How to Think The Infinite: A New Reading and Interpretation of Aristotle, *Metaphysics* II, 994b21-27

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Abstract

In *Metaphysics* 2.2, 994b21-27 Aristotle comments on how it is possible to think something that is infinitely divisible. Given that Aristotle denies elsewhere that it is possible to think an infinite number of items the passage offers important evidence for Aristotle's positive account of how one can think something that is infinite. However, Aristotle's statement in *Metaphysics* 2.2 has puzzled interpreters since antiquity. This puzzlement has been partly due to a textual problem in the passage. In this paper we first restore the original reading of *Metaph*. 2.2, 994b25-26 by making use of the evidence in Alexander of Aphrodisias's commentary and second make sense of the restored passage by interpreting it in light of Aristotle's thoughts on the infinite in *Physics* 3 and 8.

Keywords

Aristotle, *Metaphysics*, *Physics*, Alexander of Aphrodisias, Infinite, textual criticism

1 Introduction

In *Metaph*. 2.2, 994b21-27, Aristotle comments on how it is possible to think something that is infinitely divisible. Given that Aristotle has denied in the preceding lines that it is possible to

think an infinite number of causes—a position that is attested elsewhere—,[1] the passage offers important evidence for Aristotle's positive account of how one can think something that is infinite. However, Aristotle's statement in *Metaphysics* 2.2 appears to be unclear and has puzzled interpreters since antiquity. This puzzlement has been partly due to a textual problem that further adds to the obscurity of the passage. In this paper we will first show how it is possible to free the text of the textual corruption by making use of the evidence available in Alexander's commentary. Having established the original reading of the text, we will secondly show that the passage makes good sense when read in light of what Aristotle says about the infinite in the *Physics*. The aim of this paper is therefore to restore (with the help of Alexander's commentary) the original reading of *Metaph*. 2.2, 994b25-26 *and* to explicate its actual meaning by interpreting it in light of Aristotle's thoughts on the infinite in *Physics* 3 and 8.[2]

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[1] See, for instance, *APo* 1.22, 83b5-6; 84a2-4.

[2] The evidence that *Metaph.* 2.2 is intimately related to *Physics* 3 and 8 offers, we believe, also new evidence for the authenticity of *Metaphysics* 2. Doubts about the authenticity of book 2 go back to antiquity (for an overview see Berti 1983, 260-265). Nicolaus of Damascus provides evidence that the book was part of the *Metaphysics* in the first century BCE and Alexander of Aphrodisias (second century CE) regards it as authentic (*In Metaph*. 137.2-3; see Kotwick 2016, 17-18; 80-82). Yet a scholium in the *Metaphysics* ms. E (*Parisinus gr*. 1853) attests that some questioned Aristotle's authorship of book 2 and ascribed it to Pasicles of Rhodes, the son of Aristotle's student Eudemus. As Vuillemin-Diem 1983 shows, however, the scholium seems to be the result of a series of misunderstandings of Asclepius of Tralles's (sixth century CE) remarks (*In Metaph*. 4.17-24) about book 1. Asclepius himself regards book II as authentic (*In Metaph*. 113.5-9). For our arguments for its authenticity, see below.

In addition to the question whether Aristotle himself or one of his students wrote book 2, one may further ask whether book 2 properly belongs into the *Metaphysics* or whether it was, as Jaeger and Ross argue, originally an introduction to the *Physics* (see Jaeger 1912, 114-118; Ross 1924, 213). Indeed the last sentence of *Metaph*. 2.3 (995a14-19) suggests a close connection to the *Physics*. Since we will in this paper point to the close relation

2 An Overview of Our Interpretation

In this overview we will introduce the passage in question, the puzzle that it generates and our solution to that puzzle. In *Metaphysics* 2.2, Aristotle argues (i) against the possibility that there is an infinite series of causes (994a3–b27) and (ii) against the possibility that there are infinitely many kinds of causes (994b27-31).[3] In the lines preceding our passage, Aristotle argues against the possibility that there are infinitely many formal causes of a thing. One reason why this is impossible is the resulting impossibility of knowledge (994b20-23). According to Aristotle, to have knowledge of something is to know the causes of that thing. But if something has infinitely many causes and one cannot grasp infinitely many items, attaining knowledge of this thing will be impossible. 'How can one think things that are infinite in this way?', Aristotle asks rhetorically at 994b22-23. And the answer expected is clearly this: 'It is not possible to think things that are infinite in this way'.

