of the principle.

Hintikka's tentative formulation of the principle is as follows:

- (2) each possibility is realized at some moment of time.

It may not be entirely clear why (2) is unacceptable; at

least one modern philosopher entertains a thesis reminiscent of (2).¹¹ Aristotle showed, in *De Int.* 9, why it would be inaccurate to attribute (2) to him. (2) precludes possibilities which are never actualized and Aristotle definitely believed in these. "...it is possible for this cloak to be cut up, and yet it will not be cut up, but will wear out first."¹² Because of Aristotle's belief in unactualized possibilities, Hintikka improves the formulation of the principle of plenitude:

(2') No possibility remains unrealized throughout an infinity of time.

Hintikka then gives three variants of (2'):

(V1) that which never is, is impossible,
and

(V2) what always is, is by necessity.
and

(V3) nothing eternal is contingent.

The variants, I take it, have the same truth value as (2'). But we are proceeding too quickly. What evidence exists for attributing (2) and later the improved version (2'), to Aristotle?

The question is a subject of lively debate. There is both confirming and damaging evidence. Let us begin with the latter. Arthur Lovejoy maintained that Aristotle

explicitly rejected the principle. Lovejoy supports this claim with two passages, which are both located in the *Metaphysics*. The first is in Bk. III (at 1003a2), the second in Bk. XII (at 1071b18-20). In *The Great Chain of Being*, the translations Lovejoy uses for these passages are, respectively, "...it is not necessary that everything that is possible should exist in actuality" and "...it is possible for that which has potency not to realize it".¹⁹ On the basis of these two quotations, Lovejoy concludes that Aristotle openly renounced the principle of plenitude.

Hintikka exposes the ambiguity of these passages and accuses Lovejoy of exploiting that ambiguity. Four different construals are possible:

- I. Some potentialities may **sometimes** fail to be actualized.
- II. Each potentiality may **sometimes** fail to be actualized.
- III. Some potentialities may **always** fail to be actualized.
- IV. Each potentiality may **always** fail to be actualized.

Lovejoy fails to consider the first pair of interpretations, which is consistent with Hintikka's (2'). The second pair contradicts (2'). Hintikka argues

that the first pair is more plausible and thus that Lovejoy's conclusion that Aristotle renounced the principle of plenitude is incorrect.¹⁴

Hintikka's comments on the passage from the second book of the *Metaphysics* are very terse. He maintains that even if there were a way of extracting Aristotle's meaning from the text, "it would still not settle the question, for Aristotle is in this passage formulating a problem rather than giving his own considered opinion."¹⁵ Later Hintikka indicates that the problem to which he is referring is "whether the elements exist potentially or in some other way." The passage relied on by Lovejoy comes in as either an implication or a caveat to the hypothesis that the elements exist in some other way. If (as Hintikka appears to hold) the passage is an implication, then it is indeed part of the formulation of a problem and Hintikka would be correct in holding that we cannot be sure of an answer. On the other hand, if (as Lovejoy holds) the passage is a declaration on Aristotle's part, we still could not be certain about settling the question.¹⁶ For even if the passage in question is a declaration of Aristotle's views, it would be unclear which of I.-IV. was being endorsed.

Nor does the second passage, by itself, yield results

which settle the dispute with Lovejoy. More illuminating is the sentence which occurs a little later (at 1071b18-20 of Bk. XII of the **Metaphysics**:

Further, even if it [a Form] acts, this will not be enough, if its substance is potentiality; for there will not be eternal movement, for that which is potentially may possibly not be. ¹⁷

Hintikka is correct in maintaining that the principle Aristotle is invoking in the passage at 1071b18-20 is identical to the the one previously mentioned at 1071b13-14.

This being the case, we can exclude both III. and IV. as possible readings of the evidence of Lovejoy. As Hintikka points out, the principle in question permits Aristotle to conclude that a Form F which only potentially exists does not entail eternal movement because F may be unactualized at some times, actualized at others. The crucial point here is that there is no discussion here of a potentiality which always remains unactualized. Thus the conclusion that both passages from Bk. XII of the **Metaphysics** fail to vindicate interpretations III. and IV. given above. So Lovejoy's view that Aristotle repudiated the principle of plenitude is groundless.

This leaves us a choice between interpretations I. and II. Hintikka holds that I. is "clearly too weak to

support Aristotle's argument [in Bk. XII of the *Metaphysics*]."¹⁸ The conditional which expresses Aristotle's point is that

(A1) if F only potentially exists, then F might not exist.

Assume (A1). Now, if only some potentialities are unactualized, and thus do not exist, at some times (I.), then it is possible that the F's are not included among the potentialities. So the antecedent of (A1) is false. (It is not being said that a conjunction of (A1) and interpretation I. show that (A1) is false. That would, of course, constitute committing the fallacy of denying the antecedent.) But Aristotle maintained that this antecedent was true. It follows, then, that interpretation II. is a better reading than I. of the principle of plenitude.

Hintikka uses the passage from the *Metaphysics* to further argue in favor of an even stronger version of II: Even if it is true of each merely potential being

that it *may* fail to exist at some moment of time, it may still *happen to* exist all through an eternity. Or, rather, it *ay so* exist unless it is assumed that its possibility of not existing is at some time actualized.¹⁹ [Hintikka's italics]

That is, Aristotle would be loathe to say that when a Form only potentially exists, it nevertheless does exist throughout an infinity of time. To prevent this result,

Aristotle needed the following assumption:

(A2) Every mere possibility is, at some time, not actualized.

(A2) is a stronger version of II.²⁰ Hintikka concludes that the attribution to Aristotle of (A2) definitely shows Lovejoy to be wrong. A proper reading of the *Metaphysics* shows that Aristotle supported, rather than claimed to be false, the principle of plenitude.

Hintikka offers a very thorough treatment of the positive and negative evidence for Aristotle's adherence to the principle of plenitude. Accordingly, Hintikka considers pieces of apparent counter evidence other than that offered by Lovejoy. One such piece of evidence comes from Bk. I of the *Posterior Analytics*:

For what is accidental is not necessary, so you do not necessarily know why the conclusion holds-not even if it should always be the case but not in itself (e.g. deductions through signs). For you will not understand in itself something that holds in itself; nor will you understand why it holds.²¹ Hintikka entertains the notion that this passage

contradicts (V1) which is truth-functionally equivalent to Hintikka's preferred formulation of the principle of plenitude. But this conclusion is not a well-founded one. "The only thing we can definitely extract from the passage is that even an attribute that always belongs to a subject is not necessarily **known** to do so...."²² If Aristotle made the natural distinction between

epistemological and metaphysical necessity, we cannot interpret the passage from the *Posterior Analytics* as a denial of (V1).

I stated above that, for Hintikka, (2') is better than (2) because the former is left untouched by cases of unactualized potentialities. But Hintikka goes further than arguing that (2') is forced on us by such cases; he denies that they demonstrate that Aristotle was not an adherent of the 'principal forms' of the principle of plenitude.²³ Hintikka believes that some commentators seriously overestimate the significance of instances of unactualized potentialities. Hintikka's explanation of the passage from *De Int.* 9 (see n. 12) focusses on the fact that the cloak does not eternally exist: "...for when the cloak wears out, it goes out of existence, and no possibility can any longer be attributed to it."²⁴ Effectively, then, the principle of plenitude will not apply to many cases where there is a *prima facie* reason to invoke modality. This matter will be discussed at more length in chapter three.

Several of the pieces of apparent negative evidence are like the passage from *De Int.* 9 given above. That is, these other pieces of evidence also supposedly show that Aristotle was committed to unactualized

potentialities. For example, Bk. III of the **Physics** contains a passage which might be read as such a commitment: "Some things are in fulfillment only, others in potentiality and in fulfillment-one being a 'this', another so much....and. similarly for the other categories of being."²⁵ It is by no means clear that this implies for Aristotle that a 'genuine' potentiality will not be actualized at some time or other.

Another example occurs in Bk. XI of the **Metaphysics**: "Some things exist only actually, some potentially, some potentially and actually-some as beings, some as quantities, others in the other categories."²⁶ This passage seems to be very strong evidence in favor of potentialities which forever remain unactualized. If such potentialities do not exist, how can we explain the difference between things which exist potentially and those which exist **both** potentially and actually? But Aristotle's distinction here might be one of **how many times** a potentiality is actualized; things which exist potentially may only be actualized **once**, while things which exist both potentially and actually may simply be potentialities which are actualized **more than once**. This interpretation is as plausible as the one which ascribes permanently unactualized potentialities to Aristotle. It follows that the passage

just given from the **Metaphysics** cannot be admitted as definite evidence that Aristotle believed in potentialities which are never actualized.

Hintikka's argument that Aristotle was committed to the principle of plenitude is not composed merely of attacks on negative pieces of evidence. Hintikka concedes that many of the pieces of positive evidence which he adduces are not as strong as others.²⁷ But much of it seems most convincing. For example, Bk. II of **On Generation and Corruption**, contains the following:

For what is of necessity coincides with what is always, since that which must be cannot not be. Hence a thing is eternal if it is of necessity; and if it is eternal it is of necessity. And if, therefore, the coming-to-be of a thing is necessary, its coming-to-be is eternal. (See n. 4.)

In my opinion, this is the most compelling passage in favor of attributing the principle of plenitude to Aristotle. The other pieces of positive evidence mentioned by Hintikka are far less conclusive. They do, however, suggest that Aristotle thought of modality as being intrinsically linked with temporality; this in turn implies for Hintikka that Aristotle adhered to the principle of plenitude.

A clear instance of this latter category of positive evidence occurs in Bk. IX of the **Metaphysics**: "...no eternal thing exists potentially." ²⁸ This passage, Hintikka notes, announces the presence of (V3).

(Hintikka would not, I think, invoke this passage as definite proof for (2')-although it is good evidence for the more modest (2). If (V3) semantically entails (2'), then the text from the *Metaphysics* just cited is not definite proof for (V3).)

Hintikka gives an interpretation of Bk. IX of the *Metaphysics* which is very disputed. In that I lack the required scholarly training, I will only present the facts and leave it up to others to adjudicate. The debate concerns the following citation:

If what we have described is identical to the potential or convertible with it, evidently it cannot be true to say 'it is possible but will not be', which would imply that things incapable of being would vanish.²⁹

One might suppose that this passage is very strong evidence for the thesis that Aristotle was opposed to the view that possibilities could forever be unactualized. But there is an alternate reading, one which has been endorsed both by G. E. L. Owen and Martha Kneale. After 'it cannot be true to say', they translate "that this is possible but will not happen and to say this to such effect that the existence of the impossible will escape us in this way."³⁰ This second translation interprets Aristotle as contending that there will be cases of unactualized potentialities-as long as this does not entail vitiation of (the concept

of) the impossible.³¹

The weakest piece of evidence which is adduced by Hintikka is also from Bk. IX the *Metaphysics*:

Again, if that which is deprived of potentiality is incapable, that which is not happening will be incapable of not happening; but he who says of that which is incapable of happening that it is or will be will say what is untrue; for this is what incapacity meant.³²

It strikes me that a supporter of almost any modal theory would be content with this passage. I do not think there is any reason to suppose that the passage is defending the truth of either (2) or (2'). Thus it is bizarre, in my opinion, that Hintikka should single out this passage as evidence in favor of attributing the principle of plenitude to Aristotle.

One of the pieces of positive evidence allows Hintikka to claim that Aristotle offered a 'kind of proof for the principle' in Bk. I of *On the Heavens*. This evidence is also somewhat inconclusive. The following is the argument's conclusion:

Neither that which always is, therefore, nor that which always is not is either generated or destructible. And clearly whatever is generated or destructible is not eternal. If it were, it would be at once capable of always being and of not always being; but, this has been shown to be impossible.³³

The passage in question does not seem to be an argument

for the principle of plenitude at all, although it could be argued that the principle is being alluded to.

