

FATALISM AND FALSE FUTURES IN

DE INTERPRETATIONE 9

JASON W. CARTER

1. Introduction

Fatalism, as I shall use the term here, is the doctrine that everything that happens was always necessarily going to happen, and everything that does not happen was always necessarily not going to happen.¹ The earliest philosophical argument that we find in its favour is one based

This paper is dedicated to Sarah Broadie. Her work on Aristotle's modal concepts proved invaluable during its writing, and her positive comments on a presentation of its main ideas whilst we were colleagues at St Andrews confirmed that it was worth completing. While testing out the paper's central thesis with scholars and audiences at LMU Munich, the University of St Andrews, the University of Edinburgh, Villanova University, and Louisiana State University, I have benefited from lively discussions with Peter Adamson, Andreas Anagnostopoulos, Damian Caluori, Lauren Carter, Laura Castelli, David Charles, Alexander Douglas, Benjamin Harriman, Reier Helle, Inna Kupreeva, Alex Long, Gregory Moss, Michail Peramatzis, Bryan Pickel, Brian Rabern, Christof Rapp, Robert Roreitner, Joshua Thorpe, Patrick Todd, and Simon Trépanier. On the penultimate draft, Victor Caston, Rachana Kamtekar, and my two anonymous referees offered me crucial suggestions that led to vast improvements. Finally, I owe a special debt of gratitude to Otilia Bejancu, whose encouragement during a *κρίσις* changed the course of this paper's future.

¹ Although Aristotle himself does not (as the Stoics and later Peripatetics do) discuss this necessitarian doctrine in terms of 'fate' (εἰμαρμένη), the label 'fatalism' is nevertheless more apt than 'determinism'.

upon the truth values of affirmations and denials that Aristotle reports in *De Interpretatione* 9.² According to the argument, since statements that refer to future contingent singular events such as, ‘There will be a sea battle tomorrow’, have a truth value, then it is now already necessary or impossible that the events referred to by those statements will take place at the time stated.

In *DI* 9, Aristotle presents two slightly different versions of this logical argument for fatalism. Ancient and modern scholars agree that his refutation of these arguments involves his rejection of one or more of the following semantic principles:

PRINCIPLE OF BIVALENCE (PB) =_{def}: For every proposition *p*, necessarily, *p* is either true or false.³

This is because the former doctrine is mainly concerned with the relation between truth and modality, and the latter mainly with the relation between cause and effect. While Aristotle does think that modality and causality are related, in *De int.* 9 he is mainly concerned with the former. Cf. M White, ‘Fatalism and Causal Determinism: an Aristotelian Essay’, *Philosophical Quarterly* 31 (1981), 231–41. For a clear overview of the later Hellenistic debates related to the logical argument for fatalism, see S. Bobzien, *Determinism and Freedom in Stoic Philosophy* (Oxford, 1998), 59–86.

² For the text of *De Interpretatione*, I have relied upon *Aristotelis categoriae et liber de interpretatione*, ed. by L. Minio-Paluello (Oxford, 1949). Translations of *De Interpretatione* generally follow J. Ackrill, *Aristotle: Categories and De Interpretatione [De Interpretatione]* (Oxford, 1963). All other translations are my own.

³ Aristotle marks this out as the differentia of statement-making sentences at *De int.* 4, 16b33–17a3.

LAW OF EXCLUDED MIDDLE (LEM) =_{def}: For every proposition p , necessarily, either p is true or not- p is true.⁴

RULE OF CONTRADICTORY PAIRS (RCP) =_{def}: For every pair of contradictory Aristotelian statements, one member of the pair is true, and the other false.⁵

Like others before me, I shall be concerned most with RCP. It is a rule proposed by Aristotle in working out the semantics of his own term logic. It claims that, given a contradictory pair (ἀντίφασις) of statements (*DI* 6, 17a34–7), one of which is an affirmation (κατάφασις), and the other a denial (ἀπόφασις),⁶ one of the pair is true, and the other false (*DI*

⁴ I have formulated LEM in this way to mirror Aristotle’s expression of this principle in *Metaph.* 4.7, 1011b23–4: ‘But neither is it possible for there to be anything in the middle of a contradiction, but it is necessary either to affirm or deny any one item of one thing (Ἀλλὰ μὴν οὐδὲ μεταξὺ ἀντιφάσεως ἐνδέχεται εἶναι οὐθέν, ἀλλ’ ἀνάγκη ἢ φάναι ἢ ἀποφάναι ἐν καθ’ ἐνὸς ὅτιοῦν).’ See C. Kirwan, *Aristotle: Metaphysics Books Γ, Δ, and Ε* (Oxford, 1993), 116–118. Aristotle expresses LEM by saying that it is necessary to affirm or deny that any single predicate F belongs to any single subject x , on the assumption that either the affirmation or denial is *true*. Cf. C. Izgin, ‘Internal Negation and the Principles of Non-Contradiction and of Excluded Middle in Aristotle’, *History and Philosophy of Logic*, Vol. 41 (2020), 1–15, at 6–8. As I argue below (section 8), it is misleading to formulate Aristotle’s version of LEM either as the principle that it is true that (p or not- p), or as the syntactic claim that ‘ p or not- p ’ is substitutable for ‘ p ’, as R. Gaskin, *The Sea Battle and the Master Argument [Sea Battle]* (New York, 1995), 13, claims.

⁵ For a clear set of reasons for distinguishing these principles, see R. Jones, ‘Truth and Contradiction in Aristotle’s *De Interpretatione* 6–9’, *Phronesis* 55 (2010), 26–67, at 26.

⁶ An Aristotelian denial takes negation to be internal to a proposition: it has the form (x is-not F). In this respect, it differs from a negation in modern propositional logic, which is external to a proposition.

7, 17b27–28; *DI* 8, 18a26–27). For example, the pair: (‘Socrates is wise’, ‘Socrates is-not wise’).⁷ RCP presupposes both PB and LEM. It is related, but not equivalent to, the law of non-contradiction (LNC). This is because LNC has (by most accounts) no exceptions, whilst RCP, according to Aristotle, does.⁸

The oldest ancient interpretation of Aristotle’s refutation of fatalism,⁹ reported in Simplicius,¹⁰ is that Aristotle and the Peripatetics avoided fatalism by claiming that PB (and

It has the form: $\sim(x \text{ is } F)$. See G.E.M. Anscombe, ‘Aristotle and the Sea Battle’, *Mind* 65 (1956), 1–15 at 1, and C. Whitaker, *Aristotle’s De Interpretatione: Contradiction and Dialectic* (Oxford, 1996), at 81. Later Peripatetics were at pains to defend this view of negation against Stoic objections. See Alex. Aphr., *Pr.* 401.1–405.16 Wallies, and J. Barnes, ‘Peripatetic Negations’, *Oxford Studies in Ancient Philosophy* 4 (1986), 201–214.

⁷ A basic Aristotelian statement combines one predicate with one subject (*De int.* 5, 17a21–4). An affirmation *affirms* that a predicate belongs to a subject, and a *denial* denies that a predicate belongs to a subject (*De int.* 6, 17a25–6).

⁸ LNC and RCP are therefore not equivalent. The ability of statements to violate RCP is due to semantic permissions in Aristotle’s term logic, such as it being permissible to stipulate that a single term (e.g. ‘cloak’) can refer to a conjunction of two items (man-and-horse), and it being permissible to establish the contradictory of unquantified statements (e.g. ‘plants are poisonous’) through internal negation (see n. 6), but obligatory to establish their truth or falsity on semantic grounds.

⁹ Because my interest lies in the earlier tradition’s ability to offer viable interpretations of *De int.* 9, I concentrate here on this tradition’s two most prominent historical interpretations, which I label the ‘oldest’ and ‘second oldest’ interpretations.. Cf. Gaskin (*Sea Battle*, 14–15), who labels both interpretations ‘anti-realist’.

¹⁰ Simplic., *In Cat.* 407.6–14 Kalbfleisch. However, for an alternative view, according to which this passage can be read as suggesting that the oldest Peripatetic view is actually the one defended by Ammonius, cf. M. Mignucci, ‘Ammonius on Future Contingent Propositions’, in A. Falcon and P.

hence, RCP) does not apply to future contingent statements until the events they refer to occur or fail to occur.¹¹ According to the second oldest interpretation, found in Ammonius and Boethius, Aristotle's way out of fatalism is to reject RCP, but hold that PB and LEM *do* hold for future contradictory pairs, in the sense that each member of a future contingent pair is true or false, but not 'definitely' (*definite*) or 'in a definite manner' (ἀφορισμένως) true or false.¹²

The main difficulty with the first ancient interpretation is that, while Aristotle incorporates a number of interesting features into his term logic, such as allowing the truth value of statements to change over time (*Cat.* 5, 4a23–26), and assigning falsity to affirmative

Giaretta (eds.), *Ancient Logic, Language, and Metaphysics: Selected Essays by Mario Mignucci* (London, 2020), 195–218, at 212–213.

¹¹ See R. Sorabji, *Necessity, Cause and Blame: Perspectives on Aristotle's Theory [Necessity]* (London, 1980), at 92. Modern defences of this view include D. Frede, *Aristoteles und die "Seeschlacht": Das Problem der Contingentia Futura in De Interpretatione 9* (Göttingen, 1970), summarized in 'The Sea-Battle Reconsidered. A Defence of the Traditional Interpretation' ['The Sea-Battle'], *Oxford Studies in Ancient Philosophy* 3 (1985), 31–87, as well as P. Crivelli, *Aristotle on Truth [Truth]* (Cambridge, 2004), 198–233.

¹² See, for example, Boeth., *In De int.*, 2nd edn 2.106, 30–107, 2 and 2.189, 9–10, and Ammon., *In Int.*, 154.10–12 Busse; 149.1–18 Busse. However, Ammonius overwhelmingly prefers to speak in terms of whether future contradictory pairs *divide* truth and falsity in a 'definite' (ἀφορισμένως) or 'indefinite' manner (ἀορίστως), e.g. 130.23–6; 131.2–4; and 141.18–20. However, this way of speaking is not incompatible with the first: if neither p nor $\text{not-}p$ is (at present) definitely true or false, then it follows that the truth or falsity of p and of $\text{not-}p$ is not divided in a definite manner across the contradictory pair. On the compatibility of Boethius' and Ammonius' approaches, see R. Sorabji, 'Boethius, Ammonius, and their different Greek backgrounds', in D. Blank, N. Kretzmann, R. Sorabji and M. Mignucci (eds.), *Ammonius: On Aristotle on Interpretation 9 with Boethius: On Aristotle on Interpretation 9: First and Second Commentaries* (London 2014), 16–23.

statements whose subject terms do not exist (*Cat.* 10, 13b12–16),¹³ he does not ever explicitly claim that PB can be violated by statement-making sentences.¹⁴ The main problem with the second is that it is unclear how to interpret the notion of each member of a contradictory pair of propositions being true or false, but not definitely either. An additional problem is that it lacks direct textual support: neither in *DI* 9, nor elsewhere, does Aristotle refer to definitely or indefinitely true or false statements, or to truth or falsity being divided in a definite or indefinite manner over contradictory pairs.¹⁵

¹³ See S. Carson, ‘Aristotle on Existential Import and Nonreferring Subjects’, *Synthese* 124 (2000), 343–360.

¹⁴ For a subtle defence of the idea that Aristotle was not committed to the view that all statement-making sentences are subject to PB, see F. Ademollo, ‘The Principle of Bivalence in *De Interpretatione* 4’, *Oxford Studies in Ancient Philosophy* 38 (2010), 97–113.

¹⁵ It is likely that the origin of this view came from taking Aristotle’s claim, at *De int.* 9, 19a34–5, that the relationship between the truth values of future contingent contradictory pairs follows the way accidental contraries hold of a subject, to refer to *Categories* 10, 12b38–40. According to that passage, the essential properties of an item (e.g. the heat of fire) belongs ‘definitely (ἀφορισμένως)’ to it at all times that it exists, unlike non-essential properties. Notably, in this passage, Aristotle equates ‘belonging definitely’ with ‘belonging necessarily’. Another possible way to interpret truth/falsity that is not definite is along the lines suggested by J. Hintikka, *Time and Necessity: Studies in Aristotle's Theory of Modality [Time]* (Oxford, 1973), 172–73, according to which the truth value of a future contingent statement changes as the facts related to bringing about its truth change. This is also a possible way of interpreting Boethius’ view. See N. Kretzmann, ‘Boethius and the Truth about Tomorrow’s Sea Battle’ [‘Boethius’], in D. Blank, N. Kretzmann, R. Sorabji, and M. Mignucci, *Ammonius: On Aristotle on Interpretation 9 with Boethius: On Aristotle on Interpretation 9: First and Second Commentaries* (London 2014), 24–52, at 32. I shall argue that Aristotle accepts that the truth

In what follows, I claim that both these venerable interpretations miss the mark. In their place, I try to rejuvenate a third interpretation of Aristotle’s refutation of fatalism, advocated by certain unnamed philosophers ridiculed by Boethius in the sixth century.¹⁶ This interpretation holds that Aristotle thought that future contingent statements follow PB but violate RCP by both being *false*.¹⁷ The difficulty in seeing that this is Aristotle’s implicit position in *DI* 9, I argue, is due to a difficulty in seeing which of the modally laden *tense-logical* principles appealed to by the fatalist are ones that Aristotle accepted.