But, as Aristotle goes on to say, the case of the line is different (994b23). The suggestion is that the line is a case in which one *can* think something infinite, in contrast to the case of a chain of infinitely many causes. Aristotle clearly believes that the infinite exists in some way and that it is necessary for an adequate physical science;[4] if it were impossible to think the infinite at all, Aristotle would have a problem explicating his conception of physical science.

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of *Metaph.* 2.2 to parts of the *Physics*, one might take this as new support for the view promoted by Jaeger and Ross. That is a possibility we do not have space presently to explore, however, as it lies beyond the scope of this paper. Our main effort it is to make satisfactory sense of the transmission and meaning of *Metaph.* 2.2, 994b23-26.

[3] Cf. Gigon 1983, 203-213.

[4] *Ph.* 3.6 206a9-10. That the infinite is among the basic concepts of physical science is made clear in *Ph.* III.1, 200b12-20.

Thus, he owes us an explanation of how we are able to think the infinite. In our passage Aristotle is addressing a part of this problem: He shows how it is possible to think an infinitely divisible line.

In our passage then the question is: how exactly do we grasp the infinite in the case of the line? We believe that Aristotle presents his solution in lines 994b24-26. Here he exploits the structural identity between the problem of how to think the infinite and the problem of how to traverse an infinitely divisible line. First, Aristotle remarks that the one who is traversing the line cannot be counting the sections.[5] If she did that, she would never reach the end. Similarly, in understanding that the line is infinitely divisible—in understanding what infinite divisibility is—, we are not dividing the line in infinitely many parts while counting the resulting segments. This would involve the aforementioned impossibility of knowing an infinite number of things—be it causes or line segments.

If one cannot think the infinite by thinking of the divisions one by one, then how can one do it? Aristotle answers this question in lines 994b25-26. Unfortunately, though, the text as it is preserved in our manuscripts is corrupt; it will help us to have a closer look at the passage. The direct manuscript tradition of Aristotle's *Metaphysics* brought down to us the following text (994b21-27):[6]

καὶ τὸ [22] γιγνώσκειν οὐκ ἔστιν, τὰ γὰρ οὕτως ἄπειρα πῶς ἐνδέχεται [23] νοεῖν; οὐ γὰρ ὅμοιον ἐπὶ τῆς γραμμῆς, ἢ κατὰ τὰς διαιρέ-[24]σεις μὲν οὐχ ἵσταται, νοῆσαι δ᾽ οὐκ ἔστι

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[5] *Metaph.* 2.2, 994b24-25 and *Ph.* 8.8, 263a29-31.

[6] This passage presents the text as printed in Jaeger's 1957 OCT edition. The English translation is by Ross in Barnes 1984, but is substantially revised from line b25 onwards. All following translations of Aristotle are taken from Barnes 1984, but have been substantially revised by the authors.

μὴ στήσαντα (διόπερ [25] οὐκ ἀριθμήσει τὰς τομὰς ὁ τὴν ἄπειρον διεξιών), ἀλλὰ καὶ [26] τὴν ὕλην **ἐν κινουμένῳ** νοεῖν ἀνάγκη. καὶ ἀπείρῳ οὐδενὶ ἔστιν [27] εἶναι· εἰ δὲ μή, οὐκ ἄπειρόν γ᾽ ἐστὶ τὸ ἀπείρῳ εἶναι.