Hintikka refrains from using the the argument from *De Int.* 9 as positive evidence for attributing the principle of plenitude to Aristotle. For his main objective with respect to *De Int.* 9 is to highlight the effect of assuming the principle of plenitude; Hintikka avoids the problem posed if he were both to rely on *De Int.* 9 as reason for attributing the principle in question to Aristotle and claim that the principle helps to best explicate the argument in *De Int.* 9.

It is certainly true that Hintikka is doubtful about the worth of many of the passages which he cites to support his case. In particular, many of the citations simply feature modal and temporal terms in close proximity to one another; rather than claim these examples have the status of definite proof, he points to their circumstantial role. The following is a list of such openly inconclusive proof: Bk. II of the *Topics* (112b1); Bk. II of *On Generation and Corruption* (335a32-b7); Bk. I of *Parts of Animals* (644b21-23); Books I and XI of the *Metaphysics* (1026b27-37 and 1064b32, respectively.) Hintikka then claims that these passages are supportive of his overall contention "especially

when combined with Aristotle's remarks in *An. Prior I* 13. 32b4 on the classification of events into necessary, general, indeterminate, and rare...."³⁴

Hintikka's positive argument for attributing the principle of plenitude to Aristotle, then, has both strong points and weaknesses. Some of the evidence which he cites (especially Bk. II of *On Generation and Corruption* 338a1-3) is very compelling. But the majority of his evidence is either weak or inconclusive.

Chapter Three-Hintikka's Account of De Int. 9

Hintikka begins his analysis of the ninth chapter of Aristotle's *De Interpretatione* by noting that different scholars fundamentally disagree on the nature of the problem being addressed. The central problem is captured in the following question: "What is the view he [Aristotle] wants to refute there, and what is the view for which he wants to argue?" ⁹⁵ The account endorsed by Hintikka is at considerable variance with the overwhelming majority of treatments of *De Int.* 9.

Most accounts focus on the problem of future-truth, which is that if sentences about the future (i.e., predictions) are already true, then fatalism will be true. The following is Hintikka's own formulation of the problem:

Assume that....[p or not-p] or
[necessarily (p or not-p)] is true universally.
Then it will be the case, as Aristotle says, that
if someone declares a certain individual event will
take place and someone declares that it will not
take place, one of them will be making a true
statement while the other will be making a false
one; necessarily so, if (2) is universally true.
For instance, it will either be true to say that a
sea fight will take place or else true to say that
it will not take place tomorrow. Suppose....that
the former alternative happens to obtain. Then it
is true (already true) that there will be a sea
fight tomorrow. But if this is already true today,
how can the occurrence of the sea fight tomorrow be
contingent?⁹⁶

Hintikka then assumes that the latter alternative is

true (that the prediction about the non-occurrence of the sea fight tomorrow is already true). The sea fight in this case will be impossible. According to the traditional interpretation, then, a constraint must be placed on *tertium non datur*. If a constraint is not effected, then all events are either fated to be or fated not to be. Such accounts are referred to as versions of the traditional interpretation, because they are almost as old (and interesting) as Aristotle's argument in *De Int.* 9.²⁷

The merits of this formulation by Hintikka of the traditional interpretation are also discussed in chapter four. For now, it is clear that Hintikka sees the traditional interpretation as an account aimed at the truth-value of predictions. It is also clear that Hintikka views the problem of future truth with a time of evaluation of the truth-value of the predictions which is located solely in the present. This latter point is an important one, since it allows Hintikka to separate the traditional interpretation, which relies on the problem of future truth (as he describes it) from his own interpretation, which relies on the problem of infinite past truth. To properly explain this (supposedly alternative) problem, the impact (as viewed by Hintikka) of attributing to Aristotle the principle

of plenitude must first be assessed.

In chapter VIII of *Time and Necessity*, Hintikka writes that in "passage after passage, he [Aristotle] explicitly or tacitly equates possibility with sometime truth and necessity with omnitemporal truth."³⁹ Hintikka thinks of the principle of plenitude as supporting a close link between time and modality, with the provisos already mentioned.⁴⁰ Hintikka makes the natural move of applying the principle of plenitude to sentences. He notes that the following two types of sentences will pose different problems for Aristotle:

(3) *p* at *t*₀

and

(4) *p*.

Both (3) and (4) contain references to time: whereas the *t*₀ of (3) need not be tied to the present, (4) could be paraphrased as

(4*) *p* now.⁴⁰

Any sentence which is fixed to a specific time like (3) is, by the principle of plenitude, necessarily true if true at all (i.e., true at one time). For such a sentence is always true if true at all. Conversely, if (3) was false at all, it would be impossible. This result does not usually hold for more ordinary sentences like (4).

Hintikka interprets (3) as a perfect example of the future particulars Aristotle mentions in *De Int.* 9.

That is, the warning about future particulars being true or false which Aristotle makes at the beginning and the end of the chapter is, according to Hintikka, being aimed at sentences with the form of (3). Hintikka then observes that Aristotle's problems are compounded

by the fact that he [Aristotle] neither clearly realized how closely he was committed in his conceptual system to considering....[(4) and (4*)]rather than....[(3)]....as a paradigm of an informative sentence nor fully realized what alternatives were open to him. I want to suggest that in *De Int.* 9 the difficulties broke to the surface.⁴¹

Unfortunately, Hintikka does not immediately explain the significance for Aristotle of a sentence being informative.

Nor does Hintikka refer to any of Aristotle's works to support this contention. Yet the view that Aristotle was committed to informative sentences (or, as Hintikka subsequently calls them, "temporally indefinite" sentences) is a crucial one for Hintikka's interpretation, as Hintikka himself puts it:

Aristotle's main problem was not a metaphysician's vague worry about whether present truth about the future prejudices future events; it was the difficulty of a systematist who had defined his notions for too narrow a range of cases and was then forced to accomodate awkward new cases in his framework.⁴²

In other words, because Aristotle both (a) predominantly

thought in terms of sentences like those of the form (4) and (b) was a firm defender of the principle of plenitude (including its metalinguistic implications), he was perplexed by the results obtained with sentences of the same form as (3) (which Hintikka later labels "temporally qualified" sentences). Part of Hintikka's interpretation, then, is that sentences of the same form as (3), combined with (b), yield sentences of the form of

(3*) it is necessary that (p at t_0).

Hintikka sees the need for providing textual evidence (from *De Int.* 9) to support his claim that Aristotle's argument is built on the distinction between temporally indefinite as opposed to temporally qualified sentences. He has two pieces of evidence, one direct and the other indirect. The direct piece is contained in the following excerpt:

What is, necessarily is, when it is; and what is not, necessarily is not, when it is not. But not everything that is, necessarily is; and not everything that is not, necessarily is not. For to say that everything that is, is of necessity, when it is, is not the same as saying unconditionally that it is of necessity.⁴³

Hintikka concentrates on the sense, for Aristotle, of the word 'unconditionally' (*haplos*). He holds that *haplos* is best translated as 'without qualifications'.⁴⁴ The phrase 'when it is' suggests to Hintikka

that the qualifications being discussed are temporal in nature.

It has been suggested to me that the passage just given might be translated as "What is, necessarily is, if it is; and what is not, necessarily is not, if it is not."⁴⁵ This is a fascinating possibility: if it were true, then Hintikka's entire account is in serious trouble. For Hintikka's assertions regarding the role being played by temporal qualifications would be utterly groundless. In this case, however, no mistakes have been made with the translation. The following is from the original text of *De Int.* 9:

Τὸ μὲν οὖν εἶναι τὸ ὅρ' ὅταν ᾖ, καὶ
τὸ μὴ ὅρ' μὴ εἶναι ὅταν μὴ ᾖ, ἀνάγκη.

The presence of the word for "when" (ὅταν) is undeniable.

The evidence which lends indirect support to Hintikka's claim also serves to justify the transition from sentences of type (3) to ones of type (3*) with the following passage from *De Int.* 9:

Again, if it is white now it was true to say earlier that it would be white; so that it was always true to say of anything that has happened that it would be so. But if it was always true to say that it would be so, or would be so, it could not not be so, or not be going to be so. But if

something cannot not happen it is impossible for it not to happen; and if it is impossible for something not to happen it is necessary for it to happen. Everything that will happen, therefore, happens necessarily. So nothing will come about as chance has it or by chance; for if by chance, not of necessity.⁴⁶

Recall from the previous chapter that Hintikka also considers this part of *De Int.* 9 as reason to attribute the principle of plenitude to Aristotle.

Predictions with the same form as (3) have been true throughout the past. Hence Hintikka's term 'the problem of infinite past truth'. Hintikka believes the restraint being recommended by Aristotle is aimed at sentences which are directly prefixed by an 'it is necessary that' operator. The transition from sentences of type (3) to ones of type (3*) is, Hintikka contends, blocked by Aristotle's restriction on the MLEM. The MLEM, recall, is the principle that, for any sentence p, either necessarily p or necessarily not-p is true. The MLEM arguably applies to sentences concerned with both the past and the present. (This includes sentences of type (3).) Yet Hintikka generates the problem by combining the MLEM solely with the past evaluation of sentences concerned with the future.⁴⁷ It may be thought that other reasons can be given for withholding the MLEM from future sentences. Consider

(5) A sea battle will occur tomorrow.

If (5) is true **at present**, then it is in an obvious

sense inevitable that there will, in fact, be a sea battle tomorrow.

Following Quine, it might be objected that two modifications on (5) are required in order to achieve the desired result. The first modification concerns the verb construction of (5); Quine would hold that the future tense should not be used to express an eternal truth. That is, a tenseless verb construction is to be preferred. Accordingly, we obtain

(5') A sea battle occurs tomorrow.

The second modification needed to obtain an eternal sentence is the replacement of the indexical "tomorrow" by a specific moment. Thus,

(5'') A sea battle occurs at t_2

If we apply the MLEM to the **present** truth of (5'') (as opposed to Hintikka's evaluation of the **past** truth of (5)), and additionally assume both that (a) there are times earlier, and later, than t_2 (t_1 and t_3 , respectively) and that (b) t_1 is the present time, it follows that the sea battle is presently unavoidable. That is, when (5'') is evaluated via the MLEM at t_1 , the events at t_2 are inevitably true. Hintikka, as we have seen, uses only the past evaluation of sentences along with the MLEM to generate the problem. I take it, then, that Hintikka would not object to taking (5'') and

evaluating it at t_1 and concluding that the events at t_2 were necessary.

(Conditions (a) and (b) no doubt seem curious to the reader. I agree. We are uncomfortably shifting from indexicals to non-indexicals (a) and vice versa (b). But both conditions are justified, in that Hintikka adopts analagous conditions (albeit implicitly) when discussing the evaluation of predictions located in the past.)

Now, Hintikka does not provide a clear explanation as to why predictions must be evaluated solely from the point of view of the past in order to obtain the vindication of determinism. I will now give three reasons which attempt to account for Hintikka's preference. I will then show that they are untenable.

Firstly, if the problem is generated by the evaluation of sentences from the standpoint of the present, then the text of *De Int.* 9 will reflect this. But the text of *De Int.* 9 does not reflect such evaluation. By *modus tollens*, then, the problem is not generated by the evaluation of sentences from the present.

Secondly, as indicated above, the traditional

interpretation seems to commit one to the view that Aristotle sought to restrict the applicability of the law of excluded middle is inconsistent with Aristotle's unequivocal support for this law. Yet this claim is once again in direct conflict with textual evidence.

Thirdly, the traditional interpretation falls prey to what I will call "The Problem of Unactualized Possibilities". This objection has already been alluded to. (See p. 2.) Assume that (i) the traditional interpretation is correct and that (ii) the metalinguistic formulation of the MLEM is accurate. Recall that (ii) consists of the claim that

(2'') " \Box p" is true iff "(t) (p at t)" is true.