The paper is organized as follows. In section 2, I lay out the first fatalist argument that Aristotle reports and the tense-logical principles to which it appeals. I show that, although Aristotle accepts its validity, and might accept all its tense-logical principles, he does not think this first argument is sound. In section 3, I discuss the stronger, second fatalist argument, and argue that Aristotle accepts its validity, but not all its tense-logical principles. In particular, I

value of a future tense statement changes (or becomes fixed) at the time of a future event’s realisation, but that before this change, all future contingent statements are false.

¹⁶ See Boeth., *In De int.*, 2nd edn 2.215, 15–24. I hasten to add that Boethius does not tell us why these philosophers thought that future contingent singular statements are all false. However, if their arguments were coherent, I do not see how they could have followed any other line of argument than the modal-semantic one I offer here.

¹⁷ If this interpretation is right, Aristotle turns out to have anticipated an important modern view about the semantics of future tense statements advocated by A.N. Prior, *Past, Present and Future* [*Past*] (Oxford, 1967); C. Hartshorne, ‘The Meaning of “Is Going to Be”’ [‘Meaning’], *Mind* 74 (1965), 46–58, and more recently, P. Todd and B. Rabern, ‘Future Contingents and the Logic of Temporal Omniscience’ [‘Future Contingents’], *Noûs* 55 (2021), 102–127.

argue that he must reject either the principle that, if p is the case, then at some earlier time it was true to say that ‘ p will be the case’, or he must reject the principle that future statements have *always* been true prior to the event they refer to (or both). This leaves him with the problem of determining what truth value, if any, statements about the future have.

In sections 4–5, the heart of the paper, I discuss Aristotle’s apparent rejection of the solution that both members of a contradictory future pair are false. I argue that, of the two arguments raised against this solution, the first presupposes both PB and RCP, and the latter is a principle that Aristotle wants to reject for future statements, and so does not undermine the both-false view, while the second objection rests upon a problematic tense-logical principle that links the denial of a future tense statement with the necessity of its contradictory. For these reasons, I claim, these objections should be viewed as two additional fatalist arguments, and do not reflect Aristotle’s own semantic views about future tense affirmations and denials. In section 6, I argue that Aristotle shares with the fatalist a modal semantics according to which unqualified future tense statements, in most contexts, implicitly contain a necessity operator. This, I argue, entails that both members of a future contingent singular contradictory pair are false. However, I show that, for this very reason, he is unlikely to share the fatalist’s view, put forward in the fatalist’s second argument against the both-false solution, that the denial of a future tense statement entails the necessity of its contradictory.

In section 7, I address some objections to the claim that the both-false view could constitute Aristotle’s implicit solution to the fatalist arguments in *DI* 9. In section 8, I offer some intra-textual reasons related to Aristotle’s purported affirmation of LEM in *DI* 9 that imply that he must implicitly endorse the both-false view. In section 9, I offer extra-textual evidence from *Posterior Analytics* 2.12 that Aristotle explicitly endorses the both-false view of future tense statements. In section 10, I conclude with a few observations about the cost of accepting the both-false solution as Aristotle’s.

2. The first fatalist argument

In *DI* 9, within the context of an overall argument that RCP do not apply to future contingent singular statements (since otherwise fatalism follows), Aristotle presents two clear, and (as I shall argue) two unclear arguments on behalf of the fatalist.¹⁸ The strategy of each fatalist argument that Aristotle reports, I shall claim, is to argue that, because certain tense-logical principles hold, and RCP applies to future contingent statements, fatalism is true. The first fatalist argument runs as follows:

εἰ γὰρ πᾶσα κατάφασις ἢ ἀπόφασις ἀληθῆς ἢ ψευδῆς, καὶ ἅπαν ἀνάγκη ἢ ὑπάρχειν ἢ μὴ ὑπάρχειν· εἰ γὰρ ὁ μὲν φήσῃ ἔσεσθαι τι ὁ δὲ μὴ φήσῃ τὸ αὐτὸ τοῦτο, δῆλον ὅτι ἀνάγκη ἀληθεύειν τὸν ἕτερον αὐτῶν, εἰ πᾶσα κατάφασις ἀληθῆς ἢ ψευδῆς· ἄμφω γὰρ οὐχ ὑπάρξει ἅμα ἐπὶ τοῖς τοιούτοις. εἰ γὰρ ἀληθὲς εἰπεῖν ὅτι λευκὸν ἢ οὐ λευκὸν ἔστιν,

¹⁸ It is true that Aristotle characterizes, at 18b26, the conclusions of at least the first two arguments that I discuss here as ‘absurdities’. Cf. J. Ackrill, *De Interpretatione*, 137. For that reason, a good case can be made for thinking that Aristotle considers each of them to be a *reductio* of the view that RCP applies to future contingent statements, with fatalism itself as the absurd conclusion. This, I think, must be partly conceded. Aristotle considers any argument whose conclusion is that there are no chance events, but only necessary ones, to be absurd. However, at the same time, Aristotle clearly recognizes fatalism as a serious philosophical position whose faults must be diagnosed and attacked (see *De int.* 9, 19a7-22). He also recognizes that fatalism is intrinsically linked to the arguments he gives for RCP applying to future contingent statements (*De int.* 9, 19a23-39). In so doing, Aristotle’s arguments may justifiably be treated as given on behalf of a fatalist.

ἀνάγκη εἶναι λευκὸν ἢ οὐ λευκόν, καὶ εἰ ἔστι λευκὸν ἢ οὐ λευκόν, ἀληθὲς ἦν φάναι ἢ ἀποφάναι· καὶ εἰ μὴ ὑπάρχει, ψεύδεται, καὶ εἰ ψεύδεται, οὐχ ὑπάρχει· ὥστ' ἀνάγκη τὴν κατάφασιν ἢ τὴν ἀπόφασιν ἀληθῆ εἶναι. (*DI* 9, 18a34–b4)

(i) For if every affirmation or denial is true or false, it is also necessary that everything is the case or is not the case. (ii) For if a person says that something will be and another says this same thing will not be, it is clearly necessary for one of them to be saying what is true—if every affirmation is true or false; (iii) for both will not be the case at the same time under such circumstances. (iv) For if it is true to say that it is pale or is not pale, it is necessary for it to be pale or not pale; (v) and if it is pale or not pale, then it was true¹⁹ to say or deny this. (vi) If it is not the case, it is false to say, and if it is false to say, it is not the case. (vii) So it is necessary for the affirmation or the denial to be true. -(trans. Ackrill, modified)

For ease of understanding the tense-logical principles at play in this argument, a minimal amount of formalism will be useful. Using a slightly modified version of A.N. Prior's tense logic, I shall make use of the following operators:

T = 'It is true that. . .'

ψ = 'It is false that. . .'

¹⁹ Pace Frede, 'The Sea-Battle', 37 n. 12, who takes the ἦν ('was') here to be 'non-temporal'. It is true that ἦν is not found in all manuscripts and has a complicated textual history. See Gaskin, *Sea Battle*, 27 n. 15. However, it is difficult to see what sense can be made of the first argument without it. The reconstruction I offer (below) is close to that of Ammon., *In Int.*, 141.10–17 Busse, who recognizes the importance of the ἦν and rightly sees it as anticipating the second argument.

P = ‘It was the case that. . .’

F = ‘It will be the case that. . .’

PF = ‘It was the case that it would be the case that. . .’

H = ‘It has always been the case that. . .’

I shall also use the \square operator not in the familiar way, but to mark out the kind of temporal or *de facto* necessity that Aristotle thinks an event may possess during the time in which it is actual or has become unpreventable. Finally, since each fatalist argument begins with a focus on token-reflexive present tense sentences, that is, sentences that are true/false relative to the time of an utterance, I shall also use ‘ p ’ restrictively, to designate a variable for which one should substitute only token-reflexive *present tense* Aristotelian statements, such that ‘ p ’ stands for a (present tense) Aristotelian affirmation (e.g. ‘[Now] Socrates is sitting’), and ‘ $\sim p$ ’ a (present tense) Aristotelian denial (e.g. ‘[Now] Socrates is not sitting’), purged of further temporal operators. Aristotelian statements in non-present tenses (e.g. ‘Socrates will be sitting’) are captured by operations upon p (here: Fp). The reason for having these strictures in place is that a central question in the debate on Aristotle’s solution to the logical argument for fatalism is whether he accepts a general semantics that—without temporal strictures—implies: Tp (at t) $\rightarrow \square p$ (at t). By showing step by step exactly which tense-logical principles Aristotle affirmed, and which ones he denied, it can be shown that the answer to this question is a qualified “yes”.

With this symbolism in hand, we may see that the first fatalist argument relies upon three tense-logical principles that involve present tense Aristotelian affirmations.

Present Necessity: $Tp \rightarrow \square p$

(‘If it is true that p then it is necessary that p .’)²⁰

Retro-Truth: $p \rightarrow TPFp$

(‘If p then it is true that it was the case that it would be the case that p .’)²¹

Retro-Necessity: $TPFp \rightarrow \square PFp$

(‘If it is true that it was the case that it would be the case that p , then it is necessary that it was the case that it would be the case that p .’)

With these principles in hand, we can reconstruct the first fatalist argument that Aristotle reports. This argument is a condensed and sketchy attempt to show that if RCP holds of present tense statements, then it also holds of future tense statements made in the past, and if so, then

²⁰ See D. Burrell, ‘Aristotle and “Future Contingencies”’, *Philosophical Studies* 13 (1964), 37–52, at 39–49. However, cf. C. Kirwan, ‘Aristotle on the Necessity of the Present’, *Oxford Studies in Ancient Philosophy* 4 (1986), 167–187, at 177–81.

²¹ Again, the left-hand side of this conditional should be read as restricted to affirmations and denials that contain no future or past temporal operators. See section 1. Thus, one cannot substitute for ‘ p ’ formulae which contain F or P operators, e.g. by taking $p = PFp$, and then inferring $p \rightarrow TPF(PFp)$. This restriction prevents the principle from being used recursively to prove things like, if it is true that it was (once) the case at *some* time t_n that is earlier than t that it would be the case that p at t , then it is true that it was the case at an even earlier time t_{n-1} that p would be the case at t . See section 3 below. It also prevents the principle from being used in other illicit ways that are not necessarily licensed by Aristotle. See Gaskin, *Sea Battle*, 78–80. I thank Brian Rabern for this point.

all future tense statements are true or false and the events referred to by those statements necessarily will be or not. The argument runs as follows:²²

1. [It is true that p or $\sim p$.]
2. If it is true that p or $\sim p$, then it is necessary that p or $\sim p$. [iv]
3. [If it is necessary that p or $\sim p$, then p or $\sim p$].²³
4. If p or $\sim p$, then it is true that it was the case that it would be the case that p or $\sim p$. [v]
5. If it is true that it was the case that it would be the case that p or $\sim p$, then it is necessary that it was the case that it would be the case that p or $\sim p$. [v]²⁴
6. If it is necessary that it was the case that it would be the case that p or $\sim p$, then it is necessary that either Fq is true and $F\sim q$ is false, or that $F\sim q$ is true and Fq is false. [vi, vii]²⁵

²² Each premise is linked to the roman numerals that I have inserted into the translated text. Premises that are not in the text are marked out with brackets. A formal reconstruction of each argument is given in the footnotes.

²³ Alternatively, one might read an implicit ‘ἀνάγκη εἶναι’ at 18b1 after ἔστι. This would mirror the symmetry of thought in 18b2–3. However, this reading is not supported by the MS tradition, and in any case is not necessary to make the argument valid.

²⁴ This premise is implied by the compressed thought of lines 18a39–b2. The thought is: if p is true, then p is necessary; if p 's being the case in the future *was* true in the past, then p 's being the case in the future *was* necessary in the past.

²⁵ The intuitive assumption here is that, if future singular statements indexed to the past follow RCP, then so do future singular statements indexed to the present.

7. Therefore, it is necessary that Fq is true or $F\sim q$ is true. [ii]²⁶
8. If it is necessary that Fq is true, or necessary that $F\sim q$ is true, then it is necessary that Fq , or necessary that $F\sim q$. [i]²⁷
9. Therefore, it is necessary that Fq or that $F\sim q$.

This fatalist argument is valid. The challenge is to see which of its premises Aristotle might reject. According to a prominent and persuasive interpretation of Aristotle's modal metaphysics, he accepts at least premise 2, which expresses the principle of *Present Necessity*. This is because, as part of his solution to the fatalist problem, Aristotle claims that necessity—

²⁶ Cf. Ammonius, *In De Interpretatione*, 141.2–4 Busse, who, on the basis of the γὰρ ('for') at *De int.* 9, 18a39, also takes the argument beginning at (iv) to justify (i) and (ii).