26 ὕλην *ω^{αβ}* Bekker Bonitz Christ Jaeger : ὅλην ci. Ross ‖ ἐν κινουμένῳ *ω^{αβ}* ci. Al. 164.23 Bekker Bonitz Christ Jaeger : κινουμένῳ *ω^{AL}* : κινουμένην Al.¹ 164.15 (ci. τινὲς secundum Al. 164.24) : οὐ κινουμένῳ ci. Ross

And knowledge becomes impossible; for how can one think things that are infinite in this way? For this is not like the case of the line, to whose divisibility there is no stop, but which we cannot think of if we do not make a stop; so that one who is traversing the infinitely divisible line cannot be counting the sections. But further, one must think the matter in something *that is in motion*. And it is not possible that there is something which *is* infinite; but if it was possible, being infinite is not infinite.

Our analysis will focus on the phrase 'But further, one must think the matter in something that is in motion' (ἀλλὰ καὶ τὴν ὕλην ἐν κινουμένῳ νοεῖν ἀνάγκη) in lines b25-26. In this phrase, particularly the term 'matter' (ὕλην) has caused much misunderstanding and has been met with disapproval among readers, editors, and commentators. Already Bonitz in 1849 expressed his difficulty in making sense of this passage.[7] In his 1924 edition,[8] Ross proposes a drastic solution: he suggests replacing ὕλην ('matter') by ὅλην ('whole'), and ἐν κινουμένῳ ('in something that changes') by οὐ κινουμένῳ ('something that does not move'). Ross's text reads:

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[7] Bonitz 1849, 134.

[8] Ross 1924, 219: "ἀλλὰ … ἀνάγκη is very difficult".

ἀλλὰ καὶ τὴν ὅλην οὐ κινουμένῳ νοεῖν ἀνάγκη ('but *the whole* line also must be apprehended by something in us which *does not move* (in thought) from part to part').[9]

In ancient scholarship, by contrast, the commentator's critical eye focused on the word κινουμένῳ rather than on ὕλη—as the commentary by Alexander of Aphrodisias (200 CE) bears witness. In the following, we will show that in the text of the *Metaphysics*, ὕλην does not need to be changed, and that the expression ἐν κινουμένῳ is the truly problematic part of this section. Moreover, we will show that ἐν κινουμένῳ is the result of a change made to the text on the basis of Alexander's comments on the passage. When we reconstruct the *Metaphysics* text that Alexander used when writing his commentary, we find that he read κινουμένῳ simply and without the preposition ἐν, but that Alexander himself suggested by way of conjecture to add the preposition ἐν. This has been suggested by Marwan Rashed in a footnote in his book *Essentialisme*.[10] We will provide further crucial evidence that Alexander's reading is indeed what Aristotle originally wrote, and that the reading we find in our *Metaphysics* text goes indeed back to Alexander's conjecture.

The result of this reconstruction will be that the sentence in lines 994b25-26 does not read ἀλλὰ καὶ τὴν ὕλην ἐν κινουμένῳ νοεῖν ἀνάγκη ('but further one must think the matter in something that is in motion'), but instead ἀλλὰ καὶ τὴν ὕλην κινουμένῳ νοεῖν ἀνάγκη ('but further one must think the matter while moving').[11] The change from ἐν κινουμένῳ to

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[9] Ross 1924, 219-220: "I read with hesitation, τὴν ὅλην οὐ κινουμένῳ, which at least connects better with what precedes … 'It is not possible to apprehend the line without calling a halt to the process of dividing, but *the whole* line also must be apprehended by something in us which *does not move* (in thought) from part to part.'" Ross's translation in Barnes 1984, 1571 is based on a Greek text that reads the words τὴν ὕλην ἐν κινουμένῳ: 'But further, the *matter* in a changeable thing must be cognized.'

[10] Rashed 2007, 315-316 n. 861.

[11] The form κινουμένῳ 'the one who moves / someone moving' is intransitive.