It is easy to derive from (2'') the following:

(2'')* " \Diamond p" is true iff " \exists t) (p at t)" is true.

(I leave the details of this derivation to the reader.)

(2'')* is clearly false. It might, for example, be true that

(6) It is possible that Jones will win the lottery.

Combining (6) with (2'')* yields

(7) There is a time at which Jones will win the lottery.

If it is assumed that (2'')* is true, then the inference from (2'')* and (6) to (7) is invalid. The obvious premise to abandon is (2'')*; it is false. It follows, does it not, that since the friends of evaluation of

predictions located in the present (i.e., the traditional interpretation) are committed to the truth of (2''), that they are likewise committed to an absurd position?

All three of these criticisms are inconclusive. The first objection is, I think, somewhat trivial. For it could plausibly be argued that the text makes mention of both methods of generation. Indeed, Hintikka concedes that the problem of future truth **does** have a role to play in the sea battle argument, only he believes that role to be a subsidiary one.⁴⁰ So Hintikka could not, *ex hypothesi*, rely on this first objection. (In chapter four, a similar objection is made *contra* Hintikka: it is held that there is no textual support for sentences that have the form of (3).)

The second criticism looks to be decisive at first glance. Indeed, several writers support this objection. Now it is undeniable that Aristotle was strongly committed to the law of excluded middle. The positive (and compelling) evidence is of both a direct and indirect sort. I will consider the latter evidence first.

The indirect evidence is found in the **Metaphysics**. The law of non-contradiction is, for Aristotle, "the most certain of all principles."⁴⁹ Aristotle offers three formulations of this law: logical, ontological, and psychological. By DeMorgan's Theorem, the law of non-contradiction is materially equivalent to the law of excluded middle. That is,

$$\neg (p \wedge \neg p) \equiv (p \vee \neg p)$$

Indirectly, then, Aristotle was committed to the truth of the law of excluded middle.

The direct evidence in favor of attributing the law of excluded middle is also contained in Bk. IV of the **Metaphysics**. Aristotle rhetorically asks "is he in error who judges either that the thing is so or that it is not so and is he right who judges both?" (When Aristotle speaks of a person who "judges both" he is referring to someone who consciously makes contradictory ascriptions. I think that Aristotle is very close, in Bk. IV of the **Metaphysics**, to explicitly formulating DeMorgan's Theorem.)

However, Aristotle was not, I maintain, arguing in favor of a restriction of the law of excluded middle at all in **De Int.** 9. Aristotle was instead restricting the principle of bivalence (the principle that holds

that every sentence is either true or false). It is crucial that everytime Aristotle discusses tautologies, part of the discussion is always in terms of ontology. For example, as already noted, part of Aristotle's discussion of the law of non-contradiction involves an ontological formulation:

And it will not be possible for the same thing to be and not to be, except in virtue of an ambiguity, just as one whom we call 'man', others might call 'not-man'; but the point in question is not this, whether the same thing can at the same time be and not be a man in name, but whether it can in fact.⁵⁰

Yet such a formulation is significantly absent from *De Int.* 9. The significance of such an omission is just that it lends plausibility to the view that Aristotle was placing restraints on the principle of bivalence rather than on the law of excluded middle. (Recall that Hintikka believes, albeit incorrectly, that the defenders of the traditional interpretation are committed to contending that Aristotle was (inconsistently) restricting the law of excluded middle.)

Two points need to be made in connection with this answer to the second criticism: Firstly, one might reply that the distinction between the principle of bivalence and the law of excluded middle is a somewhat arbitrary one. But this is mistaken. Suppose that we have a

three-valued language, L (any sentence p may be either true, or false, neuter) and that there is a rule such that whenever p is neuter, not- p is true. The law of excluded middle is intact, while the principle of bivalence is not.⁵¹ It seems rather fantastic to hold that this distinction was not seen by Aristotle.

It is true that Hintikka gives some consideration to the suggestion that Aristotle was restricting the PB rather than the LEM. But Hintikka's treatment is far too ephemeral as is shown when Hintikka introduces it in the following footnote from *Time and Necessity*:

Some writers-e.g., Lukasiewicz and Mrs. Kneale-distinguish between the law of excluded middle (every sentence of the form ' p or not- p ' is true and the principle of bivalence (every sentence is true or false). A few, including Mrs. Kneale and Colin Strang, think that Aristotle is striving to make this very distinction in *De Int.* 9. Whatever the merits of this distinction are in the abstract, I cannot find it in Aristotle's text. My main reason for thinking that the distinction is not Aristotle's is given in the first few paragraphs of section 8.⁵²

This footnote uncomfortably merges two separate ideas. The first is that of the distinction in itself between the PB and the LEM. This, I take it, is what Hintikka means by the distinction "in the abstract". He gives the clear impression that the distinction need not be recognized by all; only "some writers" make it. Sorabji would, I think, say that this point was incorrect. The PB and the LEM are identical neither in formulation, nor

in operation. If Hintikka is questioning that there is a difference between the PB and the LEM, he is simply mistaken.

The third criticism can also be met. Again, two points are critical: Firstly, the problem of unactualised possibilities arose after a strong form of the principle of plenitude was ascribed to Aristotle. The uncontroversial aspect of the principle of plenitude is the following conditional:

(2'**) If " p " is true, then " $(\exists t) (p \text{ at } t)$ " is true.

The controversial aspect of the principle of plenitude, the part which is causing the trouble, is the converse of (2''):

(2'') If " $(\exists t) (p \text{ at } t)$ " is true, then " p " is true.

(From (2''), we obtain

(2'') If " p " is true, then " $(\exists t) (p \text{ at } t)$ " is true.)

But, of course, there is no reason why the defenders of the traditional interpretation need themselves adopt as patently bad a doctrine like (2''). Indeed, if Sorabji is correct, severe limitations must be placed on the applicability of the

principle of plenitude. Secondly, and more to the point, the problem of unactualised possibilities is real for someone who, like Hintikka, does ascribe the strong form of the principle of plenitude to Aristotle.

It is to Hintikka's credit that he calls into question the value of the solution which he attributes to Aristotle. However, his concession is somewhat cryptic. "...If my interpretation is right, the distinction [between temporally qualified and temporally unqualified sentences] looks much more like a restatement of Aristotle's problem than a solution to it."⁵³ This comment by Hintikka is very puzzling; was there any question as to what Aristotle considered the solution to the problem to be? That solution is simply to restrict the application of some logical rule. The distinction which he makes constitutes a solution only in so far that it helps indicate which logical principle Aristotle was restricting. On the other hand, Hintikka is quite clear as to which principle is being restricted. (So Hintikka's comment leaves me somewhat baffled.)

Hintikka also states that Aristotle left unanswered the question, "If something is possible to happen at this very moment, will it have to happen?"⁵⁴ This

question might be said to be the most important in the evaluation of determinism. Instead, Hintikka says that Aristotle put this question in terms of sentences which are specified independently of the moment of utterance.

Hintikka's treatment of the sea battle argument of *De Int.* 9 is consistent with the notion that Aristotle was an adherent of the principle of plenitude. It is important, however, to see that the traditional interpretation has not been shown by Hintikka to be inconsistent with the textual evidence of *De Int.* 9. Moreover, as we shall see in chapter four, there are many powerful reasons to hold that Hintikka's interpretation itself is faulty. It is also important to see that there is no compelling reason, textual or otherwise, to prefer Hintikka's interpretation over the traditional one.

Hintikka extends his interpretation of the sea battle argument to Aristotle's treatment of Megarian determinism. This account by Aristotle constitutes the second of the four modal problems here under analysis.

Chapter Four-Hintikka on Aristotle on Megarian
Determinism

Hintikka's account of Aristotle's treatment of Megarian determinism shares many of the features of Hintikka's account of Aristotle's treatment of *De Int.* 9. In both cases, Hintikka sees his task as that of reconstructing the information as given by Aristotle about the argument. Hintikka's reconstruction once again focusses on the importance of ascribing the principle of plenitude to Aristotle. Hintikka's main position is that the 'Master Argument' of Diodorus was designed to remedy the incompatibility of the concept of possibility, as it is usually understood, with the thesis of determinism by replacing the normal concept of possibility with an 'extensional' one.

Hintikka is explicit about a fundamental assumption upon which his arguments concerning Megarian determinism are based. He maintains that "the modes of reasoning that Diodorus used are likely to have been similar to those of Aristotle....[and that on this basis]....we can fairly confidently say that we know at least a rough outline of how Diodorus argued."⁶⁴ This assumption may be troublesome to some philosophers. In my opinion, it is a claim which is incorrect. I will endorse, in the

following chapter, Richard Sorabji's contention that the principle of plenitude had only limited applicability for Aristotle. So I am not in accord with Hintikka's position that Aristotle had unwavering support for the principle; so the assumption that both Aristotle and Diodorus tacitly believed in (9) appears to be in trouble. But this need not be the case: perhaps Diodorus did not have unqualified support either for (9); thus bringing him (I would say) into agreement with Aristotle.

At any rate, the task at hand is to illustrate Hintikka's analysis of Aristotle's views regarding the Master Argument of Diodorus. Put simply, that task cannot be achieved if Hintikka's assumption is not granted. As I will show shortly, a great deal of philosophical mileage is obtained by granting Hintikka's assumption.⁵⁵

Here are the main steps of the Master Argument as given by Epictetus:

- (6) Everything that is past and true is necessary.
- (7) The impossible does not follow from the possible.
- (8) What neither is nor will be is possible.

Epictetus holds that Diodorus "used the plausibility of the first two propositions [(6) and (7)-M.D.] to

establish the thesis that nothing is possible which neither is nor will be true."⁵⁶ Diodorus, then, was attempting to demonstrate the plausibility of an alternate definition of possibility. In his work on Stoic logic, Mates gives the following as Diodorus' conclusion

(9) The possible is that which is or will be true.⁵⁷

Hintikka contends that (6), (7), and (9) were endorsed by Aristotle. (9) is simply the principle of plenitude. Most of the arguments for attributing the principle to Aristotle have already been exhaustively been discussed. Two other arguments of this type are given in ch. nine of *Time and Necessity*.⁵⁸ (As one of these arguments is very similar to one which is evaluated in chapter six I will refrain from dealing with them now. See n.⁵⁹ for further comment.)

There is little doubt that Aristotle supported the first premise ((6)). Hintikka quotes with approval from Bk. III of Aristotle's *Rhetoric*:

Forensic oratory [as opposed to political oratory-M.D.] deals with what is or is not **now** true, which can better be demonstrated, because not contingent--there is no contingency in what has now already happened.⁶⁰

As we shall see, this passage is not the sole piece of evidence in favor of attributing (6) to Aristotle.