²⁷ Formally:

1. $Tp \vee T\sim p$ [assumption of RCP]
2. $Tp \vee T\sim p \rightarrow \Box p \vee \Box \sim p$ [*Present Necessity*]
3. $\Box p \vee \Box \sim p \rightarrow p \vee \sim p$ [assumption]
4. $p \vee \sim p \rightarrow TPFp \vee TPF\sim p$ [*Retro-Truth*]
5. $TPFp \vee TPF\sim p \rightarrow \Box PFp \vee \Box PF\sim p$ [*Retro-Necessity*]
6. $\Box PFp \vee \Box PF\sim p \rightarrow \Box [(TFq \wedge \psi F\sim q) \vee (\psi Fq \wedge TF\sim q)]$
7. $\Box TFq \vee \Box TF\sim q$ [1–6]
8. $\Box TFq \vee TF\sim q \rightarrow \Box Fq \vee \Box F\sim q$
9. $\Box Fq \vee \Box F\sim q$ [7, 8]

in the sense of unpreventability—may be assigned to an event relative to the time period in which it obtains.²⁸ Later in *DI* 9, he writes:

Τὸ μὲν οὖν εἶναι τὸ ὄν ὅταν ᾗ, καὶ τὸ μὴ ὄν μὴ εἶναι ὅταν μὴ ᾗ, ἀνάγκη· οὐ μέντοι οὔτε τὸ ὄν ἅπαν ἀνάγκη εἶναι οὔτε τὸ μὴ ὄν μὴ εἶναι· —οὐ γὰρ ταῦτόν ἐστι τὸ ὄν ἅπαν εἶναι ἐξ ἀνάγκης ὅτε ἔστιν, καὶ τὸ ἀπλῶς εἶναι· ὁμοίως δὲ καὶ ἐπὶ τοῦ μὴ ὄντος. (*DI* 9, 19a23–27)

So, it is necessary that what-is exists when it is, and what-is-not does not exist when it is not. But certainly it is not the case that, for everything that is, it is necessary for it to be, nor for everything that is not, that it is necessary for it not to be. For to say that everything that is exists of necessity when it is, is not the same as saying that it exists of necessity *simpliciter*. Similarly, with what is not. -(trans. Ackrill, modified)

Aristotle distinguishes here two ways in which necessity can operate—*simpliciter*, e.g. the kind of eternal at-all-times necessity that attaches to $2+2 = 4$, and *temporally*, according to which it is necessary that an event that is or has been actual at some time t is and always will have been actual at t .²⁹

²⁸ See Hintikka, *Time*, 160–62; M. White, ‘Aristotle and Temporally Relative Modalities’, *Analysis* 39 (1979), 88–93; S. Waterlow, *Passage and Possibility: A Study of Aristotle's Modal Concepts [Passage]* (Oxford, 1982), 88–93, and Gaskin, *Sea Battle*, 1–11.

²⁹ According to another possible reading of *De int.* 9, each fatalist argument that Aristotle reports turns on confusing the *necessitas consequentiae* with the *necessitas consequentis*. On this view, 19a23–25 states the principle of *necessitas consequentiae*. See, for example, G. Fine, ‘Truth and Necessity in *De Interpretatione* 9’. *History of Philosophy Quarterly* 1 (1984), 23–47. On this reading, in each argument,

An example of how Aristotle thought that the temporally relativized modality specified in *Present Necessity* works can be reconstructed from his discussion of falsehood and possibility in *De Caelo* 1.12. Here Aristotle commits himself to the tense-logical principle that if it is true that Socrates is sitting at t_0 , at t_0 , (i) it is *necessary* that Socrates is sitting at t_0 , (ii) it is *impossible* that Socrates is not sitting at t_0 , and (iii) it is *possible* for Socrates to be standing at t_1 (281b15–18).³⁰ This is a temporal form of necessity that holds of an event relative to a time, which Aristotle thinks can be inferred from the truth value of the statement specifying the event.³¹

the fatalist accepts as true that $\Box(p \rightarrow p)$ and $\Box(Pp \rightarrow Pp)$, and by an illicit modal shift, wrongly infers $\Box p$ from the former, and $\Box Pp$ from the latter. Against this reading of the passage, see Frede, ‘The Sea-Battle’, 70–3. Gaskin (*Sea Battle*, 44) notes that the essential problem for this view is that, ‘the fallacy it diagnoses has nothing to do with either the fatalist’s claim or the proposed solution’.

³⁰ See Waterlow, *Passage*, 20–7. See also M. Malink and J. Rosen, ‘A Method of Modal Proof in Aristotle’. *Oxford Studies in Ancient Philosophy* 42 (2012), 170–261, at 196. Aristotle also accept this principle’s corollary, $\Psi p \rightarrow \Box \sim p$. Although one need not think of $\Psi p \rightarrow \Box \sim p$ as a corollary, since one may substitute all cases of Ψp with $T \sim p$, the elimination of this principle would obscure an important logical difference between our and Aristotle’s view of negation (see n. 6), as well as the logic of Aristotle’s dialectic in *De int.* 9. For example, Aristotle thinks that falsehood, but *not* truth, is naturally related to something *not* being the case (*De int.* 9, 18b3).

³¹ Cf. D. Frede, ‘Omne quod est quando est necesse est esse’, *Archiv für Geschichte der Philosophie* 54(2), 153–167, at 163. Aristotle thinks this form of necessity also belongs to the past, and occasionally expresses the tense-logical principle of *Past Necessity*: $TPp \rightarrow \Box Pp$. See *NE* 6.2, 1138b7–9; *Rhet.* 3.17, 1418a3–5. However, this principle does not, as one might expect, figure in any of the fatalist’s arguments, nor in any of Aristotle’s responses to the fatalist. I take it that this form of necessity is metaphysical but not *sui generis*, because it is ultimately based upon Aristotle’s temporalized theory of

While Aristotle is concerned both in *DI* 9 and *De Cael.* 1.12 to distinguish absolute necessity from *de facto* temporalized necessity, the strategy of the first fatalist argument is rather to *extend* the relative necessity of presently unpreventable events to the future. To do so, the fatalist argues that, if present tense statements abide by RCP and refer to events that are now necessary, then future-tense statements that abide by RCP will refer to events that are now necessary too. However, how do we find true statements about the future that abide by RCP?

In premise 4, the fatalist introduces a simple and intuitive principle that performs this work. Using *Retro-Truth*, the fatalist argues that, for any contradictory pair of present-tense singular statements—all of which are granted to abide by RCP³²—we can form a corresponding future tense contradictory pair which could have been uttered in the past.

Take the contradictory pair, ‘Socrates is philosophizing at the Piraeus now’, and ‘Socrates is not philosophizing at the Piraeus now’. If the former statement is true, by appeal to *Retro-Truth*, we can infer that it was true at some time in the past, say, yesterday afternoon, that ‘Socrates will philosophize at the Piraeus tomorrow’. Moreover, we can infer that the contradictory member of this pair, if false today, was also false at that past time. Thus, any arbitrary contradictory pair of present-tense singular statements can be used to generate a contradictory pair of future-tense singular statements when relativized to an earlier time and placed in the future tense. These future contradictory pairs, the fatalist argues, abide by RCP if all present-tense contradictory pairs do. If so, then all future contradictory pairs follow RCP.³³

potentiality and actuality, which underpins his conception of natural necessity more generally, e.g. at *Post An.* 2.11, 94b37–95a4.

³² In the sense that, across a whole *antiphrasis*, necessarily, one member of the pair is true, and one member of the pair is false.

³³ At least, all future contingent statements that concern subjects that exist at the time of utterance. Affirmations (in all tenses) about non-existing subjects Aristotle treats as false. See *Cat.* 10, 13b12–16.

This is the fatalist's tense-logical justification for the claim that, when someone says that something will be, and their dialectical partner says that it will not be, one of them must be speaking the truth (*DI* 9, 18a35–39).

To get to fatalism, the fatalist introduces *Retro-Necessity* in premise 5. It is modelled on *Present Necessity*. The idea is that, if it was true yesterday that Socrates would philosophize at the Piraeus tomorrow, then it was in some sense necessary yesterday that Socrates would philosophize at the Piraeus tomorrow. If we generalize from such examples, then fatalism seems to follow.

Aristotle does not explicitly tell us whether he accepts *Retro-Truth* or *Retro-Necessity*. However, even if he accepted both principles, given the more rigorous argument that follows in *DI* 9, 18b9–16, it is unlikely that he thinks this first argument is sound. One reason for this is that, because the past time period to which *Retro-Truth* and *Retro-Necessity* refer is not explicitly quantified, these principles may be read as implying only that, *at some time or another* in the past, it was true that Socrates would philosophize at the Piraeus, perhaps because there was an event (or group of events) that occurred in the past that was sufficient for causing his philosophizing there, such as Socrates being accosted by questioning friends.³⁴ One need not infer from these principles the claim that, for any unit of time n (e.g. 1000 years) ago, it

³⁴ Cf. Proclus (*De providentia* 14.9–23 Boese), who defends just this sort of limited retrospective predictability of a future event. As J. Opsomer and C. Steel, *Ten Problems Concerning Providence* (London, 2014), 14, point out, Proclus claims that at a certain point in time, for a future contingent event A , there is a subtle change or ‘tipping of the scale ($\mu\epsilon\tau\acute{\alpha}\pi\tau\omega\sigma\iota\varsigma$)’ at which time A becomes necessary or impossible. Cf. Crivelli, *Truth*, 205. As we shall see, this is a view that Aristotle will come to reject in *Post An.* 2.12. See section 9.

was the case that Socrates would philosophize at the Piraeus in n units of time hence. For this, one needs a further bridging principle. This is what the second fatalist argument supplies.³⁵

3. The second fatalist argument

In the second argument, the fatalist introduces two tense-logical principles designed to shore up the worry that *Retro-Truth* is of limited value in inferring the necessity of future events. This more sophisticated argument runs:

ἔτι εἰ ἔστι λευκὸν νῦν, ἀληθὲς ἦν εἰπεῖν πρότερον ὅτι ἔσται λευκόν, ὥστε ἀεὶ ἀληθὲς ἦν εἰπεῖν ὅτιοῦν τῶν γενομένων ὅτι ἔσται· εἰ δ' ἀεὶ ἀληθὲς ἦν εἰπεῖν ὅτι ἔστιν ἢ ἔσται, οὐχ οἷόν τε τοῦτο μὴ εἶναι οὐδὲ μὴ ἔσεσθαι. ὁ δὲ μὴ οἷόν τε μὴ γενέσθαι, ἀδύνατον μὴ γενέσθαι· ὁ δὲ ἀδύνατον μὴ γενέσθαι, ἀνάγκη γενέσθαι· ἅπαντα οὖν τὰ ἐσόμενα ἀναγκαῖον γενέσθαι. οὐδὲν ἄρα ὁπότερ' ἔτυχεν οὐδ' ἀπὸ τύχης ἔσται· εἰ γὰρ ἀπὸ τύχης, οὐκ ἐξ ἀνάγκης. (*DI* 9, 18b9–16)

³⁵ *Retro-Truth* is thus weaker than what has recently been dubbed in the tense-logic literature the principle of *Retro-closure*. Formulated metrically, this is the principle that, if p , then it was the case n units of time ago that it would be the case in n units of time hence that p , i.e. $p \rightarrow PnFn p$. See Todd and Rabern, 'Future Contingents', at 103. Cf. R. Thomason, 'Indeterminist Time and Truth Value Gaps', *Theoria*, 36 (1970), 264–281, at 281, whose supervaluationist theory would take Aristotle to affirm *Retro-closure* while still leaving the future open. The view that Aristotle holds that time's structure is branched 'verzweigt ist' as the supervaluationist affirms is also suggested by H. Weidemann, *Aristoteles Peri Hermeneias* (Berlin, 2014), 251-2.

(i) Again, if it is pale now it was true to say earlier that it would be pale; (ii) so that it was always true to say of any of the things that has come to be that it would come to be so. (iii) But if it was always true to say that it was so, or would be so, it was not able to not be so, or not able to not come-to-be so. (iv) But if something is not able to not come to be it is impossible for it not to come to be; and (v) if it is impossible for something not to come to be, it is necessary for it to come to be. (vi) All the things, then, that will be, come to be necessarily. (vii) So neither way happens as chance has it or by chance; (viii) for if by chance, not from necessity. -(trans. Ackrill, modified)

In this second argument, we see the fatalist introduce two further tense-logical principles:

Eternal Truth: $TPFp \rightarrow HTFp$

(‘If it is true that it was the case that it would be the case that p , then it has always been true that it would be the case that p .’)

Eternal Necessity: $HTFp \rightarrow H\Box Fp$

(‘If it has always been true that it would be the case that p , then it has always been necessary that it would be the case that p .)