(Hintikka notes that 'several interesting implications' can be drawn from this passage. I fully agree. The most interesting, from my point of view, is that "for Aristotle everything that is **present** is necessary in the same way as is everything **past**."⁶¹ And Hintikka goes on to point to the similarity between this passage and the already mentioned 19a23-25 of *De Int.* 9. The passage from *De Int.* 9 is the following: "What is, necessarily is, when it is, and what is not, necessarily is not, when it is not." I endorse this account of Aristotle given by Hintikka. That is, I concur that Aristotle held that the past and (in a sense) the present were necessary. However, I also say where Hintikka does not, that attribution of this view to Aristotle does not conflict with the 'traditional' interpretation of the sea battle argument.⁶²)

Let us now consider the other evidence that Aristotle was an adherent of (6). The following passage is from Bk. VI of the *Nicomachean Ethics*:

Nothing that is past is an object of choice, e.g. No one chooses to have sacked Troy; for no one **deliberates** about the past, but about what is future and contingent, while what is past is not capable of not having taken place, hence Agathon is right in saying

For this alone is lacking even in God
To make undone things that have once been done.⁶³

Hintikka also refers to Bk. I of *On the Heavens* to show Aristotle's support for (6):

...it cannot truly be said of a thing that it exists last year, nor could it be said last year that it exists now. It is therefore impossible for what once did not exist later to be eternal. For in its later state it will possess the capacity of not existing, not only of not existing at a time when it exists-since then it exists in actuality-but of not existing last year or in the past. Now suppose it to be in actuality what it is capable of being. It will then be true to say that it does not exist last year. But this is impossible. No capacity relates to being in the past, but always being in the present or future.⁶⁴

Hintikka concentrates on the final sentence. For my part, this passage also shows that Aristotle was quite explicit about the respective roles played by location in time of an event and the modality attached to that event. This in turn undermines at least part of Hintikka's analysis.⁶⁵

As Hintikka indicates, it is the second premise ((7)) which is the most puzzling. But, once again, there is a large amount of textual evidence which suggests that Aristotle supported this premise. Hintikka first calls attention to the similarity between (7) and Aristotle's "definition" of possibility contained in Bk. I of the *Prior Analytics*: "I use the terms 'to be possible' and 'the possible' of that which is not necessary but, being assumed, results in nothing impossible."⁶⁶ Hintikka refers next to the following

passage, also from Bk. I of the *Prior Analytics* to support the ascription to Aristotle of (7): If a particular, as opposed to a universal, premise "is necessary, the conclusion will not be necessary; for from the denial of such a conclusion nothing impossible results...."⁶⁷ This passage is not, in my opinion, very good evidence for supposing that Aristotle supported (7). Aristotle is here stressing that a contradiction is not entailed by negating the conclusion of an inference with a necessary particular premise. In other words, the conclusion is not a necessary truth. This point is somewhat different than the one expressed in (7).⁶⁸

Hintikka then calls attention to the following passage from Bk. VIII of the *Physics*: "...if we assume something is possible, nothing impossible will follow (though something false may)."⁶⁹ Hintikka also relies on the already discussed and controversial passage from Bk. 4 of the *Metaphysics* to support his contention (see p. 11 and n. ³⁰). Hintikka should not, I think, use this latter piece of evidence; whereas the meaning of this passage is disputed, the definition of possibility endorsed by Aristotle is uncontroversial. And Aristotle's definition constitutes good evidence in itself.

Hintikka refers to the same positive evidence regarding Aristotle's adherence to the principle of plenitude to show that Aristotle supported (9). Hintikka evidently considers (9) to be identical to the principle of plenitude. I have already raised some of my reservations concerning this matter. In addition, I will endorse in the following chapter Sorabji's objections of Hintikka's views regarding the principle of plenitude.

Hintikka provides two main reconstructions of Diodorus' arguments. He begins his initial reconstruction of the Master Argument by saying that Diodorus 'had' the following premises:

(10) it is possible that p ;

and

(11) it is not the case that p and it will never be the case that p .

Precisely what Hintikka has in mind when he attributes (10) and (11) to Diodorus is not wholly clear. Certainly it is conceivable that Diodorus thought of both premises as being innocuous. But Hintikka gives no reason for us to suppose that Diodorus actually employed (10) and (11) in his argument. Once again, I will give Hintikka the benefit of the doubt; the assumption that Diodorus made

use of these two premises will be (hesitatingly) granted.

Hintikka also attributes to Diodorus the following refined versions of (6) and (7):

(6*) any true statement concerning the past is
necessary;

and

(7*) if a possibility is assumed to be actualized,
no impossible conclusions follow.

(7*) would, according to Hintikka, allow Diodorus to replace (10) with

(10*) at time t_0 , it will
be true that p ,

where t_0 is some unspecified particular moment of future time. Evidently (7*) is not by itself sufficient to explain the entailment. For Hintikka gives a further brief argument to show why Diodorus could move from (10) to (10*). Hintikka holds that the fact that Diodorus shared with Aristotle a belief in (9) (the principle of plenitude) justifies this entailment. The thesis contained in (9), to repeat, is that possibilities will be actualized at some time or other. It follows, does it not, that if p is possible, p will be the case at some moment in the future?

There are two main criticisms that Hintikka has not considered in his argument. Firstly, it appears to be somewhat bizarre to make use of (9) to establish the entailment from (10) to (10*). For (9) is taken, by Epictetus, among others, to be the conclusion of the Master Argument. Therefore, unless Hintikka is accusing Diodorus of being hopelessly circular, (9) should not be invoked. I hold that this criticism of Hintikka's reconstruction of the Master Argument is tenable.⁷⁰

Secondly, and more importantly, the inference from (10) to (10*) is straightforwardly invalid. For even if Diodorus did share with Aristotle a firm belief in the principle of plenitude, it need not follow that there is a particular moment of **future** time at which **p** is true. Given the principle of plenitude, it follows that there is some particular moment of **either** future **or** present time at which **p** is true. (10*) clearly represents only one of these two disjuncts. I will return to this point after I have completed Hintikka's reconstruction of the Master Argument.

Hintikka then concentrates on showing that a result of (10*) is rendered impossible by (11) and (6*). This will establish that the 'original' set of premises (presumably the set consisting of (6*), (7*), (10), and

(11)) is inconsistent. From (10*) Hintikka obtains

(12) at time t_1 it will be

true that p was the case yesterday;

where t_1 is one day after t_0 ..

The next step in Hintikka's reconstruction is analogous to the sequential inference from (10) to (10*) to (12). From (11) Hintikka obtains

(11*) at time t_0 , it will

be false that p .

(My comments regarding the inference from (10) to (10*) also apply to the one from (11) to (11*).) From (11*) he obtains

(13) at time t_1 it will be

false that p was the case yesterday.

Hintikka then applies (6*) to (13) to reach the following conclusion:

(13*) at time t_1 it will be true that it is impossible for p to have been the case yesterday.

(13*) expresses "the impossibility Diodorus was looking for."²¹ (13*) thus shows (12) not only to be false, but impossible as well.

Hintikka actually rejects the inference from (6*), (7*), (10), and (11) to (13*). His motivation for

rejecting it is not identical to the criticism just given of the inference to (10*) from (10) (and, equivalently, to (11*) from (11)). Rather he contends that a scope ambiguity in the initial premise is illicitly exploited by Diodorus. I will return to Hintikka's reasons for rejecting the Master Argument in a moment.

I said above that two reconstructions of the Master Argument are provided by Hintikka. I have summarized the first reconstruction. The following passage from *Time and Necessity* introduces the second one:

If someone now asserts 'it is possible that *p*' does he mean that *p* should be the case *now* or that it should be the case *now or sometime in the future*. In our reconstruction, we assumed that the latter is meant. [I have already stated my objection to this claim-M.D.] What happens if the former is what is meant?²²

Hintikka's second reconstruction therefore is committed to eliminating all temporally specified sentences and replacing them with ones of the form

(4*) *p* (now).

The impossibility which, on this reading, Hintikka interprets Diodorus as deriving will involve the following sentences:

(14) It is now possible that *p*;

and

(15) *p* is not now the case.

For in the same way, Hintikka confusingly asserts, that (10*) was deduced from (10), the following can be obtained from (14):

(14*) p is now the case.

Precisely how one is supposed to derive a contradiction on the basis of (14*) and (15) is by no means clear.⁷⁹

Some comments are called for regarding the affinities, both perceived and real, which Hintikka calls attention to between his account of the sea battle argument and his account of the Master Argument. In both cases, Hintikka feels the role of temporally qualified sentences to be vital. And the justification for this type of analysis is just that Aristotle was supposedly a firm supporter of the principle of plenitude.

Hintikka's interpretation of Aristotle's views regarding the Master Argument is, alas, a confusing one. Whereas his reconstructions of the Master Argument portray Diodorus as sharing with Aristotle an adherence to the principle of plenitude, Hintikka's evaluation of the Master Argument construe Diodorus as attempting to prove

(16) $\Diamond (\exists t) p \text{ at } t \rightarrow (\exists t) p \text{ at } t.$

"...Diodorus strove to prove the principle of plenitude

instead of just *assuming* it [Hintikka's italics].⁷⁴

I will now briefly explain why Hintikka considers his reconstructions of the Master Argument to be invalid. To prove (16), Diodorus supposedly assumed

$$(16^*) \quad \Diamond (\forall t) p \text{ at } t.$$

He also had the following conditional at his disposal:

$$(17) \quad (\forall t) \neg p \text{ at } t \rightarrow \neg \Diamond p \text{ at } t)^{75} \quad \text{The negation of the desired conclusion is}$$

$$(16^{**}) \neg (\exists t) p \text{ at } t.$$

If (16) is to be proved, then the set containing (16*) (17), and (16**) will be inconsistent. However, this set does not result in a contradiction.

But a contradiction does arise if the friends of the Master Argument confused the *de dicto* (16*) with the *de re*

$$(16^{*'}) \quad (\exists t) \Diamond p \text{ at } t.$$

Hintikka believes that such a confusion would hardly have been surprising. For the English translations of (16*) and (16*') are, respectively

$$(16^*a) \quad \text{It is possible that } p \text{ should be the case now or in the future,}$$

and

(16*'a) There is some time such that p is possibly the case now or in the future.⁷⁶

I do not accept Hintikka's interpretation of Aristotle's account of the Master argument. This is partially due to my scepticism regarding Hintikka's ascription to Aristotle and Diodorus of the principle of plenitude. There is also the fact that Hintikka's reconstructions of the Master Argument appear to have little, if any, connection with the available textual evidence. Hintikka himself admits that his interpretation is at considerable variance with

Epictetus' presentation of the Master Argument.⁷⁷

Finally, and most damaging is that Hintikka's begs the question, albeit somewhat subtly.

I have stated some of the objections to Hintikka's analyses of two modal puzzles in Aristotle. By no means, however, have I given as comprehensive a treatment of Hintikka's views as I would like. Accordingly, then, I will devote one more chapter to the metaphysical views of modality which Hintikka attributes to Aristotle.

Chapter Five-Sorabji on Hintikka on Aristotle

In his *Necessity, Cause and Blame*, Richard Sorabji raises some points in opposition to Hintikka's interpretation of the sea battle argument of *De Int.* 9. Sorabji is especially critical of the view that the principle of plenitude significantly helps in analysing the sea battle argument.⁷⁸ He also makes some illuminating remarks regarding Hintikka's reconstruction of the Master Argument. In this chapter, Sorabji's views on Hintikka's two interpretations will be briefly discussed. His account of Hintikka's theories is similar to mine in several respects. We can begin with Sorabji's analysis of Hintikka's treatment of *De Int.* 9.

There are three main groups of objections in Sorabji's critique of Hintikka's account of *De Int.* 9. The first group concerns Hintikka's attack on the traditional interpretation. Sorabji rejects Hintikka's view that Aristotle is not, in *De Int.* 9, focussing on the problem of future truth. Sorabji believes not only that the traditional interpretation is the best available solution, but also that Hintikka's interpretation is inconsistent. To repeat, the traditional interpretation is that Aristotle saw deterministic, and hence unacceptable, consequences as

the result if it is assumed that all predictions are true or false in advance of the pertinent events. Recall further that Hintikka holds that the traditional interpretation commits Aristotle to a denial of the law of excluded middle. As I have indicated previously, Aristotle was a strong defender of the LEM.