Given these new principles, the second, and stronger fatalist argument can be reconstructed as follows:

1. [It is true that p .]
2. If it is true that p , then it is true that it was the case that it would be the case that p . [i]

3. If it is true that it was the case that it would be the case that p , then it has always been true that it would be the case that p . [ii]
4. If it has always been true that it would be the case that p , then it has always been necessary that it would be the case that p . [iii, iv, v]
5. [If it has always been necessary that it would be the case that p , then it is necessary that Fq , or necessary that $F\sim q$.]
6. Therefore, it is necessary that Fq or necessary that $F\sim q$. [vi]³⁶

The fatalist begins in premise 2 by appealing once again to *Retro-Truth*. This is to remind us of the claim in the first argument, that of present events, which are now necessary, it seems true that there are (or could have been) true and false future predictions stated in the past. In premise 3, the fatalist introduces the bridging principle of *Eternal Truth*, which links *Retro-Truth* to the form of necessity required to derive fatalism. From it, the fatalist claims, one may infer *Eternal Necessity*, introduced in premise 4. Together, these premises imply the doctrine of fatalism. This fatalist argument, Aristotle seems to think, just like the first, is valid but unsound.³⁷ If so, which tense-logical principle(s) does Aristotle reject?

³⁶ Formally:

1. Tp [assumption]
2. $Tp \rightarrow TPFp$ [*Retro-Truth*]
3. $TPFp \rightarrow HTFp$ [*Eternal Truth*]
4. $HTFp \rightarrow H\Box Fp$ [*Eternal Necessity*]
5. $H\Box Fp \rightarrow \Box Fq \vee \Box F\sim q$ [assumption]
6. $\Box Fq \vee \Box F\sim q$ [1–5].

Cf. Gaskin, *Sea Battle*, 26.

³⁷ Cf. C. Strang, 'Aristotle and the Sea Battle', *Mind* 69 (1960), 447–465, at 447.

As we saw above, it is open to Aristotle to accept *Retro-Truth*, because the claim that a present or past event, at *some time or another* in the past, *became* unpreventable due to a sufficient cause being in place is compatible with future contingent statements in general being exceptions to RCP (before they become unpreventable) and so with the falsity of fatalism. However, in this argument, *Retro-Truth* is used as a sufficient condition in *Eternal Truth*, and *Eternal Truth* as a sufficient condition in *Eternal Necessity*, which makes its acceptance trickier.

However, we know that Aristotle would accept *Eternal Necessity*. This is because he controversially, but explicitly, commits himself to this principle in *De Caelo* by arguing for the claim that what always exists necessarily exists (*DC* 1.12, 337b35–338a4). Hence, if a future statement has always been true, as the third premise claims, then it has always necessarily been true, and hence, the event to which it refers always unpreventably necessary as well.

This commitment leaves Aristotle with only two options. To refute the fatalist view that RCP holds of future singular statements, he must deny either *Retro-Truth*, or *Eternal Truth* (or both).³⁸ If he does not, then it follows that at every time in the past, RCP, and necessity or unpreventability, will hold of every future contradictory pair. However, if Aristotle denies either of these principles, then he needs to explain what truth value, if any, future contingent affirmations and their corresponding denials have—whether spoken in the past or in the present.

³⁸ Cf. C. Williams, ‘True Tomorrow, Never True Today’, *The Philosophical Quarterly* 28 (1978), 285–299. See J. Barnes, *Posterior Analytics* (Oxford, 1993), 236: ‘In certain passages Aristotle says, or appears to say, that if at *t* it is true to say that *a* is *A*, it does not follow that at all times before *t* it was true that *a* would be *A*.’ This is simply another way of saying, as I have argued, that Aristotle may have affirmed *Retro-Truth*, but not *Eternal Truth*. Aristotle’s final and strict position on the matter is that neither *Retro-Truth* nor *Eternal Truth* is a valid tense-logical principle. See section 9.

4. The first argument against the both-false view

One option with respect to the truth values of future contingent statements would be to say that, before a future event occurs or is unpreventably about to occur, it is simply false to say that a future event will occur, and *also* false to say that it will not occur. Aristotle considers this both-false solution immediately after the second fatalist argument and offers two arguments against adopting it. Scholarly consensus holds that, in each argument, Aristotle is speaking in *propria persona*.³⁹ This consensus, I shall argue, is almost certainly mistaken. The arguments against the both-false view, as we shall see, because of their tense-logical assumptions, are much more plausibly viewed as two additional fatalist arguments. The first argument offered against the both-false solution runs as follows:

ἀλλὰ μὴν οὐδ' ὡς οὐδέτερόν γε ἀληθὲς ἐνδέχεται λέγειν, οἷον ὅτι οὔτ' ἔσται οὔτε οὐκ ἔσται. πρῶτον μὲν γὰρ οὔσης τῆς καταφάσεως ψευδοῦς ἢ ἀπόφασις οὐκ ἀληθής, καὶ ταύτης ψευδοῦς οὔσης τὴν κατάφασιν συμβαίνει μὴ ἀληθῆ εἶναι. (*DI* 9, 18b17–20)

Nor, however, is it possible to say that neither is true—that it neither will be nor will not be so. For, firstly, while the affirmation is false the denial is not true, and while the denial is false the affirmation turns out not to be true. -(trans. Ackrill, modified)

³⁹ See, for example, Gaskin, *Sea Battle*, 28, and Ackrill, *De Interpretatione*, 137. The only exception I am aware of is R. Sorabji (*Necessity*, 95), who claims that ‘*the determinist* is allowed to rule out the suggestion that neither member of the contradictory pair is true’ (italics mine).

Taking Aristotle as speaking in *propria persona* and rejecting this potential solution to fatalism is problematic on three counts. The first is that, for advocates of Aristotle's rejection of PB for future contingent statements, these lines would have Aristotle affirming not only that one cannot accept the both-false view, but also that one cannot reject PB, on the basis that RCP holds of future contingent statements. So, either Aristotle is here affirming that one can neither reject PB as a solution to fatalism, *nor* can one reject RCP, or, he is speaking on behalf of the fatalist, in which case we may query whether Aristotle would accept either the fatalist's claim that PB must hold of future contingents, or the fatalist's arguments against the both-false solution.

The second problem, as John Ackrill points out, is that the argument against the both-false solution 'simply begs the question'.⁴⁰ Although Ackrill does not do so, we may charitably take this as evidence of the argument not being Aristotle's own. Ackrill thinks Aristotle's suggestion is an attempt to 'evade the inference' from PB (i.e. that every statement is true or false) to RCP (that within a contradictory pair, either the affirmation is true, and the denial false, or *vice versa*). However, the context makes this move unlikely, and in any case, there is no reason for Aristotle to take this tactic. He has already established that one can assume PB without assuming RCP (see *DI* 9, 18a31–32). Instead, it seems that the first argument against the both-false view *assumes* RCP to justify the claim that either a future affirmation or its denial that follows PB *must* be true, which is just what the fatalist, but not necessarily Aristotle, believes.⁴¹

The third problem is, why Aristotle would here assume RCP in order to reject the both-false solution, given that he himself is explicitly committed to the view that future contingent

⁴⁰ Ackrill, *De Interpretatione*, 137.

⁴¹ Alternatively, the principle assumed here may be Aristotle's version of LEM. See n. 58.

statements are exceptions to RCP. This rejection is announced at the opening lines of the chapter:

Ἐπὶ μὲν οὖν τῶν ὄντων καὶ γενομένων ἀνάγκη τὴν κατάφασιν ἢ τὴν ἀπόφασιν ἀληθῆ ἢ ψευδῆ εἶναι...—ἐπὶ δὲ τῶν καθ' ἕκαστα καὶ μελλόντων οὐχ ὁμοίως. (*DI* 9, 18a28–34).

So with respect to things that are and things that were it is necessary for the affirmation or the denial to be true or false. . .but with particulars that are going to be it is not the same. -(trans. Ackrill, modified)

These three problems combine into a general one: what function do these two arguments against the both-false solution serve?

The only plausible solution, I think, is that, at this point in the dialectic, Aristotle is *continuing to argue on behalf of the fatalist, using fatalist semantic assumptions*. This PB-based defence, which permits both members of a contradictory pair to be false, is not acceptable to the fatalist, since they have already given two arguments, based upon past predictions that have now come to (not) be the case, that aim to show that RCP *does* apply to future statements. Since RCP implies that one member of the pair must be *true*, the fatalist cannot accept the both-false-solution advanced here.

If so, then here at least, Aristotle is not arguing that it is impossible that the statements, ‘There will be a sea battle tomorrow’ and ‘There will not be a sea battle tomorrow’ are both false. If he himself wants to abandon (or modify) RCP for future statements (as the majority of commentators think), nothing here prevents him from adopting the both-false solution.

5. The second argument against the both-false view

As they do with the first argument, scholars almost universally take the second argument against the both-false view to represent Aristotle's own view. This argument runs:

καὶ πρὸς τούτοις, εἰ ἀληθὲς εἰπεῖν ὅτι λευκὸν καὶ μέλαν, δεῖ ἄμφω ὑπάρχειν, εἰ δὲ ὑπάρξειν εἰς αὐριον, ὑπάρξει εἰς αὐριον· εἰ δὲ μήτ' ἔσται μήτε μὴ ἔσται αὐριον, οὐκ ἂν εἴη τὸ ὁπότερ' ἔτυχεν, οἷον ναυμαχία· δεοὶ γὰρ ἂν μήτε γενέσθαι ναυμαχίαν μήτε μὴ γενέσθαι. (*DI* 9, 18b20–25)

(i) Moreover, if it is true to say that something is pale and large, they must both hold of it, and (ii) if they will be true tomorrow, it must be that they will both hold tomorrow; and (iii) if it neither will be nor will not be tomorrow, then there is no “as chance has it”. (iv) Take a sea battle: (v) it would have to neither come to be nor not come to be. -
(trans. Ackrill, modified)

Here, two additional tense-logical principles are introduced to block the both-false solution to the logical argument for fatalism. They are:

Future Truth Necessity: $TFp \rightarrow \Box Fp$

(‘If it is true that it will be the case that p , then it is necessary that it will be the case that p .’) ⁴²

Future Falsity Necessity: $(\psi Fp \rightarrow \Box F\sim p) \wedge (\psi F\sim p \rightarrow \Box Fp)$

⁴² Although Aristotle does not specify it, the principle covers the truth of denials as well. See n. 30.

(‘If it is false that it will be the case that p , then it is necessary that it will be the case that not- p ; and if it is false that it will be the case that not- p , then it is necessary that it will be the case that p .’)

We can reconstruct the argument as follows:

1. [It is true that Fp and true that Fq .]
2. If it is true that Fp and true that Fq , then it is necessary that Fp and necessary that Fq .
[ii]
3. If 2, then if it is false that Fr and false that $F\sim r$, then it is necessary that $F\sim r$ and necessary that Fr . [iii]
4. It is false that Fr and false that $F\sim r$. [iv]
5. Therefore, it is necessary that $F\sim r$ and necessary that Fr . [v]
6. [It is impossible that $F\sim r$ and Fr are both necessary.] [LNC]
7. [Therefore, it is impossible that it is false that Fr and false that $F\sim r$.]⁴³

⁴³ Formally:

1. $\mathbf{TF}p \wedge \mathbf{TF}q$ [assumption]
2. $\mathbf{TF}p \wedge \mathbf{TF}q \rightarrow \square Fp \wedge \square Fq$ [*Future Truth Necessity*]
3. (2) $\rightarrow (\psi Fr \wedge \psi F\sim r \rightarrow \square F\sim r \wedge \square Fr)$ [*Future Falsity Necessity*]
4. $\psi Fr \wedge \psi F\sim r$
5. $\square F\sim r \wedge \square Fr$ [1–4]
6. $\sim\Diamond(\square F\sim r \wedge \square Fr)$ [assumption of LNC]
7. $\sim\Diamond(\psi Fr \wedge \psi F\sim r)$ [4–6]

Aristotle, I think, takes this argument to be valid, but unsound. If so, then this argument against the both-false view, just like the one above, must also be ascribed to the fatalist.

To see why it is unsound, first note that, in order for *Future Truth Necessity*, which figures in premise 2, to be justified, the fatalist must affirm an implicit semantic view of ‘will be’, according to which future tense affirmations or denials, such as:

(1) ‘There will be a sea battle tomorrow.’ = Fnp

can naturally be taken to express modal necessity, i.e.

(2) [*It is necessary that*] there will be a sea battle tomorrow. = $\Box Fnp$

However, *Future Falsity Necessity* is described in a somewhat different way. To deny that a future event will be, is by this principle to affirm that the *non-occurrence* of that event is necessary; and to deny that a future event will not be, is, by this principle, to affirm that the *occurrence* of that event is necessary.

However, these principles pose a problem for Aristotle, as well as for the both-false theorists (whoever they may turn out to be), since they hold that future contingent events are *not* necessary. For, according to Aristotle’s two-sided theory of possibility, which is clearly in play throughout *DI* 9,⁴⁴ ‘if a thing is possible to be, it is at the same time possible also not to be (ἄμα γὰρ δυνατόν εἶναι καὶ μὴ εἶναι)’ (*DI* 13, 22b20-1).⁴⁵ Hence, Aristotle and the both-

⁴⁴ See *De int.* 19a7–11; 19a21–22.

⁴⁵ See also *APr.* 1.13, 32a18–21; cf. *APr.* 1.3, 25a37–b19. Aristotle’s one-sided notion of possibility allows that necessity implies possibility, because it is defined only in terms of not being impossible (and *not* also in terms of not being necessary). On his two-sided account of possibility, according to

false theorist have a strong reason to think that this second argument against the both-false view is unsound, in virtue of either *Future Truth Necessity*, or *Future Falsity Necessity*, or both, being illegitimate tense-logical principles.⁴⁶

One obvious way to deny both of these principles would be to claim that future tense statements can naturally be taken to express not modal necessity, but modal possibility. If so, the both-false theorist, along with Aristotle, might think that, ‘There will be a sea battle tomorrow’, really means:

(3) [*Possibly*], there will be a sea battle tomorrow.

And that, ‘There will not be a sea battle’, expresses:

(4) [*Possibly*], there will not be a sea battle tomorrow.⁴⁷

which what is possible is neither necessary nor impossible, what is necessary is not (in addition) possible. This is because, on this account, what is necessary to be the case is not compatible with what possibly is not the case, and whatever is (two-sided) possible to be the case is also (two-sided) possible not to be the case. See Malink, ‘Aristotle on One-Sided Possibility’ [‘One-Sided Possibility’], in M. Cresswell, E. Mares, and A. Rini (eds.), *Logical Modalities from Aristotle to Carnap: The Story of Necessity* (Cambridge, 2016), 29-49, at 29–30; Hintikka, *Time*, 27–40.

⁴⁶ Pace Gaskin (*Sea Battle*, 29 n. 22), who, accepting the argument at face value, claims: ‘If it is false that a sea battle will take place and false that one will not take place, then it is both true that one will not take place and true that one will take place.’

⁴⁷ D. Charles, *Aristotle on Meaning and Essence* (Oxford, 2000), 384, in defending the view that Aristotle takes modal terms to be copula-modifiers, makes a related suggestion: ‘The future (in contrast to past and present) might be analysed in terms of possibility. Thus: “Theaetetus will be an Athenian”

Unfortunately, (3) and (4) are not natural Aristotelian interpretations of unqualified future tense affirmations and denials.⁴⁸ For one thing, according to Aristotle's modal semantics, (3) and (4) do not form a contradictory pair (*DI* 12, 21b36–7), but mutually entail each another, since (3) cannot be true without (4) also being true (*DI* 12, 21b13–22). Thus, if the modal possibility interpretation provided the right semantics for the future tense, then future contingent contradictory pairs would always both turn out *true*. Such a semantics would dismantle the logical argument for fatalism, for sure, but it could not be Aristotle's considered view. This is because he is at least committed to the view that future contingent statements can form contradictory pairs (*DI* 9, 19a36–7).

So, if the fatalist's necessitarian semantics of the future tense is unsound and a modal possibility semantics is not viable, what then could, 'There will be a sea battle tomorrow' mean? One might think it means:

might be analysed as: Theaetetus is-possibly an Athenian.' If Charles is right, then the corresponding denial of the former phrase, 'Theaetetus will not be an Athenian', might be analysed as either: (i) Theaetetus is-not-possibly an Athenian, or (ii) Theaetetus is-possibly-not an Athenian. In either case, the future tense will be ambiguous between an 'is-possibly' sense, and an 'is-not-possibly' sense. If the future tense 'will be' has *only* a single 'is-possibly (not)' sense, then it follows that there are *no* contradictory future contingent statements. This is because, if one affirms that '*p* will be', one will be affirming '*p* is possibly', and if one denies this by stating that '*p* will not be', one will be asserting only that '*p* will possibly-not be'. However, if the future tense has both possibility senses, Charles' suggestion can be rendered equivalent to the view of future tense contradictories I articulate in section 10.

⁴⁸ Pace A. Bäck, 'Sailing Through the Sea Battle', *Ancient Philosophy*, 12 (1992), 133–51.

(5) [*Definitely*] there will be a sea battle tomorrow [*but possibly not*].

However, this cannot be right, for (5) seems to be synonymous with either:

(6) [*It is extremely likely that*] there will be a sea battle tomorrow.

or:

(7) [*Necessarily*] there will be a sea battle [*but possibly not*].

However, (6), insofar as it depends upon objective probabilities, is unproblematically true or false (as is its contradictory), and (7) is simply a contradiction. Whilst the former result would not be a problem on its own, it would be an embarrassment to Aristotle, whose primary task in *DI* 9 is to show that unqualified future contingent statements are exceptions to RCP (18a33–4). If ‘will be’ implicitly involves a probability or likelihood operator, then future contingent statements abide by RCP in the same way that past and present tense singular statements and universally quantified statements do.

6. The modal semantic view of ‘will be’ and future falsity

These semantic considerations against the modal possibility interpretation of future contingent statements, taken in conjunction with Aristotle’s commitment to a relative temporalized view of modality in which the truth of a statement entails the relative necessity of the event referred to by it, give us a reason to think that Aristotle must have accepted at least one element of the

fatalist's semantics of the future tense: an affirmation or denial of a singular future contingent event that does not explicitly contain the modal operator 'possibly' (or some similar qualification), by default will express that the occurrence or non-occurrence of that future contingent event is necessary. That is, for contexts in which a modally unqualified future tense statement is made, Aristotle accepts that *Future Truth Necessity* provides the right semantics for that statement.⁴⁹

One good reason to think so is that Aristotle explicitly defends this semantic view of future tense statements in *De generatione et corruptione* 2.11:

Ἵτι μὲν γὰρ ἔνια, δῆλον, καὶ εὐθὺς τὸ ἔσται καὶ τὸ μέλλον ἕτερον διὰ τοῦτο· ὁ μὲν γὰρ ἀληθὲς εἰπεῖν ὅτι ἔσται, δεῖ τοῦτο εἶναί ποτε ἀληθὲς ὅτι ἐστίν· ὁ δὲ νῦν ἀληθὲς εἰπεῖν ὅτι μέλλει, οὐδὲν κωλύει μὴ γενέσθαι· μέλλων γὰρ ἂν βαδίζειν τις οὐκ ἂν βαδίσειεν. Ἵλωσ δ', ἐπεὶ ἐνδέχεται ἔνια τῶν ὄντων καὶ μὴ εἶναι, δῆλον ὅτι καὶ τὰ γινόμενα οὕτως ἔξει, καὶ οὐκ ἐξ ἀνάγκης τοῦτ' ἔσται. (*GC* 2.11, 337b3–9)

For it is clear that there are some such events [that fail to come-to-be], and because of this there is a difference between the phrase 'something will be' and 'something is going to be'; on the one hand, if it is true to say 'it will be the case', it must be at some future time true to say that 'it is the case'. On the other hand, though it is true now to say that 'it is going to be', there is nothing to prevent its not coming to be [later]. For

⁴⁹ Pace J. Byrd, 'The Necessity of Tomorrow's Sea Battle'. *Southern Journal of Philosophy*, 48 (2010), 160–176, at 167), who takes Aristotle's 'truthmaker' requirement to involve an existing state of affairs in the future, such as an actual sea-battle. However, in the context of *De int.* 9, Aristotle presents the truthmaker of future contingent statements as *present* or *past* states of the world as they stand in relation to the future. See *De int.* 9 18b37–8; 19a32–3.

someone who is going to go walking might not go walking. In general, since it is possible for some of the things which are to also not be, it is clear that things which are coming-to-be will also be such, and their coming-to-be will not be from necessity.

In this passage, Aristotle claims that the semantic difference between affirming that an event is ‘going to be’ (μέλλει), and affirming that it ‘will be’ (ἔσται), is that the future tense copula naturally picks out an event that *must* (δεῖ) be the case at some future time, i.e. an event that *necessarily* will be the case at a given time. This is just the principle of *Future Necessity*.⁵⁰

In contrast, Aristotle asserts that, in colloquial Greek, μέλλει (‘*x* is going to’) (i) can truly (or falsely) express that a future event is now in the process of coming-to-be the case or not, (ii) does not imply that a future event is necessary, and (iii) is compatible with a future event’s failing to occur. Using this distinction, Plato might truly have said that, ‘Socrates is *going to* go straight back to Athens today after seeing the spectacle in Piraeus’, even if it turned out that, after Socrates started his journey, a group of young men accosted him in philosophical conversation and prevented him from doing so.⁵¹

⁵⁰ See Gaskin, *Sea Battle*, 98–9: ‘The passage is as unambiguous evidence as one could require that Aristotle accepts the fatalist’s inference from the truth of a **FCS** to its necessity.’ Gaskin uses ‘FCS’ as an abbreviation of ‘future contingent statement’.

⁵¹ Ammonius (*In De Interpretatione* 138.34–139.6 Busse) mentions the distinction between ‘will be’ and ‘going to be’ but denies that it is applicable to the argument of *De int.* 9. The future statements about which Aristotle is concerned, according to him, refer to a future which is ‘taken in the contingent matter’ (τὸ ἐπὶ τῆς ἐνδεχομένης ὕλης λαμβανόμενον). The difficulty with this interpretation is that Aristotle never gives any other meaning to the future tense copula than the necessitarian and non-contingent one he gives in *GC* 2.11. Moreover, Aristotle uses the distinction between ‘will be’ and ‘going to be’ to discuss events whose matters are contingent. Aristotle appeals to it again in *De*

However, the trouble with Aristotle's acceptance of *Future Truth Necessity* in the passage above is that he also believes that no future contingent event is necessary before its occurrence (*DI* 9, 19a18–22). For this reason, it is unclear whether he, or the both-false theorist, could or should accept the fatalist's corresponding principle, *Future Falsity Necessity*. This is because, granting that necessity or unpreventability attaches to the meaning of 'will be' in some contexts, what is implied by, 'It is false that there will be a sea-battle tomorrow', may not be adequately captured by *Future Falsity Necessity*. Indeed, if we include the fatalist's implicit modal content, the statement, 'It is false that, [it is necessary that] there will be a sea-battle tomorrow', is ambiguous, and admits of at least two senses:

S1: It *is-necessary* that tomorrow there will not be a sea battle. = $\Box Fn \sim p$

and

S2: It *is-not-necessary* that tomorrow there will be a sea-battle. = $\sim \Box Fn p$ ⁵²

According to *Future Falsity Necessity*, **S1** is always the correct semantics of 'It is false that there will be a sea-battle tomorrow'. However, Aristotle has good modal semantic reasons to

divinatione per somnia, to argue against the view that dreams can truly or falsely indicate future contingent events in the sense of what 'will be'. Predications of a future sea battle are again in Aristotle's sights. See *On Divination in Sleep*, 463b22-9. Boethius (*Commentarii*, II 225, 4–9) is also aware of a semantic distinction between *futurum* and *eventum* but does not seem to draw upon it outside his discussion of prophecy. However, see n. 69.

⁵² Cf. A.N. Prior, 'The Formalities of Omniscience', *Philosophy* 37 (1962), 114–129, at 124–125); Prior, *Past*, 128–129.

think that **S2** is, in some contexts, the better modal semantic interpretation of the claim that a future contingent affirmation or denial is false.

This is because, in *De Interpretation* 12–13, Aristotle points out that, to deny a modal affirmation, one cannot simply append ‘not’ to the copula or verb. Instead, one must append ‘not’ to the modal term that qualifies the copula. Thus, after considering the view that ‘ x possibly is F ’ contradicts ‘ x possibly is-not F ’ (*DI* 12, 21b10–12), Aristotle rejects it and claims that its true contradictory is rather, ‘ x is not-possibly F ’. Similarly, he argues that the denial of ‘ x necessarily is F ’ is not ‘ x necessarily is-not F ’, but rather, ‘ x is not-necessarily F ’ (*DI* 12, 21b24–6). This suggests that something is wrong with *Future Falsity Necessity*, since it implies that saying that someone’s claim about a future singular event p is false always entails committing oneself to the view that not- p is *necessary*.

Let us assume that the both-false theorist agrees that unqualified future tense statements, by default, express modal necessity in **S1**, but that she wants to deny that the events referred to by those **S1** statements *are necessary*. To do so, it is open for the both-false theorist to deny, in **S2**, both the affirmation and the denial of an unqualified future contingent statement.

If the both-false theorist, in **S2**, claims that a sea battle will neither be nor not be tomorrow, then what follows is *not* the absurd conclusion that the fatalist draws in the second argument against the both-false solution:

$$\Box F\neg p \wedge \Box Fnp = \textit{The S1 Both-False Interpretation}$$

Rather, what follows is:

$$\sim\Box Fnp \wedge \sim\Box F\neg p = \textit{The S2 Both-False Interpretation}$$

Thus, even if Aristotle accepts that, in some contexts, *Future Falsity Necessity* provides the right semantics of false future tense affirmations and denials, it does not follow that it does so in all contexts, such as those in which an interlocutor is aware of and desires to deny the modal content of the fatalist's future tense affirmation or denial. There is logical space for Aristotle to affirm—in **S2**—the falsity of, and thus to deny, *both* a future tense affirmation and its denial.⁵³

If so, then Aristotle may well accept that contradictory future contingent statements are exceptions to RCP by both members of the pair now being false, in virtue of one member of the pair expressing that a future event (which by hypothesis is contingent) is now necessary, and the other expressing that it is now impossible.