One group of objections is concerned with Sorabji's scepticism of Hintikka's view that, in *De Int.* 9, Aristotle was preoccupied with the distinction between sentences which are temporally qualified and those which are not. Sorabji is especially critical of Hintikka's reading of 19a23-26. This is the part where Hintikka sees a temporal contrast being drawn between sentences of the ordinary form *p* and the more unusual form of '*p* at *t₀*'. Sorabji sees three difficulties with Hintikka's reading of 19a23-26. The first is that the phrase 'when it is' does not force us to consider a moment which is specified independently of the time of utterance. Sorabji disagrees that sentences of the form '*p* at *t₀*' are what Aristotle has in mind here.⁷⁹

The second difficulty which Sorabji detects in this part of Hintikka's analysis is that Aristotle is not, in Sorabji's opinion, discussing sentences at all, let alone ones of the form '*p* at *t₀*' at 19a23-26. Sorabji doubts

that sentences are mentioned until we reach 19a32. This objection lacks, in my opinion, the textual justification of Sorabji's other points. Although it is true that Aristotle does not explicitly mention that he is discussing sentences in *De Int.* 9, he does announce, at the outset of the chapter, that he is concerned with restricting a principle which applies to affirmations and negations. And what are affirmations and negations if not sentences?

The third defect which Sorabji calls attention to grants the assumption that Aristotle was concentrating on sentences which were always true or always false. Sorabji points out that many sentences of the form 'p at t₀' are neither always true nor always false. That is, the presence of a specified time within a tensed sentence is not a necessary condition for eternal truth or eternal falsity. Consider

(18) There was a sea battle in 1945.

Sorabji sees that if the tense is altered for (18), the resulting sentence will not be always true (or always false). For my part, I would question the real strength of this criticism.⁸⁰

Sorabji has more general doubts about Hintikka's interpretation of the sea battle argument. Sorabji writes that "there are plenty of sentences lacking a calendar date

(or equivalent) which would nevertheless meet the requirement that concerns us."²¹ That requirement is that if a sentence S is true (or false) at all, then S is true (or false) at all times. For Hintikka, S will have the form 'p at t_0 '. Sorabji's criticism here is that other forms of sentence would also be viable candidates for S . Consider

(18*) There will be a sea battle in the Piraeus.

(18**) A philosopher king who wears cloaks will be born.

(18**') The first cloak worn by a philosopher king will wear out.

None of these sentences are of the form that Hintikka specifies in his interpretation. Yet they have either been always true or always false.²² Thus, Aristotle must, on Hintikka's interpretation, surrender the gate to the determinist; sentences like S1-S3 would be either necessarily true or necessarily false. This is precisely the opposite of what Hintikka claims his interpretation will do.

In fairness to Hintikka, he does, in *Time and Necessity*, question the worth of Aristotle's solution. He contends that Aristotle's problem is not satisfactorily solved, but that Aristotle was nonetheless committed to it.

The extent to which Aristotle was committed to the principle of plenitude is another reason for doubting the overall worth of Hintikka's view of *De Int.* 9 .

For he [Aristotle] accepted the principle of plenitude only in connexion with such things as the heavens, their motions, and the resulting seasons, not in connexion with a battle, or, for that matter, with the truth about a battle.³³

But what of Sorabji's own positive account of the sea battle? It is an overly tentative endorsement of the traditional interpretation. I call it thus because he either offers inadequate replies to the charges levelled at this interpretation or he chooses not to answer such charges. For example, Sorabji does not deal with the problem of Aristotle's comment at 19a23. As indicated above, I take Aristotle simply to be asserting that events located in the present are necessary (though in a qualified way).

I have no reluctance about adopting the traditional interpretation of the sea battle argument. And I would go further than Sorabji in that I feel that there are no textual grounds for not endorsing the traditional interpretation.³⁴

Sorabji's analysis of Hintikka's account of Aristotle's position on the Master argument of Diodorus is far less detailed than the analysis of the sea battle. Nevertheless, many of Sorabji's criticisms of

Hintikka's first account are pertinent to Hintikka's second one.

Like me, Sorabji is skeptical of the extent to which Hintikka attributes the principle of plenitude to Aristotle. In particular, Sorabji argues that Aristotle makes limited use of the principle.

For in nearly all of the instances where Aristotle invokes the principle, certainly in all the non-controversial ones, the idea that what is always true of something is necessarily true of it is explicitly applied to **everlasting** things.²⁵

This view is quite plausible, and hence devastating for Hintikka. For there is no independent evidence that Aristotle thought of sentences as eternal.

Part II: Aristotle's Modal Ontology and the
Philosophy of Language

Chapter Six-The (SI) and (EG) Problems and the Solution of Code

This chapter discusses two further difficulties for any theory of modal ontology as well as a solution to them which Aristotle may have had at his disposal. Both problems are very well-known in the philosophy of language and will here be referred to as the problems of (SI) (for 'substitutivity of identicals') and that of (EG) (for existential generalization'. Both problems have been used by Quine as reasons for abandoning the many versions of modal logic; Quine holds that the problems expose the incomprehensible nature of modal logic.^{ee}

As mentioned above, though these problems were directed by Quine at the use of the two modal operators ('it is possible that' and 'it is necessary that') they also pose problems for the use of tensed sentences and for sentences which feature the verb 'becomes'. A demonstration adapted from Alan Code's "Aristotle's Response to Quinean Criticisms of Modal Logic" of this result will be presented shortly. A convenient place to begin is with a brief review of Quine's objections.

Quine holds that the 'it is necessary that'

operator is referentially opaque. Consider Quine's famous inference:

- (i) It is necessary that: (9 > 7).
- (ii) 9 = the number of planets.
- (Therefore) (iii) It is necessary that: (the number of planets > 7).

Quine of course recognizes that this argument is invalid. The problem for Quine is to explain why the inference is invalid. Either the substitutivity of identicals must be surrendered or some limitation must be placed on the modal operator. Since Quine is loathe to give up Leibniz's law, he opts for a restriction on the applicability of the modal operator.

The problem of (EG) arises as follows:

- (iv) 9 is necessarily greater than 7.
 - (Therefore) (v) (x) (x is necessarily greater than 7)
- But what is the x of (v). Is it 9 which is identical to the number of planets?

The problem of the substitutivity of identicals arises for tensed sentences as follows. It is (at the time of writing) a lamentable truth that

- (19) The President of the U.S. = Bush

On the other hand, it is also true that

(20) The President of the U.S. attended the Yalta Conference in 1945.

But it is false that

(20*) Bush attended the Yalta Conference in 1945.

Thus, if we view (19) and (20) as premises and (20*) as a conclusion, we are confronted with an invalid form of argument.

The problem of existential generalization (EG) is related to that of (SI). If (20) is true, then surely

(20**) ($\exists x$) (x attended the Yalta Conference in 1945)

is also true. But which individual is (20**) true of? Is it the President of the U.S., i.e., Bush? It thus seems that the inference from (20) to (20*) cannot properly be made. It is clear that this difficulty of interpreting quantification will arise for many tensed sentences. (Sentences which feature verbs such as "becomes" or phrases such as "changes into" also fall prey to the problems of (SI) and (EG).²⁷) Temporal contexts, then, are referentially opaque.

What is the significance of showing that (SI) and (EG) are problematic for accounts of temporal change, in

addition to accounts of modal logic?

Since we have the same problems showing their heads with modal statements, and with tensed statements, and with statements using the verb "becomes". we have *prima facie* reason to suppose that in each of the three cases the difficulties should be handled in the same way.**

Code considers three separate responses to Quine's objections to modal logic.

These problems engender a variety of responses, depending in part on one's theory of reference. Frege was the first champion of an 'indirect' theory of reference, and it ranks as the most famous approach to the philosophy of language. Individual concepts are among the intensional entities which are necessary for Frege's theory.** In terms of possible worlds semantics, individual concepts are members of the set of functions from the domain of possible worlds to the domain of objects in each of the worlds.

One of the apparent benefits of assigning individual concepts to singular terms is, Code points out, that it permits a distinction between necessary and contingent identity claims.

The sentence " $a = b$ " is true at some possible world w if the individual concept assigned to " a " has the same value at w as does the individual concept assigned to " b ". If (and only if-M.D.1 the sentence is true in all (of a designated set of) possible worlds, the identity expressed is

necessary; if it holds at some, but not all, such points it is contingent.⁹⁰

I write "apparent" because there is a well-known argument by Kripke to the effect that all identity claims between rigid designators are metaphysically, though not epistemologically, necessary. Some philosophers have made cogent criticisms of Kripke's argument.⁹¹ The issue will not be decided here. Suffice it to say that some philosophers want to drive a wedge between necessary and contingent identity claims in a non-Kripkean fashion. One way to do this is with individual concepts.

Code notices that if the reference points of possible worlds are replaced by ones of temporal points, a solution is obtained for the problems of (SI) and (EG) (in respect to both modal logic and temporal change). He refers to Bressan's work on modal calculi as the first to use individual concepts to define intensional predicates.⁹² Each n -place predicate is assigned a function from possible worlds to sets of n -tuples of individual concepts. Code's solution modifies Bressan's intensional engineering so that possible worlds can be treated as maximal chains on the domains of times. A further point is added:

...I prefer to think of the domains of individuals associated with each point in time as space-time slices (from that time) of individuals. In this way

the spatio-temporal coincidence of two space-time worms can be reflected by the coincidence of the individual concepts with which they are associated.
99

Call the thesis that there are spatially and temporally discontinuous individual concepts the TQ.

Adoption of the TQ would give access to Aristotle and anyone else to a remedy to the difficulties posed by Quine. Quine's arguments supposedly undermine the credibility of modal logic. I do not agree at all. Neither the problem of (SI) nor the one of (EG) pose genuine problems.⁹⁴ However, various solutions to Quine's criticisms are given; many of these solutions tacitly acknowledge the validity of Quine's criticisms⁹⁵ One of the aspects which I find appealing about the TQ is that it views Quine's criticisms as pseudo-problems.

Chapter Seven-Code on Spatiotemporal Puzzles in
Aristotle

This chapter is primarily concerned with critically evaluating Code's arguments in favor of attributing the TQ to Aristotle. Code begins by pointing out that Aristotle felt the following (reconstructed) argument to be invalid:

(21) The musical thing has become the literate thing. Therefore,

(21*) The musical thing is now the literate thing. Therefore, (by (SI)),

(21**) The literate thing has become the musical thing. This argument occurs twice in Aristotle's writing: in Bk. I of the *Topics* and in Bk. VI of the *Metaphysics*.⁹⁶ The inference was apparently used by certain sophists who hoped thereby to show the following metaphysical thesis to be false: (M_A) Everything which is not eternal has come into being.

Code concentrates on the fact that Aristotle has correctly identified the fallacy involved in the inference: the sophists were confusing merely coincidental entities with identical ones. "One natural way to understand Aristotle here is to think of the musical and the literate as being spatiotemporal continuants which coincide in one another..."⁹⁷ That is,

Code thinks it natural to attribute to Aristotle, at least in this case, an answer which is obtained by the TQ.⁹⁹

Now, Code is fully aware that some philosophers do not agree with the position that Aristotle did not confuse the coincidental with the identical. The first stage in Code's argument for attributing the TQ to Aristotle involves, then, a defense of Aristotle against some modern critics. The disagreement is over the correct interpretation of an argument presented in Bk. V of the *Metaphysics*. Alan White holds that Aristotle there confuses the following questions:

- (22) When are two individuals, *a* and *b*,
coincidental in some (possibly distinct)
individual *c*?

and

- (23) When are *a* and *b* one and the same individual?

Call White's position the "confusion thesis".⁹⁹

Adoption of the confusion thesis does manage to explain at least two puzzling passages in Aristotle. Consider first the following passage from Bk. I of the *Topics*:

...a third use [of numerical unity] is found when it is rendered in reference to some accident, as when the creature who is sitting, or who is musical, is called the same as Socrates.¹⁰⁰

Aristotle is making use of the fact that the musical creature coincides with Socrates as a case of numerical unity. White could claim this is an example of the confusion thesis in action. Now consider the following passage taken from Bk. V of the **Metaphysics**:

...[thel white [thing] and [thel musical [thing] are the same because they are accidents of [coincidental tol the same [thing]....¹⁰¹
In other words, Aristotle again uses the fact that

two individuals coincide as a rationale for saying that they are one. White could again point to this case as one where Aristotle has confused coincidence with identity.