7. Aristotle's both-false solution to the problem of fatalism

I have argued that, since Aristotle accepts that the truth of p entails the necessity of p relative to the time during which p is (was, or will be) true, he partially endorses the fatalist's semantics. On this semantics, a single unqualified future tense affirmation or denial implies that the occurrence of a future event is necessary or impossible. I have also argued that, since Aristotle believes that no future contingent event *is* necessary, then in contexts in which such future contingent statements are made, both the affirmation and its corresponding denial will be false.

The real question, however, is whether this semantic view is assumed within the summary of Aristotle's solution to fatalism that comes at the end of *DI* 9. The key passage is:

⁵³ See Hartshorne, 'Meaning', 47,

Λέγω δὲ οἷον ἀνάγκη μὲν ἔσεσθαι ναυμαχίαν αὔριον ἢ μὴ ἔσεσθαι, οὐ μέντοι γενέσθαι αὔριον ναυμαχίαν ἀναγκαῖον οὐδὲ γενέσθαι· γενέσθαι μέντοι ἢ μὴ γενέσθαι ἀναγκαῖον. ὥστε, ἐπεὶ ὁμοίως οἱ λόγοι ἀληθεῖς ὥσπερ τὰ πράγματα, δῆλον ὅτι ὅσα οὕτως ἔχει ὥστε ὁπότερ' ἔτυχε καὶ τὰ ἐναντία ἐνδέχεσθαι, ἀνάγκη ὁμοίως ἔχειν καὶ τὴν ἀντίφασιν· ὅπερ συμβαίνει ἐπὶ τοῖς μὴ ἀεὶ οὕσιν ἢ μὴ ἀεὶ μὴ οὕσιν· τούτων γὰρ ἀνάγκη μὲν θάτερον μῶριον τῆς ἀντιφάσεως ἀληθὲς εἶναι ἢ ψεῦδος, οὐ μέντοι τόδε ἢ τόδε ἀλλ' ὁπότερ' ἔτυχεν, καὶ μᾶλλον μὲν ἀληθῆ τὴν ἐτέραν, οὐ μέντοι ἤδη ἀληθῆ ἢ ψευδῆ. ὥστε δῆλον ὅτι πάσης καταφάσεως καὶ ἀποφάσεως τῶν ἀντικειμένων τὴν μὲν ἀληθῆ τὴν δὲ ψευδῆ εἶναι· οὐ γὰρ ὥσπερ ἐπὶ τῶν ὄντων οὕτως ἔχει καὶ ἐπὶ τῶν μὴ ὄντων, δυνατῶν δὲ εἶναι ἢ μὴ εἶναι, ἀλλ' ὥσπερ εἴρηται. (*DI* 9, 19a29–19b4)

(i) I mean that it is necessary that there will be or will not be a sea battle tomorrow; but (ii) it is certainly not necessary that a sea battle comes to be tomorrow, (iii) nor is it necessary that it does not come to be—though (iv) it is necessary that it comes to be or does not to come to be. (v) So, since statements are true in accordance with the things themselves, it is clear that for as many of them as are capable of contraries in whichever way it chances, it is necessary that the same hold for their contradictory pairs. (vi) This happens with things that are not always so or are not always not so. (vii) Of these it is necessary for one or the other part of the contradictory pair to be true or false—(viii) not, however, this one or that one, but as chance has it; or (ix) for one to be true more often⁵⁴ than the other, yet not already true or false. (x) Thus it is clear that it is not

⁵⁴ My reading turns on the ‘frequency’ reading of μᾶλλον (‘more often’ instead of ‘rather than’). Its use here seems to refer back to 19a19–22, which discusses how often future statements about events that occur ὁπότερ' ἔτυχε (‘in whichever way it chances’) or ἐπὶ τὸ πολὺ (‘for the most part’) turn out to be true/false.

necessary that of every affirmation and denial that are opposites, one is true and the other false. (xi) For what holds for things that are does not hold for things that are not but have the potential to be or not be, but they are just as we have said. -(trans. Ackrill, modified)

It is not obvious how what Aristotle says here could be compatible with the both-false solution. I will begin with the most obvious problem. If the both-false view is really Aristotle's, why then does he not simply *say* that both members of a future contingent contradictory pair are false?

Answering this question is a difficulty that besets all interpretations, including the oldest and second oldest interpretations. On any interpretation, Aristotle does not clearly articulate the solution he favours. The reason that he does not do so is that the focus of the final section of *DI 9* is on showing that future contingent affirmations and denials are only *temporarily* exempt from RCP. On my interpretation, this just means that Aristotle is in *DI 9* more interested in the fact that a future contradictory pair *will* turn out to abide by RCP than he is in the fact that each member of the pair is *false before* this happens. This is a problem that affects all interpretations. For 'false before' one may substitute 'true-or-false before', or 'without a truth value before', and see that, with respect to this question, all interpretations are on a par.

To see how the both-false solution fares against the oldest and second oldest interpretations in tackling the passage's central difficulties, we may begin with the problem that Aristotle says that it is necessary for one or the other part of the contradictory pair '*to be true or false*' (19a37; cf. 19a18–22), but not '*already true or false*' (19a39). The second oldest interpretation takes these lines to show that Aristotle thinks that future contingent singular statements *are* true or false, but not *definitely* so.

However, Aristotle's use of εἶναι ('to be' as the infinitive complement of ἀνάγκη ('necessary')) is weak evidence for this second oldest interpretation. Given the conclusion in (x), it is highly unlikely that Aristotle could be using this phrase to refer to members of a contradictory pair being indefinitely true or false *at present*. It is more likely that he is using the phrase 'necessary to be' in a typical conditional sense, that is, if *p* is/will be the case, it is necessary that *q* be/will be the case.⁵⁵ Since Aristotle says in (i) that the occurrence or non-occurrence of a given future contingent event is necessarily the case, and says in (v) and (vi) that statements are true or false in the way that contingent subjects bear contraries, we may read (vii) as saying that, from this, one may *infer* that it is necessary for one member of the contradictory pair, *Fp* and *F~p*, to be true, and the other false, at the time designated in the future tense statement (e.g. tomorrow). The both-false view is compatible with this claim: on it, it is necessary that one member of the contradictory pair will *become* true, whilst the other member will *become* permanently false.⁵⁶

⁵⁵ See, for example, *GC*. 2.11, 337a17–18. At *GC* 2.11, 337b23–35, we also find ἀνάγκη εἶναι ('necessary to be') used to refer to a temporally posterior event: 'Therefore, among things in which the posterior thing is necessary to be, with these it can be turned around, and it is always the case that, with the prior thing having come to be, it is necessary that the posterior thing come to be (Ἐν οἷς ἄρα τὸ ὕστερον ἀνάγκη εἶναι, ἐν τούτοις ἀντιστρέφει, καὶ ἀεὶ τοῦ προτέρου γενομένου ἀνάγκη γενέσθαι τὸ ὕστερον)'. Aristotle also seems to use εἶναι ('to be') in this temporally extended sense to refer to statements that turn out to be true or false in *Cat.* 5, 4a23–26 (although the MSS vary here).

⁵⁶ Gaskin (*Sea Battle*, 164) objects that adopting this future reading makes Aristotle's immediate qualification, οὐ μέντοι τόδε ἢ τόδε ('not, however, this one or that one'), 'straightforwardly false'. The objection is mistaken. For assuming that one member of the contradictory pair will be true, and the other false, the qualification rightly adds that it is not necessary in advance *which member* will be true and which (permanently) false.

The oldest interpretation of Aristotle's refutation of fatalism, in contrast, takes Aristotle's claim in (ix) that members of a contradictory pair are *not already* true or false at present to be evidence that future contingent statements are not subject to PB. However, the Greek does not force us to this interpretation. It is plausible to take Aristotle's 'true or false' in 19a37 as a shorthand way of referring to RCP, that is, one member true and the other member false. Aristotle uses $\dot{\eta}$ ('or') in this shorthand way in other places in the *Categories* and in *De Interpretatione*. Indeed, Aristotle *must* be using $\dot{\eta}$ this way *DI* 9, 18a29, as well as 18a34, rather than simply affirming PB. If so, we can read these lines as making the fairly minimal claim that future contradictory pairs are such that they *will have* one and only one true member, and one and only one false member, regardless of the truth values of their members before a predicted event occurs or not. This is compatible with the view that, before the future unfolds, both members of a future contingent contradictory pair are, at present, false.⁵⁷

⁵⁷ It is true that, on the both-false reading I propose here, one might plausibly think there is a sense in which future tense statements about contingent events can never abide by RCP, because once Fp is the case, p is no longer future, and hence, ' p will be', as a token-indexical statement, will always remain false. Cf. Alex. Aphr., *De Fato* 177.7–14 Bruns, for a similar worry about the claim that a future tense expression, if necessary, is 'always' true, e.g. even *after* it has occurred. Aristotle, however, does not seem to be concerned with this problem. It is likely that this is because he considered that there is an obvious sense in which future tense statements can be assessed as unproblematically true or false, namely, when the events they refer to become present. Their truth value is then assessed retrospectively relative to the present, rather than relative to a past speaker. In this way, Aristotle can admit that a future tense statement made in the past *is* true now in virtue of the event it refers to having come to be, while thinking that, relative to a past speaker, it was nevertheless false to assert that the event would (necessarily) be the case earlier. One may claim that, 'because p is now the case, it is now true that p

8. Intra-textual evidence for the both-false solution

I have now shown why the both-false view is both textually and philosophically on a par with the oldest and second oldest interpretations. What remains to be done is to show that the both-false solution has other merits that make it the most likely interpretation of Aristotle's refutation of fatalism in *DI* 9. Below, I argue that both intra-textually, and extra-textually, there is sufficient evidence for thinking that Aristotle is our both-false theorist.

The most promising piece of intra-textual evidence is that the both-false interpretation can explain, better than its competitors, Aristotle's controversial claim, raised in (i) and (iv), that (what appears to be) LEM holds of future contradictory pairs—that is, that it is necessary that either Fp or $F\sim p$ —despite affirming in (i) and (iii) that neither disjunct is necessary.

On one prominent view, Aristotle is trying to defend the claim that a version of LEM—in the form: necessarily, it is true that $(p$ or $\sim p)$ —nominally holds across any future contingent contradictory disjunction, whilst denying that PB holds of either of its disjuncts. This is an unusual and perhaps incoherent view for Aristotle to hold.

Fortunately, Aristotle's version of LEM is *not* that, necessarily, the disjunction $(p$ or $\sim p)$ is true. Rather, his version of LEM is that, necessarily, either the affirmation that p is *true*, or the denial that p is *true*.⁵⁸ Hence, it is unlikely that Aristotle is here trying to defend an

would be the case', without committing oneself to the claim that, 'before p was the case, it was true that p would be the case'.

⁵⁸ Aristotle's formulations of LEM, as far as I can tell, are uniform across the organon and do not match the supposed version of LEM we find at *De int.* 9. See *De int.* 12, 21b3-4: 'For if of everything either the affirmation or the denial [is true] (εἰ γὰρ κατὰ παντὸς ἢ κατὰφασις ἢ ἠ ἀπόφασις)'; *APr.* 1.46 51b32–

alternative version of LEM, or any version of LEM at all. Had he done so, he would have expressed this by the claim that either the affirmation or the denial that a sea battle will be is *true*; and if he wanted to deny that PB applied to each member of the contradictory disjunction, then he could not have wanted to affirm his version of LEM. What then is Aristotle claiming?

What is generally missed in the interpretation of this passage is the modal content of Aristotle's claims. In stating that the disjunction of contradictory future contingent statements is necessary, whilst neither disjunct is, Aristotle only commits himself to the general view that, for any pair of future contradictory statements:

$$(1) \quad \Box(Fp \vee F\sim p) \text{ (19a30)}$$

$$(2) \quad \sim\Box Fp \wedge \sim\Box F\sim p \text{ (19a30–31)}$$

Hence, with respect to the *truth values* of (1) and (2), and in particular, the truth value of each disjunct in (2), he must hold:

$$(1a) \quad T\Box(Fp \vee F\sim p)$$

$$(2a) \quad \Psi\Box Fp \wedge \Psi\Box F\sim p$$

33: 'So if of every single thing either the affirmation or the denial is true, if the denial is not true, it is clear that the affirmation is true somehow (εἰ οὖν κατὰ παντὸς ἐνὸς ἢ φάσις ἢ ἀπόφασις ἀληθής, εἰ μὴ ἔστιν ἀπόφασις, δῆλον ὡς κατάφασις ἂν πως εἴη).' *APr*, 2.11, 62a13–15: 'For if of everything the affirmation or the denial [is true], then if it is proved that it is not the denial, it is necessary that the affirmation is true (εἰ γὰρ κατὰ παντὸς ἢ φάσις ἢ ἀπόφασις, δειχθέντος ὅτι οὐχ ἢ ἀπόφασις, ἀνάγκη τὴν κατάφασιν ἀληθεύεσθαι)'.; *Top*. 6.6 143b15–16: 'since of everything either the affirmation or the denial is true' (ἐπεὶ κατὰ παντὸς ἢ ἢ κατάφασις ἢ ἢ ἀπόφασις ἀληθεύεται). Cf. W. Kneale and M. Kneale, *The Development of Logic* (Oxford, 1962), 48.

With the modal content on display, we can see that in (1) Aristotle is merely admitting that it is necessary that the complex event picked out by the disjunction of a future tense affirmation *and* its denial will necessarily obtain. He can admit this because the disjunction expresses that it is *now* the case that, necessarily, one *or* the other disjunct *necessarily will be the case* in the future (namely, whenever one becomes necessary, and the other impossible).⁵⁹ The disjunction refers to a complex of two events that logically contains everything that must become necessary or unpreventable at a future time. However, in (2) Aristotle affirms that neither disjunct alone within this complex can be necessary, since, judged from the perspective of the present, each refers to an event that can possibly occur, and possibly not occur.

Once we see the truth values of (2) unpacked in (2a), we can see that (2) is most naturally read as an *explicit* denial of the modal content implicit in each future contingent disjunct, when these future statements are given **S1** interpretations in accordance *Future Truth Necessity*. For Aristotle does not say that it is not *true or false* that there will be a sea battle, nor does he say that it not *true or false* that there will not be one; rather, he says that it is not *necessary* that there be a sea battle, and that it is not *necessary* that there not be a sea battle.⁶⁰

⁵⁹ Strictly then, 1a. should be symbolised as: $T\Box(\Box Fnp \vee \Box Fn\sim p)$. However, the first necessity operator, because it takes the scope of a future *disjunction* in the present, renders innocuous the fatalist necessity present in each disjunct.

⁶⁰ Cf. N. Rescher, ‘An Interpretation of Aristotle’s Doctrine of Future Contingency and Excluded Middle’, in id. *Studies in the History of Arabic Logic* (Cleveland, 2009), 43–54, at 50, who takes Aristotle’s argument to be not against the truth or falsity of future contingent statements, but against their necessary truth or necessary falsity. He does not reach the both-false view I offer here only because he wrongly thinks that Aristotle has a semantics which clearly distinguishes truth and falsity (at a time) from necessary truth and falsity (at a time).

And this conjunctive claim, as should be obvious now, is identical to how a *both-false* theorist would explicitly deny, in the undisguised discourse of **S2**, both the fatalist's **S1** affirmation, and the fatalist's **S1** denial.

As a consequence, for future contradictory pairs such as 'There will be a sea battle' and 'There will not be a sea battle', which contain *disguised* modal content, neither Aristotle's version of LEM nor RCP will apply. However, this consequence is not as devastating as it may seem. For as we shall see, modally disguised future contradictory pairs are not truly contradictory. Once formulated in a modally *undisguised* way, future tense affirmations and denials follow LEM and RCP in the standard Aristotelian way, with one being true, and the other false.⁶¹

9. Extra-textual evidence: *Posterior Analytics* 2.12

We have seen that in *GC* 2.11 Aristotle states that unqualified future tense sentences, even when about contingent events, by default imply that those events will necessarily be or not, and that he implies in *DI* 9 that any statement that implies that a future contingent event necessarily will be is false. It is less well appreciated that, in *Post. An.* 2.12, he explicitly argues for the claim that unqualified future tense statements that refer to contingent events are false.

In *Post. An.* 2.12, a chapter which concerns positing the rules for temporalized explanatory deductions involving non-simultaneous but causally related successive events, Aristotle argues that it is false to claim that, because an earlier event *A* happens, a later event *C* that is non-simultaneously caused by *A* will happen.

Take the case of a past event, *C*, that has come to be at t_1 , because another past event, *A*, has come to be earlier at t_0 . Aristotle points out that one cannot deductively reason that: since

⁶¹ See section 10.

‘this [earlier] event *has come to be* (τόδε γέγονεν), this [later] event *has come to be* (τόδ’ ὕστερον γέγονεν)’ (95a30-31). His reason for thinking so is simple: whether one considers a definite or an indefinite interval of time to lie between *A* and *C*, ‘in the interval [between t_0 and t_1] it will be *false* to say that *already* the other [event, *C*,] has come to be (ἐν γὰρ τῷ μεταξύ ψευδὸς ἔσται τὸ εἰπεῖν τοῦτο, ἤδη θατέρου γεγονότος).

Aristotle is right. This is because, by hypothesis, *A* and *C* are non-simultaneous, and hence, *A*’s having come to be at a given past time—though it may be causally sufficient for bringing about *C*—will not make it true to say that, ‘because *A* has come to be, *C* has come to be’. However, he then claims that this view about logical inferences that hold between causally related past events also applies to (a) causally related future events, and (b) causally related past and future events. He writes:

ὁ δ’ αὐτὸς λόγος καὶ ἐπὶ τοῦ ἐσομένου, οὐδ’ ἐπεὶ τόδε γέγονε, τόδ’ ἔσται. τὸ γὰρ μέσον ὁμόγονον δεῖ εἶναι, τῶν γενομένων γενόμενον, τῶν ἐσομένων ἐσόμενον, τῶν γινομένων γινόμενον, τῶν ὄντων ὄν· τοῦ δὲ γέγονε καὶ τοῦ ἔσται οὐκ ἐνδέχεται εἶναι ὁμόγονον. ἔτι οὔτε ἀόριστον ἐνδέχεται εἶναι τὸν χρόνον τὸν μεταξύ οὔθ’ ὠρισμένον· ψευδὸς γὰρ ἔσται τὸ εἰπεῖν ἐν τῷ μεταξύ. (*Posterior Analytics* 2.12, 95a35-b1)

The same account applies to what will be.⁶² Neither [is it true to say that] since ‘this [event, *A*,] has come to be, that [event, *C*,] will be. For the middle-term must be of the same kind—and of the things which came to be, [the same kind of middle-term is] ‘came to be’, and of the things that will be, [the same kind of middle-term is] ‘will be’, and of the things which are coming to be, [the same kind of middle-term is] ‘coming to

⁶² On the punctuation of this line, see Barnes, *Posterior Analytics*, 235.

be’, and among things which are, [the same kind of middle-term is] ‘being’; but what belongs to ‘what came to be’ and what belongs to ‘what will be’ are not capable of being of the same kind. Still, they are capable of being so with respect to neither an indefinite nor a definite time period; for [in either case] it will be false to say this in the interval [that because *A came to be*, *C will be*].

By the ‘same account applies to what will be’, Aristotle means that the same explanation that rules out deducing later past events from earlier causally related past events also applies to non-simultaneous but causally related future events. That is, in the interval between two causally related non-simultaneous future events, in which one future event, *A*, is earlier than another future event, *C*, it will be *false* to say that because *A* will be, *C* will be. Aristotle goes on to apply the same logic to non-simultaneous present and past events that are causally related to future events.⁶³

Imagine that we are sitting with Socrates in prison, and considering two events, *A* (Socrates drinking a lethal dose of hemlock), and *C* (Socrates’ dying from hemlock). Aristotle’s claim is that we cannot demonstrate, in the future tense, that, since the *A* came to be (at t_1), the later future event, *C*, will be (at t_2). This is because, in the time interval between t_1 and t_2 , it will be *false* to say that ‘Because *A* came to be (at t_1), *C* will be (at t_2)’.⁶⁴

⁶³ Cf. Philop., *In Post.* 389.30–5 Wallies.

⁶⁴ Barnes (*Posterior Analytics*, 236) objects that: ‘Aristotle’s argument, which worked for the past, does not work for the future; for at any point after Socrates taking the lethal dose we can truly say “Socrates will die”.’ This claim is mistaken on two counts. First, the death of any person is not a contingent future event, but a necessary one. Hence, we could have truly said at *any point* during Socrates’ life that ‘Socrates will die’. However, even if we qualify our claim about Socrates’ death to make its cause explicit, e.g. ‘Because Socrates has taken the lethal dose of hemlock, he will die from the lethal dose of

The important point is this: since Aristotle thinks that one cannot correctly deduce that a future event, *C*, with a presently *known* cause, *A*, will occur in the future, on the basis that it is *false* to say that *C* will occur during the interval of time after *A* occurs but before *C* does, then it would be absurd if he did not also agree that, of a future contingent event *C* whose non-simultaneous causal antecedents may not be known at all, both its affirmation and denial are false.⁶⁵

If so, then this passage also reveals something wholly unexpected, which is that Aristotle cannot accept *Retro-Truth*. The acceptability of *Retro-Truth* ($p \rightarrow TPFp$) was premised upon the causal assumption that, if *p* is the case, at some point in the past, there was a sufficient cause of *p*'s future occurrence. However, in this chapter, Aristotle claims that we are only licensed to reason from effect to cause, in a uniformly tensed middle term, that, if *C came to be*, then *B* and *A came to be* as necessary conditions of *C*, but not from cause to effect, that, if *A came to be*, then through *B*, *C will be*.⁶⁶ In other words, Aristotle does not think the following inference is valid:

hemlock', this statement is still false. For Socrates may have tripped on a stone while walking around his jail and hit his head in such a way that he died before the hemlock took effect (or died through countless other causes).

⁶⁵ Gaskin (*Sea Battle*, 183) argues that in *Post An.* 2.12 Aristotle recognizes that a future tense statement is false, 'not because the **FCS** asserting the occurrence of the later event is itself false—it is either-true-or-false—but because in asserting that **FCS** one commits oneself to its *truth* and *that* commitment is false.' This explanation, while logically satisfactory, strains credulity as an interpretation of *Post An.* 2.12.

⁶⁶ See I. Kupreeva, 'Aristotle on Causation and Conditional Necessity: *Analytica Posteriora* II 12 in Context', in F. De Haas, M. Leunissen, and M. Martijn (eds.), *Interpreting Aristotle's Posterior Analytics in Late Antiquity* (Leiden, 2010), 203–233, at 206.

1. If A [Socrates' drinking a lethal dose of hemlock] **came to be**, then B [the failure of Socrates' organs] **will be**.
2. If B [the failure of Socrates' organs] **will be**, then C [Socrates' dying] **will be**.
3. If A [Socrates' drinking a lethal dose of hemlock] **came to be**, then C [Socrates' dying] **will be**.⁶⁷

The argument is not valid both because it falls afoul of Aristotle's rule that temporalized causal deductions must run from later effects to non-simultaneous prior causes, and because it contains an illicit copula tense shift in premise 1 and in the conclusion. Although *Retro-Truth* ($p \rightarrow TPFp$) might be construed as reasoning from effect to cause, nevertheless, it is built upon precisely the sort of illicit tense-shifting causal reasoning that Aristotle rules out in *Post An.* 2.12. If so, Aristotle's considered view must be that *Retro-Truth* is not a valid tense-logical principle.

The upshot of assuming that the *Posterior Analytics*' deductive tense rules are tacitly at play *DI 9* is that, since *Eternal Truth* is formulated upon the condition that *Retro-Truth* is valid, we can see why Aristotle would want to resist the fatalist's inference from *Retro-Truth* to the view that all statements have always been true or false. Hence, whilst Aristotle could, in theory, have affirmed *Retro-Truth*, but denied *Eternal Truth*, here he argues unambiguously for a deductive rule that renders both of these fatalist principles invalid.

⁶⁷ Here I follow Barnes, *Posterior Analytics*, 235, who takes Aristotle to be formulating a kind of conditional syllogism. Nothing, however, ultimately hangs on whether a conditional reconstruction is the best way to represent the logical point about tense-shifting deductions.

10. Conclusion

Both intra-textually and extra-textually then, we have evidence that Aristotle affirmed, with the fatalist, the tense-logical principle of *Future Truth Necessity*, but that he denied *Retro-Truth* and *Eternal Truth*, because he thought that unqualified affirmations or denials about future contingent events are *false* during the interval between their prediction and their taking place.⁶⁸

The argument as a whole then is this: since each fatalist argument is valid, then if Aristotle affirms PB and denies that future events are necessary, the only way he could have avoided fatalism is to deny one or more of the fatalist's tense-logical principles. I have argued that, since Aristotle accepts the fatalist's semantics for present, past, and future tense affirmations, he must deny the tense-logical principles of *Retro-Truth* or *Eternal Truth* along with *Future Falsity Necessity*. To deny the last principle, he must implicitly accept that unqualified future contingent affirmations and denials are disguised necessity statements, and hence are both false.⁶⁹

⁶⁸ Once the event referred to occurs (or not) at t , from that time forward, one member *will always have been true* at t , and its contradictory *will always have been false* at t . Cf. G. Ryle, *Dilemmas* (Cambridge, 2015), 18.