Code correctly holds that the distinction between (22) and (23) is a rather obvious one. *Prima facie*, then, it is bizarre for White to support the confusion thesis. Furthermore, White's main argument is shown by Code to be inconsistent. White insists that the concept of spatio-temporal part is crucial to understanding how individuals such as the white thing and the musical thing can be parts of a third individual (Corsicus). Corsicus is simply a four dimensional continuant.¹⁰² But then (22) and (23) become, respectively,

(22') When are two individuals, a and b,
spatio-temporal parts of some third spatio-temporal continuant, c?

and

(23') When are two spatio-temporal continuants **a**
and **b** coincidentally the same?

The transition from the (22)-(23) pair to the
(22')-(23') one is significant because though there are
different answers to the former pair of questions, there
is precisely the same answer to the latter pair. Both
(22') and (23') have the following answer: either

- (1) **a** is a spatio-temporal part of **b**;
- or (2) **b** is a spatio-temporal part of **a**;
- or (3) **a** and **b** are spatio-temporal parts of some
continuant **c**.

The important point here is that, even if we grant
White's assumption that (22) means (22') and that (23)
means (23'), then White's overall claim that Aristotle
did not distinguish between (22) and (23) in no way does
damage to Aristotle's position.

In other words, if White is correct about (22) and
(23), then both (i) Aristotle was not confused about the
relation between identity and coincidence, and (ii)
Aristotle was relying on a formal definition of
coincidence similar to the following: *x* coincides in *y*
iff *x* is a spatio-temporal part of *y*. On the assumption,
then, that White is correct, this means that Aristotle
thought of coincidental sameness to be on a par with

coincidental oneness. The literate thing and the musical thing of (21) and (21*) are the same because they both share spatio-temporal parts with each other. Notice that this interpretation is consistent with the answer obtained by invoking the TQ; the musical thing and the white thing are one and the same individual (using Aristotle's sense of 'same') in precisely the same way that Bush and Reagan were seen to share spatio-temporal parts using the TQ. Recall that the President will turn out to be an individual who is both spatially and temporally discontinuous.

The strongest piece of evidence which Code cites to support his claim that Aristotle was invoking the TQ occurs in Bk. I of the *Physics*. Consider the following passage:

We say that one thing comes to be from another thing, and something from something different, in the case both of simple and of complex things....We can say the man becomes musical, or that what is not-musical becomes [that thing which is] musical, or the not-musical man becomes the musical man. Now what becomes in the first two cases--man and [that thing which is] not-musical--I call **simple**, and what each becomes--musical--simple also. But when we say the not-musical man becomes a musical man, both what becomes and what it becomes are **complex**.

....When a simple thing is said to become something, in one case it survives through the process, in the other it does not. For the man remains a man and is such even when he becomes musical, whereas what is not musicaldoes not survive, either simply or combined with the subject.

These distinctions drawn, one can gather from surveying the various cases of becoming in the way we are describing that there must be an underlying something, namely that which becomes, and that this, though always one numerically, in form at least is not one.¹⁰³

On the strength of this passage, Code concludes that Aristotle was invoking the TQ. His argument is deceptively simple: if Aristotle did not have the TQ at his disposal, the problems with the verb "becomes" (see n.⁹⁷) will recur at this point. I believe that Code has in mind the following faulty inference:

(24) The man becomes the thing which is musical.

(24*) The man becomes the thing which is unmusical.

By (EG), we obtain

(24**) (\exists x) (x becomes both the musical and unmusical thing.)

There are several aspects of Code's interpretation which I find especially appealing. I agree with the view that the problems of (SI) and of (EG) do not pose genuine difficulties for the modal logician. I also agree that it was more than natural for Aristotle to stress the distinction between continuity and identity.

Code agrees with Quine's assertion that the criticisms of modal logic force a reversion to Aristotelian essentialism. The following is from Quine's "Reference and Modality":

...Aristotelian essentialism is required if quantification into modal contexts is to be insisted on. An object, of itself and by whatever name or none, must be seen as having some of its traits necessarily and others contingently, despite the fact that the latter facts follow just as analytically from some ways of specifying the object as the former traits do from other ways of specifying it. ¹⁰⁴

It might seem that Code is among that group of philosophers who accept the soundness of the Quinean criticisms of modal logic. However, I doubt that this is the case, since the TQ effectively shows that the (SI) and (EG) problems are solvable.

Chapter Eight-Scope Ambiguities and other
Modal Inexactitudes in Aristotle.

Hintikka's view that the MLEM occurs at both the start and finish of *De Int.* 9 would be much more believable if there were a strong case to be made for the regular appearance of scope ambiguities in Aristotle's works. For, as we have seen, there is but one modal operator mentioned in the relevant passages where Hintikka believes there are two. Most convincing would be the occurrence of modal (or apodeictic) inexactitudes in Aristotle's writings. Hintikka does give two such examples, though he refrains from using it to bolster the plausibility of his claim. In this chapter, I will argue that these two criticisms of scope ambiguities in Aristotle's thought are untenable.¹⁰⁵

The first case involves Aristotle's stand on two modal syllogisms. It can be shown that Aristotle's endorsement of syllogisms of the form (Sa) and his view that those of the form (Sb) were invalid contradicts his own conversion rules for modal sentences.

(Sa) (25) A necessarily belongs to all B.

(26) B belongs to all C.

So, (27) A necessarily belongs to all C.

(Sb) (28) A belongs to all B:

(29) B necessarily belongs to all C.

So, (30) A necessarily belongs to all C.

Aristotle's position, that while (Sa) is valid while (Sb) is

not, shows that the first line of (Sa) should be translated into formal logic either as

(Sa) (25') $(\forall x) (Bx \rightarrow \Box Ax)$

or, equivalently,

(Sa) (25'') $(\forall x) (\forall y) ((Bx \wedge x=y) \rightarrow \Box Ay)$

Because the first line of (Sa) has the same form as the third line of the syllogism, as well as the second and third lines of (Sb), corresponding translations of all three can be obtained. The result will be that (Sa) is the only valid argument of the two.

The conversion rules which Aristotle used on modal sentences do not allow the following inference:

(Sc) (31) A necessarily belongs to no B

(32) B necessarily belongs to no A.

Note that (31) and (32) are similar in form to (25) and (29) above. So (31) should be translated as

(31')

$(\forall x) (Bx \rightarrow \Box \neg Ax)$

and, by the same token, (32) should be translated as

$$(32') (\forall x) (Ax \rightarrow \Box \neg Bx)$$

Hintikka believes that Aristotle must have thought of the 'it is necessary that' operator in the first and second lines of (Sc) as having full scope over the respective sentences. For Aristotle held that the negation of the first line was

(33) it is possible that A belongs to some B.

The obvious translation of (33) is the *de dicto*

$$(33') \Box \exists x (Bx \wedge Ax)$$

(33) is supposed to be the negation of the first line of (Sc). Assuming that the respective translations are correct, (33') should also be the negation of (31'), which was the translation of (31). But (33') is not the negation of (31'). Instead, the negation of (31') is the *de re*

$$(31'') \exists x \neg (Bx \rightarrow \Box Ax)$$

The trouble here is the translation of (31). If our translation of (31) is the *de dicto*

$$(31''*) \Box \forall x (Bx \rightarrow \neg Ax)$$

, as opposed to the *de re* (31''), then Aristotle is correct in holding that (31) and (33) are negations of each other.

The point, then, is that a *de dicto* reading of the 'it is necessary that' operator—a reading obtained from

Aristotle's conversion rules-contradicts the *de re* reading of that operator-which was supported by Aristotle's defense of (Sa) and his failure to support (Sb). There is, then, no consistent way to interpret Aristotle's modal sentences. Or at least this is what Hintikka concludes.

Does this failure to draw a clear distinction between *de re* and *de dicto* apodeictic sentence show, by itself, that Aristotle intended there to be two occurrences of the necessity operator where the passages of *De Int.* 9 only give one? I doubt it. For one thing, it is at least arguable that Aristotle was aware of the *de re/de dicto* distinction. (See my analysis of 32b25-32 of the *Prior Analytics* below.) I would argue instead that Hintikka has not been sufficiently rigorous in his argument. Consider the *de re* version of (33):

$$(33'') \quad \exists x (Bx \wedge \Box Ax)$$

Perhaps it is not obvious but (33'') is the contradictory of (31'). Another way to make the same point is to notice that (31'') is equivalent to (33''). Hence, contrary to what Hintikka holds, a consistent reading of apodeictic premises is possible in this case.¹⁰⁶

Hintikka could argue that (33'') is much less

natural than (33') as a translation of (33). Now I would find such an argument to be very puzzling. Since Hintikka himself does not give such an argument, I will now do so. Some authors reject *de re* formulae which use the 'it is possible that' operator. Quine justifies this rejection in "On What There Is":

We may impose the adverb 'possibly' upon a statement as a whole, and we may well worry about the semantical analysis of such usage; but little real advance in such analysis is to be hoped for in expanding our universe to include so-called possible entities. I suspect that the main motive for this expansion is simply the old notion that Pegasus, for example, must be because otherwise it would be nonsense to say even that he is not.¹⁰⁷

Quine is making two claims here: (i) the preference for *de dicto* modal formulae is justified because they do not require the introduction of new entities; (ii) the motivation for the introduction of possible entities (which would accompany several, though not all, *de re* modal formulae) is the problem of non-existence.

Both claims are dubious. Let us consider them in reverse order. (ii) is, I think, more clearly false. The problem of talking about non-existent entities need not be the reason for allowing *de re* modalities. It is true that fictional entities represent a special problem for the *de re* theorist.¹⁰⁸ But the problem of non-existence, as is well known, can be solved without possible entities. The motivation for positing the

existence of *de re* modalities lies in several areas, but the problem of non-existence is not one of them. I have already expressed, in chapter seven, my scepticism about the problems of (SI) and of (EG). I am equally dubious about other criticisms of *de re* modalities. In addition, *de re* modal formulae are needed to properly capture our intuitions. Consider the ambiguous sentence

(34) The author of *Hamlet* might not have written *Hamlet*.

One *de dicto* version of (34) is

(34') $\Diamond \exists x ((Hx \wedge \forall y (Hy \rightarrow x=y)) \wedge \neg Hx)$

Now it is clear that (34') does not convey the force of (34); (34') is obviously false. But the *de re* version of (34) does convey the intended force:

(34'') $\exists x ((Hx \wedge \forall y (Hy \rightarrow x=y)) \wedge \Diamond \neg Hx)$

The fact that *de re* modal formulae, such as (34''), seem to be required obviously undermines (i) as well as (ii). New entities are indeed being introduced in (34''). But if this introduction is required to make sense of (34), then so be it. I am thus skeptical about Quine's first claim. On the other hand, (i) is not as clearly false as (ii). For Quine would presumably justify (i) on the grounds that *de re* modal formulae presuppose transworld identity. And Quine has at his disposal an analysis of (34'') which is similar to his

analysis of *de re* epistemic formulae in "Quantifiers and Propositional Attitudes". In both cases, the "problem" of quantifying into intensional contexts would be solved.¹¹⁰

At best, Hintikka has shown that the Stagirite was unclear when it came to the scope of modal operators; Aristotle did not embed modal operators consistently. Instead, he chose to interpret different syllogisms with either a *de re* or a *de dicto* reading of the modal premisses.¹¹¹

More importantly, the interpretation which Hintikka gives of the start and finish of *De Int.* 9 (the MLEM) is that the operator is embedded twice within the LEM. So the MLEM cannot be said to be a (clear instance of) *de re* sentence as opposed to the *de dicto* $\Box(p \vee \neg p)$. (This latter sentence is what Hintikka believes the friends of the traditional interpretation to be committed to.) However, Hintikka's interpretation requires not only cases of scope ambiguity but cases of unexpected occurrence of modal operators as well. For cases of the former sort establish that a *de dicto* reading of the disputed passages might not be intended, and nothing more. A case of the latter sort would show that Aristotle attached modal operators to sentences

even when the 'natural' way to read such sentences would indicate otherwise. Hintikka needs such a case to successfully attribute the MLEM to Aristotle.¹¹²

Hintikka maintains that there are sentences in Aristotle's syllogistic that feature unexpected occurrences of modal operators. The following is taken from Bk. I of *Prior Analytics*:

We must understand 'that which belongs to every' with no limitation in respect of time. e.g. to the present or to a particular period, but without qualification. For it is with the help of such propositions that we make deductions, since if the proposition is understood with reference to the present moment, there cannot be a deduction. For nothing perhaps prevents man belonging at a particular time to everything that is moving, i.e. if nothing else were moving; but moving is possible for every horse; yet man is possible for no horse. Further let the first term be animal, the middle moving, the last man. The propositions then will be as before, but the conclusion necessary, not possible. For man is necessarily animal. It is then clear that the universal must be understood without qualification, and not limited in respect of time.¹¹³

Let us again consider (26). Hintikka argues that the passage just cited, when conjoined with the principle of plenitude, means that (26) has the same force as

$$(26') \quad \Box \forall x (Cx \rightarrow Bx) .$$

(26') will apply to all individuals at all times.