⁶⁹ The view that unqualified future tense affirmations and denials are disguised necessity claims seems to have first been noticed by Boethius (*In De int.*, 2nd edn, 2.211.29–213.18). According to him, if one states of a contingent event (not-) p that '(not-) p will be (*erit*)', by default, one's assertion will express that (not-) p is necessary or impossible: 'For whoever says "it will be" places a kind of necessity in that predication' (*Nam qui dicit erit, ille quandam necessitatem in ipsa praedicatione ponit*)' (Boeth., *In De int.*, 2nd edn, 2.212.4–5). For this reason, he says, both the assertion and denial of p are false. To avoid this problem, he goes on to say, one should not say that (not-) p 'will be', but that 'it can happen

However, the both-false reading does come at a cost (although it is one that I think is ultimately worth paying). Semantically, on the both-false view, the future contingent affirmations and denials that Aristotle considers in *DI 9* turn out to be not true *contradictory pairs*, but *contrary pairs*. This is for the simple reason that the contradictory of a modally undisguised future tense affirmation, such as ‘There necessarily will be a sea battle tomorrow’ is not, ‘There necessarily will not be a sea battle tomorrow’, but rather, ‘There will *not necessarily* be a sea battle tomorrow’, which is equivalent to ‘There *possibly* will not be a sea battle tomorrow’.⁷⁰ These modally undisguised future contradictory pairs follow RCP and LEM in the normal truth functional way (because the future necessity claim will be false, while the future possibility claim will be true).⁷¹

How then can we explain the fact that, in *DI 9*, Aristotle treats unqualified future tense affirmations and denials *as* contradictory pairs if they are in fact contraries? The answer is that, since Aristotle does not fully work out the essential differences between contrary and

(*contingit esse*)’ that (not-)*p*. Boethius’ own rejection of the both-false view seems to be based upon a novel distinction between a future contingent *proposition* which refers to a future event that is not definitely true or false, and a token *assertion* of that proposition, which, in virtue of its modal semantic content, is simply false. See Kretzmann, ‘Boethius’, 40–45; Gaskin, *Sea Battle*, 183. However, this view cannot be that of Aristotle, who does not make any sharp distinction between a token assertion that *p*, the affirmation that *p*, the proposition that *p*, the statement that *p*, or the mental state (e.g. believing/thinking judging) that *p*—especially not one according to which the affirmation or denial of *p* could differ in truth value from the proposition *p* (even granting that one may find the germ of some such distinction in *De int.* 9, 18b26–19a6). See D. Charles and M. Peramatzis, ‘Aristotle on Truth-Bearers’, *Oxford Studies in Ancient Philosophy* 50 (2016), 102–141, at 112.

⁷⁰ See *De int.* 13 22b10–28.

⁷¹ See *Pr. An.* 1.13, 32a21–29.

contradictory statements, including modally contradictory statements,⁷² until *DI* 12–14, it is reasonable to think that, in earlier chapters, including *DI* 9, he allows that unqualified (or disguised) future contingent affirmations and denials may be counted as contradictories in virtue of their syntactic form.

We know for certain that in *De Interpretatione* Aristotle sometime accepts syntactic form as sufficient for establishing a natural contradictory, since he claims that an affirmation and a denial with an unquantified universal for a subject term, such as ‘Man is pale’ (ἔστι λευκὸς ἄνθρωπος) and ‘Man is not pale’ (οὐκ ἔστι λευκὸς ἄνθρωπος) (*DI* 7, 17b9–10), constitute a contradictory pair for this very reason, despite both being able to be *true* in virtue of their differing semantic contents.⁷³

Similarly, he claims that an affirmation and denial that have an implicit or explicit double-subject, such as, ‘The cloak is pale’ (τὸ ἔστιν ἱμάτιον λευκόν)—where ‘cloak’ has been stipulated to mean ‘man and horse’—and ‘The cloak is not pale’ (τὸ οὐκ ἔστιν ἱμάτιον λευκόν), constitute a contradictory pair in virtue of their syntactic form (despite both being able to be *false*) (*DI* 8, 18a19–27).⁷⁴ If so, then there is no reason to think that unqualified future

⁷² See Malink, ‘One-Sided Possibility’, 41–46, on the violation of LEM in *De int.* 12, if the contradictory of (two-sided) ‘It is possible for x to be F ’ is taken to be (one-sided) ‘It is not possible for x to be F ’, and Aristotle’s attempt to remedy this in *De int.* 13.

⁷³ This is because some instances of the universal—Man—have paleness, and others lack it. In modern logic, these sorts of unqualified statements would be classed as generics. See S-J. Leslie, ‘Generics: Cognition and Acquisition’, *Philosophical Review* 117 (2008), 1–47.

⁷⁴ This is because each statement may be analysed into two affirmations that form a conjunction, i.e. ‘The man is pale’ and ‘The horse is pale’. So, if a man is pale, but a horse is tanned, then the affirmation, ‘Cloak is pale’ is false, because one of the conjuncts is false. But the denial, ‘Cloak is not pale’ is also false, because the other conjunct is false.

contingent statements that are syntactically contradictory could not be counted by Aristotle as contradictory pairs. Indeed, it is even plausible to think that Aristotle's later semantic insistence on distinguishing between 'will be' and 'is going to be', just like his careful formulation of LEM (and LNC) as applying only when *one item* is predicated of *one subject*, is part of an attempt to replace the more permissible syntactic understanding of what counts as a contradictory pair that we find in *De Interpretatione* with a stricter semantic model that would rule out all exceptions to RCP.

Hence, the true cost of accepting the both-false-solution is that we must accept both that Aristotle did not insist on making any sharp distinctions between modally contrary and contradictory future contingent statements in *DI 9*, and that, for unknown reasons, he chose not to revise *DI 9* once those distinctions had been theoretically worked out in *DI 12–14*.⁷⁵ However, given the amount of intra-textual and extra-textual evidence I have given here, I think this is a cost worth accepting.

My claim then is that we should take Aristotle's overall view in *DI 9* to be that RCP does not apply to future contingent contradictory pairs, because the same semantic view about future tense statements that he explicitly adopts in *GC 2.11* and *Post. An. 2.12* is already implicitly his view in *DI 9*, and that this appears, even if only unclearly, in the way he formulates his final denial of the fatalist position in claim (2), *viz.* by claiming that it is *not necessary* for a sea battle to be tomorrow (which is identical to claiming that the fatalist's **S1** affirmation, 'There will be a sea battle tomorrow', is false), and that it is *not necessary* for a sea battle not to be tomorrow (which is identical to claiming that the fatalist's **S1** denial, 'There will not be a sea battle tomorrow', is false). If so, then Aristotle—even if only implicitly—provides a workable refutation of the logical argument for fatalism that is consistent with his

⁷⁵ I thank Rachana Kamtekar for this point.

relative-temporalized view of modality and his later explicit views of the meaning of future tense statements, without sacrificing PB or LEM.

University of Glasgow

BIBLIOGRAPHY

- Ackrill, J., *Aristotle: Categories and De Interpretatione [De Interpretatione]* (Oxford, 1963).
- Ademollo, F., 'The Principle of Bivalence in *De Interpretatione* 4', *Oxford Studies in Ancient Philosophy*, 38 (2010), 97–113.
- Anscombe, G. E. M., 'Aristotle and the Sea Battle', *Mind*, 65 (1956), 1–15.
- Bäck, A., 'Sailing through the Sea Battle', *Ancient Philosophy*, 12 (1992), 133–51.
- Barnes, J., 'Peripatetic Negations', *Oxford Studies in Ancient Philosophy*, 4 (1986), 201–14.
- Barnes, J., *Posterior Analytics* (Oxford, 1993).
- Bobzien, S., *Determinism and Freedom in Stoic Philosophy* (Oxford, 1998).
- Burrell, D., 'Aristotle and "Future Contingencies"', *Philosophical Studies*, 13 (1964), 37–52.
- Byrd, J., 'The Necessity of Tomorrow's Sea Battle'. *Southern Journal of Philosophy*, 48 (2010), 160–76.
- Carson, S., 'Aristotle on Existential Import and Nonreferring Subjects', *Synthese*, 124 (2000), 343–60.
- Charles, D., *Aristotle on Meaning and Essence* (Oxford, 2000).
- Charles, D., and Peramatzis, M., 'Aristotle on Truth-Bearers', *Oxford Studies in Ancient Philosophy*, 50 (2016), 102–41.
- Crivelli, P., *Aristotle on Truth [Truth]* (Cambridge, 2004).

- Fine, G., 'Truth and Necessity in *De Interpretatione* 9', *History of Philosophy Quarterly*, 1 (1984), 23–47.
- Frede, D., *Aristoteles und die 'Seeschlacht': Das Problem der Contingentia Futura in De Interpretatione* 9 (Göttingen, 1970).
- Frede, D., 'Omne quod est quando est necesse est esse', *Archiv für Geschichte der Philosophie*, 54 (1972), 153–67.
- Frede, D., 'The Sea-Battle Reconsidered: A Defence of the Traditional Interpretation' ['Sea- Battle'], *Oxford Studies in Ancient Philosophy*, 3 (1985), 31–87.
- Gaskin, R., *The Sea Battle and the Master Argument [Sea Battle]* (New York, 1995).
- Hartshorne, C., 'The Meaning of "Is Going to Be"' ['Meaning'], *Mind*, 74 (1965), 46–58.
- Hintikka, J., *Time and Necessity: Studies in Aristotle's Theory of Modality [Time]* (Oxford, 1973).
- Izgin, C., 'Internal Negation and the Principles of Non-Contradiction and of Excluded Middle in Aristotle', *History and Philosophy of Logic*, 41 (2020), 1–15.
- Jones, R., 'Truth and Contradiction in Aristotle's *De Interpretatione* 6–9', *Phronesis*, 55 (2010), 26–67.
- Kirwan, C., *Aristotle: Metaphysics Books Γ, Δ, and E* (Oxford, 1993).
- Kirwan, C., 'Aristotle on the Necessity of the Present', *Oxford Studies in Ancient Philosophy*, 4 (1986), 167–87.
- Kneale, W., and Kneale, M., *The Development of Logic* (Oxford, 1962).
- Kretzmann, N., 'Boethius and the Truth about Tomorrow's Sea Battle' ['Boethius'], in D. Blank, N. Kretzmann, R. Sorabji, and M. Mignucci, *Ammonius: On Aristotle On Interpretation 9 with Boethius: On Aristotle On Interpretation 9: First and Second Commentaries* (London 2014), 24–52.

- Kupreeva, I., ‘Aristotle on Causation and Conditional Necessity: *Analytica Posteriora* II 12 in Context’, in F. De Haas, M. Leunissen, and M. Martijn (eds.), *Interpreting Aristotle’s Posterior Analytics in Late Antiquity*, (Leiden, 2010), 203–33.
- Leslie, S.-J., ‘Generics: Cognition and Acquisition’, *Philosophical Review*, 117 (2008), 1–47.
- Malink, M., ‘Aristotle on One-Sided Possibility’, in M. Cresswell, E. Mares, and A. Rini (eds.), *Logical Modalities from Aristotle to Carnap: The Story of Necessity* (Cambridge, 2016), 29–49.
- Malink, M., and Rosen, J., ‘A Method of Modal Proof in Aristotle’, *Oxford Studies in Ancient Philosophy*, 42 (2012), 170–261.
- Mignucci, M., ‘Ammonius on Future Contingent Propositions’, in A. Falcon and P. Giaretta (eds.), *Ancient Logic, Language, and Metaphysics: Selected Essays by Mario Mignucci* (London, 2020), 195–218.
- Minio-Paluello, L. (ed.), *Aristotelis categoriae et liber de interpretatione* (Oxford, 1949).
- Moraux, P. (ed.), *Aristote: Du ciel* (Paris, 1965).
- Mugler, C. (ed.), *Aristote: De la génération et de la corruption* (Paris, 1966).
- Opsomer, J., and Steel, C., *Ten Problems concerning Providence* (London, 2014).
- Prior, A. N., ‘The Formalities of Omniscience’, *Philosophy*, 37 (1962), 114–29.
- Prior, A. N., *Past, Present and Future [Past]* (Oxford, 1967).
- Rescher, N., ‘An Interpretation of Aristotle’s Doctrine of Future Contingency and Excluded Middle’, in id., *Studies in the History of Arabic Logic* (Cleveland, 2009), 43–54.
- Ryle, G., *Dilemmas* (Cambridge, 2015).
- Sorabji, R., ‘Boethius, Ammonius, and Their Different Greek Backgrounds’, in D. Blank, N. Kretzmann, R. Sorabji, and M. Mignucci, *Ammonius: On Aristotle On Interpretation 9*

- with *Boethius: On Aristotle On Interpretation 9: First and Second Commentaries*
(London 2014), 16–23.
- Sorabji, R., *Necessity, Cause and Blame: Perspectives on Aristotle's Theory* [*Necessity*]
(London, 1980).
- Strang, C., 'Aristotle and the Sea Battle', *Mind*, 69 (1960), 447–65.
- Thomason, R., 'Indeterminist Time and Truth Value Gaps', *Theoria*, 36 (1970), 264–81.
- Todd, P., and Rabern, B., 'Future Contingents and the Logic of Temporal Omniscience'
['Future Contingents'], *Noûs*, 55 (2021), 102–27.
- Waterlow, S., *Passage and Possibility: A Study of Aristotle's Modal Concepts* [*Passage*]
(Oxford, 1982).
- Weidemann, H. (ed.), *Aristoteles Peri Hermeneias* (Berlin, 2014).
- Whitaker, C., *Aristotle's De Interpretatione: Contradiction and Dialectic* (Oxford, 1996).
- White, M., 'Aristotle and Temporally Relative Modalities', *Analysis*, 39 (1979), 88–93.
- White, M., 'Fatalism and Causal Determinism: An Aristotelian Essay', *Philosophical Quarterly*, 31 (1981), 231–41.
- Williams, C., 'True Tomorrow, Never True Today', *Philosophical Quarterly*, 28 (1978),
285–99.