Sorabji's remarks on the applicability of the principle of plenitude (see p. 49) may arouse suspicion

in Hintikka's reading of sentences like (26). That is, it might be inappropriate to invoke the principle of plenitude for entities such as propositions. Leaving such concerns aside, it is incredible, and almost assuredly false, to charge that sentences which share the form of (26) should be read as ones like (26'). Many conditionals have the same form as (26) and yet it would be false to claim that they are true when prefixed by a 'it is necessary that' operators. It might, for example, be true that

(35) All trespassers will be prosecuted,
but false that

(36) It is necessary that (all trespassers will be prosecuted).

Another good reason for rejecting Hintikka's contention that Aristotle looked on all universally quantified conditionals as being within the scope of an 'it is necessary that' operator is that the view is inconsistent with Aristotle's rejection of the syllogism given above as (Sb). Consider again

(28) A applies to all B.

If Hintikka is correct, then Aristotle equated (28) with

(37) it is necessary that: A applies to all B.

The translation of (36) is

(37')

$$\Box \forall x (Tx \rightarrow Px)$$

The rationale for Hintikka's translation of conditions is that the whereas the (Sb) syllogism is invalid, the syllogism would be valid if (28) were replaced by (37).

It is incredible that though Hintikka comments on the fact that unspoken necessity operators having full scope over universally quantified conditionals contradicts Aristotle's rejection of the (Sb) syllogism, he does not see the inconsistency of his own views. Hintikka argues on the one hand that (29) and (30) must have *de re* readings because the syllogism as a whole is invalid according to Aristotle. Hintikka then holds that the syllogism is really a valid one. Where then is the rationale for giving *de re* readings to the syllogism? And if it is valid, why did Aristotle reject it? Was he genuinely confused? Hintikka has some explaining to do. Yet all he says is that the validity of (Sb) further supports the view that Aristotle did not embed operators in a consistent fashion. This part of Hintikka's discussion about Aristotelian modality is very weak.

Surely it is more plausible to read the passage from the *Prior Analytics* as a warning against using conditionals which are tied to times in conjunction with modal premises which might be tied to times. The

result will be a counterintuitive one. The interpretation of Hintikka is not only implausible, but it lacks justification as well.¹¹⁴

Hintikka has another argument which seeks to establish that sentences like (26) should be understood as ones like (26'). Consider the following syllogism, also taken from the *Prior Analytics*:

(Se) (38) A possibly belongs to every B.

(39) B belongs to every C.

So, (40) A possibly belongs to every C.

Hintikka then makes the sweeping pronouncement that it doesn't "matter how you interpret the premisses, there is no hope of turning the syllogism into a valid one unless you lend modal force....." to (39). Certainly the following *de dicto* reading of (Se) is invalid:

(38') $\Diamond \forall x (Bx \rightarrow Ax)$

(39') $\forall x (Cx \rightarrow Bx)$

So, (40') $\Diamond \forall x (Cx \rightarrow Ax)$

On the basis of this interpretation, Hintikka argues that (39) must be understood as

(41) $\Box \forall x (Cx \rightarrow Bx)$.

Yet a *de re* reading of the same syllogism is valid:

(38'') $\forall x (Bx \rightarrow \Diamond Ax)$

(39'') $\forall x (Cx \rightarrow Bx)$

So, (40'') $\forall x (C_x \rightarrow \Diamond Ax)$.

It was hard to believe that this alternate, and perfectly natural, interpretation of (Se) did not occur to Hintikka. To be fair, Hintikka does give the *de re* reading of (Se), but only after his ill-timed comment. However, Hintikka cites a further piece of the *Prior Analytics* to establish his point that the *de dicto*, and not the *de re*, reading is the one to be preferred:

The expression 'it is possible for this to belong to that' may be taken in two ways: either 'to which it belongs' or 'to which it may belong'; for 'A may be said of that of which B' means one or other of these-either 'of which B is said' or 'of which it may be said'; and [so-M.D.] there is no difference between 'A may be said of that of B' and 'A may belong to every B'. It is clear then that the expression 'A may possibly belong to every B' might be used in two ways. First then we must state the nature and characteristics of the deduction which arises if B is possible of the subject of C and A is possible of the subject of B. For thus both propositions are assumed in the mode of possibility; but whenever A is possible of the subject of B, one proposition is simple, the other possible. Consequently we must start with propositions which are similar in form, as in the other cases.¹¹⁵

I find it difficult to accept this passage as proof that the *de dicto* reading of (Se) is the only correct one. Hintikka does not even read the passage as a recognition on Aristotle's behalf of the *de re/de dicto* distinction in sentences of the form 'A may belong to every B'.

Perhaps this is unfair, since in chapter two of *Time and Necessity*, Hintikka seems to be on the verge of endorsing this view. His subsequent rejection strikes me as bizarre.¹¹⁶ It is also important to remember that, as Hintikka himself argues, there are syllogisms for which a *de re*, and others for which a *de dicto* reading of the modal operator (of either kind) is more appropriate. In my opinion, (Se) belongs to that class of syllogisms which should be interpreted which contain modal premises of the *de re* variety. So this second argument which tries to show that Aristotle did not always explicitly call attention to the presence of modal operators is, like its predecessor, unconvincing.

If this is correct, Hintikka does not succeed in showing that the MLEM is the principle being restricted. Thus far, we have only considered the positive evidence and have concluded that it is inadequate. Two strong pieces of negative evidence have previously been discussed. The first piece occurs when Aristotle calls our attention to the faulty inference from

$$\Box (p \vee \neg p)$$

to the conclusion $\Box p \vee \Box \neg p$.

Aristotle's warning concerning this inference occurs at 19a27-33 of *De Int.* 9. It is highly unlikely that he would call attention to the very distinction which

Hintikka claims, albeit implicitly, is being ignored. When I say that Hintikka's implicit claim is that the distinction is being ignored, I simply mean that Hintikka in no way recognizes that it is *prima facie* bizarre to interpret the inference at 19a27-33 in the way he does. And the reason his interpretation is *prima facie* bizarre is that the passage in question makes no mention of two separate occurrences of the 'it is necessary that' operator; the evidence suggests only one operator. So it is incumbent on Hintikka to give a forceful argument for the alleged presence of two operators.

The second piece of negative evidence was scrutinized in chapter three. Hintikka's attribution to Aristotle of the view that the MLEM needs to be restricted implies that Aristotle did not distinguish the PB from the LEM. As I have argued in chapter two, it seems false to suppose that Aristotle merged the two logical principles.

Hintikka's interpretation regarding the start and finish of *De Int.* 9 is thus mistaken on several counts. Not only is there no reason to hold that he is correct there are (at least) two reasons for doubting it.

Notes

¹Quine formulated these two difficulties in his "Reference and Modality". (In **From a logical Point of View**. Problems involving the substitutivity of identicals were raised in Russell's seminal essay, "On Denoting". But the formulation of the problems is different.

²By 'trivial determinism' I mean the sort contained in the saying "What will be, will be". Equally trivial is the determinism evinced by Aristotle comment in *De Int.* 9 that "everything necessarily will be or will not be." I contend that Hintikka is incorrect when he asserts that this comment indicates the falsity of the traditional interpretation of the sea battle argument.

³Hintikka himself is somewhat inconsistent as to how Aristotle is to be understood with respect to determinism. Aristotle was strongly opposed to fatalism. Hintikka's rather implausible view is that Aristotle was himself largely unaware of his own reasons for this rejection.

⁴I am using here Ross' translation of the *Metaphysics* in *The Collected Works of Aristotle*, edited by Jonathan Barnes. The Barnes edition is used throughout this thesis.

⁵Kripke's approach in the 1963 paper is considerably more sophisticated than his paper "A Completeness Theorem in Modal Logic".

⁶I have in mind here the works of Joseph Almog.

⁷Richard Sorabji, *Necessity, Cause and Blame: Perspectives on Aristotle's Theory*.

⁸The philological arguments are primarily due to Sorabji.

⁹I do not wish the reader to confuse this unrestricted principle with the restricted logical principle mentioned before.

¹⁰At any rate, this is the clear implication of an end note to Code's paper.

¹¹I am referring to Almog.

¹²Aristotle, *De Int.* 9.

¹³Arthur Lovejoy, *The Great Chain of Being*, (Cambridge, Mass.,: HUP, 1936), p. 72.

¹⁴But even if, as Hintikka holds, it is the first pair which Aristotle adhered to, an uncomfortable inconsistency soon arises.

¹⁵Jaakko Hintikka, *Time and Necessity*, (Oxford: OUP, 1973), p. 95.

¹⁶So Lovejoy's account, if not hopelessly ambiguous, is simply false.

¹⁷Aristotle, *Metaphysics*.

¹⁸Hintikka, p. 98.

¹⁹Hintikka, p. 99.

²⁰Hintikka goes on to identify "mere possibility" with contingency. Curiously enough, this emphasis on subtle distinction has no role to play in Hintikka's account of Aristotle's stand on unactualized particulars.

²¹Aristotle, *Posterior Analytics*.

²²Hintikka, p. 101.

²³I think that Hintikka's subsequent argument is most untenable. My own view is that Aristotle's recognition of unactualized potentialities is tantamount to an explicit renunciation of an unrestricted version of the principle of plenitude. This, coupled with some of the textual evidence adduced by Hintikka, forces me to conclude that though the principle of plenitude was present in Aristotle, it was not, for Aristotle, an omnipotent metaphysical thesis.

²⁴Hintikka, p. 100.

²⁵Aristotle, Bk. III, *Physics*.

²⁶Aristotle, Bk. XI, *Metaphysics*.

²⁷Hintikka, p. 105.

²⁸Aristotle, Bk. IX, *Metaphysics*.

²⁹Aristotle, Bk. IX, *Metaphysics*.

³⁰Hintikka's case for the significance of unactualized depotentialities is made in various places in *Time and Necessity*. I argue in chapter two that holding temporal and modal operators to be strictly interchangeable yields the unpalatable result that all possibilities are actualized.

³¹The closest thing to an affirmation of the principle is Aristotle's comment that "it is impossible for a thing always to exist and yet to be destructible...." (at 281b34 of *On the Heavens*). But there is no argument from Aristotle to establish the truth of (2) (let alone an argument in favor of (2')).

³²Aristotle, Bk. IX *Metaphysics*.

³³Aristotle, Bk. I, *On the Heavens*.

³⁴Hintikka, p. 105. This argument in particular is especially confusing. I had thought that Hintikka's overall contention was that Aristotle's modal terminology is best understood if we first attribute the principle of plenitude to Aristotle. (But in light of the cited passage, this seems wrong.)

³⁵Hintikka, p. 147.

³⁶Hintikka, pp. 148-149.

³⁷I think that Hintikka's objections to the traditional interpretation are incorrect. I am also critical, in chapter seven, of his positive argument in favor of his own interpretation.

³⁸Hintikka, p. 151.

³⁹Yet, as I have indicated, the provisos regarding unactualized potentialities appear to be most unconvincing.

⁴⁰For Hintikka's point about the "now" to stand,

elimination here of the indexical cannot be allowed.

⁴¹Hintikka, p. 151.

⁴²Hintikka, p. 152.

⁴³Aristotle, *De Int.* 9.

⁴⁴Hintikka, p. 158.

⁴⁵This suggestion was by Richard Robinson, Feb. 16, 89.

⁴⁶Aristotle, *De Int.* 9.

⁴⁷I think acceptance of the MLEM would cause damage even if sentences lacked the form of (3).

⁴⁸It has not been pointed out that, from the point of view of the defender of the traditional interpretation, it is precisely the fact that Hintikka ascribes to Aristotle a subsidiary role of the problem of future truth which guarantees the deficiency of Aristotle's alleged solution. For the traditional interpretation does result in a satisfactory solution.

⁴⁹Aristotle, *Bk. IV, Metaphysics.*

⁵⁰Aristotle, *Bk. IV, Metaphysics.*

⁵¹Proof by Sorabji, p.98.

⁵²Hintikka, p. 148.

⁵³Hintikka, p. 159.

⁵⁴Hintikka, p. 181.

⁵⁵Even though I am reluctant to accept Hintikka's assumption, I feel that there are other aspects of his argument which have more blatant defects about them.

⁵⁶Hintikka, pp. 180-181.

⁵⁷Benson Mates, *Stoic Logic*, (Berkeley: Univ. of Cal. Publications in Philosophy, 1953), p. 37.

⁵⁸Hintikka, pp. 189-190.

⁵⁹One of the arguments is designed to show that Aristotle's use of conditionals must be understood as an employment of modality. This argument is almost assuredly false. The ramifications for Hintikka are somewhat curious.

⁶⁰Aristotle, Bk. III, *Rhetoric*.

⁶¹Hintikka, p. 183 .

⁶²Aristotle's strong defence of the LEM is in no way vitiated if it is assumed that the PB, and not the LEM, is the focus of the attack in *De Int.* 9. If one wishes to block the fatalistic consequences of the sea battle argument, the PB is a legitimate target. As Sorabji shows, Aristotle's argument in *De Int.* 9 is best understood by appeal to the traditional interpretation.

⁶³Aristotle, Bk. VI, *Nicomachean Ethics*.

⁶⁴Aristotle, Bk. I, *On the Heavens*

⁶⁵ This emphasis on the relative roles of temporality and modality is at considerable variance with Hintikka's position that Aristotle was largely unaware of these relative roles.

⁶⁶Aristotle, Bk. I, *Prior Analytics*.

⁶⁷Aristotle, Bk. I, *Prior Analytics*.

⁶⁸A quick read of the passage in question leads one to suspect that Hintikka made a simple error.

⁶⁹Aristotle, Bk. VIII, *Physics*.

⁷⁰Hintikka's views on Megarian determinism are far less plausible than his ones on Aristotle's sea battle argument.

⁷¹Hintikka, p. 192.

⁷²Hintikka, p. 195.

⁷³My objection to the inference of (10*) from (10) obviously apply to the inference of (14*) from (14).

⁷⁴Hintikka, p. 200. The converse of (16) was assumed by Aristotle, according to Hintikka. There is not a shred of textual evidence which would make this contention a plausible one.

⁷⁵Nor is there any compelling textual evidence to justify the ascription to Diodorus of (17).

⁷⁶Hintikka's version of the *de re* (16*a') seems suspicious. See p. 208.

⁷⁷Hintikka, p. 211 .

⁷⁸Like me, Sorabji explicitly endorses the traditional interpretation of *De Int.* 9.

⁷⁹Sorabji, *Necessity, Cause and Blame*, (Ithaca: Cornell Univ. Press, 1980), p. 134. I concur with Sorabji's assessment; Hintikka simply lacks the textual evidence to make his analysis a convincing one.

⁸⁰I think that Hintikka could rightly deny that Sorabji's point would somehow vitiate his (Hintikka's) analysis in terms of temporally specified sentences. All Hintikka would have to do would be to exhaustively list the necessary and sufficient conditions which are required for his thesis. Space does not allow me to do so here, but I am nevertheless convinced that Sorabji is mistaken on this point.

⁸¹Sorabji, p. 134.

⁸²Sorabji's point, can, I think, be put another way: there is no reason to think that sentences of the form of (3) are essential to the position that Aristotle's determinism is generated by predictions whose evaluation is from the present looking backwards.

⁸³Sorabji, p. 135.

⁸⁴The difficulty regarded by Sorabji as problematic for the traditional interpretation is the fact that Aristotle asserts that the LEM is a tautology. I agree, but I believe this is consistent with a restraint on PB.

⁸⁵Sorabji, p. 132.

⁸⁶Quine, "Reference and Modality", in *From a logical point of view*. Perhaps "philosophical uselessness" should take the place of "incomprehensible nature". There are actually three criticisms which Quine levels at modal logic. I will not discuss the third

criticism here as it is a matter of some dispute how to interpret this objection. The problems of (SI) and (EG) are, by way of contrast, totally straightforward.

⁹⁷Code uses the following inference to show that the problem of (EG) occurs with the verb "becomes":

(i) The Vice-President becomes the President.

(ii) The Speaker of the House becomes the Vice-President.

(Therefore) (iii) (\exists x) (x becomes the President the Speaker of the House becomes x)

The accompanying assumptions that we make to show the implausibility of this inference are (a) that Ford is the Vice-President referred to in (i) and that (b) there was a time at which Rockefeller was the Speaker of the House referred to in (ii). Now the x in (iii) is clearly neither Ford nor Rockefeller. Keeping these assumptions (actually, (a) is a fact not merely an assumption) we can also show that the verb "becomes" also falls prey to the problem of (SI). Code, pp. 161-162.

⁹⁸Code, p. 162.

⁹⁹David Kaplan has demonstrated that individual concepts can be painlessly eliminated in "How to Russell a Frege-Church".

⁹⁰Code, p. 170.

⁹¹Almog has raised some concerns which are especially pertinent. Yet the theory of direct reference remains intact.

⁹²

⁹³Code, p. 171.

⁹⁴AThe problem of (SI) may be resolved with Russell's Theory of Definite Descriptions. As for the problem of (EG), I am prepared to accept the final existentially quantified sentences.

⁹⁵For example, David Lewis reacts by outright denial of transworld identity. Kit Fine radically alters the domains of his possible worlds, so as to nullify the de re/de dicto distinction.

⁹⁶This inference is somewhat irritating in that it does not use three terms.

⁹⁷Code, p. 170.

⁹⁹It is by no means a simple problem with which this chapter is based, namely, whether it is correct or not to list Aristotle among the adherents of the TQ. On the one hand, it seems anachronistic in the extreme to hold that Aristotle thought of individual concepts as does a modern philosopher of language; he simply lacked the required intensional tools. On the other hand, it would be wrong to view Code's argument as anything besides the attempt to show that the TQ is the modern day counterpart to Aristotle's own way of handling the (SI) and (EG) problems.

¹⁰⁰That is, White is accusing Aristotle of confusing identity with mere overlap.

¹⁰¹Aristotle, Bk. I, **Topics**.

¹⁰²Aristotle, Bk. V, **Metaphysics**.

¹⁰³But, of course, a different example, with a different number of dimensions, could have been used.

¹⁰⁴Aristotle, Bk. I, **Physics**.

¹⁰⁵Quine, "Reference and Modality", p. 29.

¹⁰⁶The original intent of this chapter was to deprive Hintikka of an argument which he did not explicitly make, namely that the presence of modal inexactitudes shows that ascription of the MLEM to Aristotle is not implausible. Lately, however, I have realized that a different point can be argued for: Aristotle's modal syllogisms are valid if the modal formulae are given *de re* readings.

¹⁰⁷Hintikka does not specify where there occurs the evidence upon which his argument is based. After an extensive search, I have found that the passage in question is located at 25a31-33 of Bk. I of the **Prior Analytics**.

¹⁰⁸Quine "On What There Is", p. 4.

¹⁰⁹A sentence with any individual constant might or might not be true, depending on the semantics and on whether the individual constant names a fictional entity or not.

¹¹⁰This example is due to Kripke.

¹¹¹Unfortunately, Quine's analysis of *de re* modality would compell him to use possible worlds,

something Quine is loathe to do.

¹¹¹I find Hintikka's approach to be puzzling. Modern philosophers allow for scope distinctions in modal formulae; why can't ancient philosophers be allowed the same option?

¹¹²But Hintikka does not argue along such lines.

¹¹³Aristotle, Bk. I, **Prior Analytics**.

¹¹⁴The inconsistency just mentioned is most powerful.

¹¹⁵Aristotle, Bk. I, **Prior Analytics**.

¹¹⁶Hintikka, p. 38. This part of **Time and Necessity** contains what I consider to be a straightforward error: Hintikka says that Aristotle thinks of the following sentence as ambiguous:

(P) it is possible for A to apply to all B.

I agree. But Hintikka's pair of ambiguous readings seem to be the *de dicto*

(P₁) it is possible that: A

applies to everything to which B in fact applies, and the *de re*

(P₂) A possibly applies to

everything which B possibly applies.

My disagreement is with (P₂); I prefer the following:

(P₂.) A possibly applies to every B.

The translations of the two *de re* interpretations ((P₂) and (P₂.) are, respectively,

(P₂) $\Diamond \forall x (Bx \rightarrow Ax) \rightarrow \forall x \Diamond Ax$

and

(P₂.) $\forall x (Bx \rightarrow \Diamond Ax)$.

(11th hour observation: it occurs to me that Hintikka may simply be holding that for Aristotle has a choice

not between (P_1) and (P_2) but instead between (P_2) and what I have called $(P_2.)$. On this reading, Aristotle was exposing the ambiguity between two *de re* sentences, and was unconcerned about any *de dicto* interpretations of (P) . Because of this latter point, I think that this interpretation is also implausible.)

Glossary

de re/de dicto distinction

-a formula F is **de re** iff F contains a modal operator O such that either (i) O has scope over any individual constant in F; (ii) O has scope over any free variables in F; or (iii) at least some of the bound variables of F are bound by a quantifier which lies outside the scope of O.

-a formula F is **de dicto** iff F contains a modal operator O and is not **de re**.

Megarian Determinism-That brand of determinism which was argued for by Diodorus. Principle of

Plenitude-Metaphysical thesis ascribed by Hintikka to Aristotle, which (roughly) is that the distinction

between temporality and modality is more apparent than real. In *The Great Chain of Being*, Lovejoy traces the role played by the principle in a variety of the philosophical problems. These include the argument from evil,

Temporally Qualified and Unqualified Sentences-This is the key distinction of Hintikka's treatment of the sea battle argument. The difference is between sentences of

the form

' p at t_0 ' and ones of the form p .

Traditional Interpretation-This term applies to several separate accounts of Aristotle's arguments in the ninth chapter of his book *De Interpretatione*, all of which share the view that the problem of future truth has a direct bearing on the vindication of fatalism in the chapter.

Problems of (SI) and (EG)-The two unambiguous problems posed for modal logic in Quine's "Reference and Modality".

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