κινουμένῳ without ἐν prompts a change in the syntactical function of the dative κινουμένῳ. The participle κινουμένῳ must now be taken as the dative of the person that is used with δεῖ or ἀνάγκη and that indicates the person who must do something.[12]

Having restored the original reading of the line, we propose the following interpretation of it. The problem is how one can understand that the line is infinitely divisible. Since a line is divisible in virtue of its matter, i.e. its extension between the endpoints, one has to think the matter of the line. This explains the occurrence of the term ὕλη. Aristotle then uses the image of someone moving to convey the way in which, by grasping the matter, one also grasps its infinite divisibility. We propose that Aristotle's solution to the problem of how it is possible to traverse an infinitely divisible line in *Physics* 8.8 can be used as a model for an account of how it is possible to think something infinite.[13] While moving and traversing a certain distance, one

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[12] Cf. Kühner/Gerth I: § 423,18c and § 427; pp. 420-421 and 447. LSJ s.v. ἀνάγκη 'c. dat. pers.' The following parallel passages show that Aristotle sometimes uses the construction of ἀνάγκη + dative of person with infinitive instead of the more common construction of ἀνάγκη + accusative with infinitive: *Cael.* 306a23-24: Ἔτι δ' **ἀνάγκη τοῖς** ταῦτα **λέγουσιν** οὐκ ἐκ σώματος ποιεῖν γένεσιν· 'Further, those who hold these views must suppose that generation does not start from a body'; *Cael.* 309a11-12: Λέγουσι μὲν οὖν τοῦτον τὸν τρόπον, **ἀνάγκη** δὲ προσθεῖναι **τοῖς** οὕτω **διορίζουσι** … 'They put it in this way, but those who define it thus must add that …'; *GA* 738b6-7: ἀνάγκη δὲ καὶ τοῖς ἄλλοις ἀθροίζεσθαί τινα σύστασιν εἰς τὸν ὑστερικὸν τόπον. 'but also the others must collect some substance in the uterine region.'; *GC* 314a8-11: Ὅσοι μὲν γὰρ ἕν τι τὸ πᾶν λέγουσιν εἶναι καὶ πάντα ἐξ ἑνὸς γεννῶσι, **τούτοις** μὲν **ἀνάγκη** τὴν γένεσιν ἀλλοίωσιν φάναι … 'For those who say that the universe is one something (i.e. those who generate all things out of one thing) must assert that coming-to-be is alteration'; *Metaph.* 1001a18: **ἀνάγκη** γὰρ καὶ **τούτοις** τοσαῦτα λέγειν τὸ ἓν καὶ τὸ ὂν ὅσας περ ἀρχὰς εἶναί φασιν. 'for these also must say that being and unity are precisely all the things which they say are principles'; *Metaph.* 1075a23-24: λέγω δ' οἷον εἷς γε τὸ διακριθῆναι **ἀνάγκη ἅπασιν** ἐλθεῖν 'I mean, for instance, that all must at least come to be dissolved into their elements'.

[13] In section 3.2.2 we will spell out the analogy in detail.

has crossed infinitely many line parts, but one has not made any division nor counted the divisions. Thus, in thinking the extension while moving, one has thought of something that is infinitely divisible. Yet this does not commit the mover to think of all the possible division. Rather, just as the mover traverses the whole distance, the thinker thinks the distance as a whole. The image of someone moving is thus another crucial ingredient of Aristotle's solution to the problem of how one can think something infinite.

In the next section, we will first set out the reconstruction of the original reading from the evidence given in the commentary by Alexander of Aphrodisias and then defend our interpretation of the newly restored passage in greater detail.

3 The Defense of Our Interpretation

3.1 Reconstructing the Original Reading of Line 994b26

Aristotle's *Metaphysics* has come down to us in two versions, called α and β,[14] themselves originating from an ancestor, which we may refer to as $\omega^{\alpha\beta}$.[15] All of our *Metaphysics* manuscripts ultimately derive from this text, which can be dated roughly to the period between 225 and 400 CE,[16] yet the earliest manuscript we have is only from the ninth century CE.[17] In order to reconstruct from our manuscripts the state of the *Metaphysics* text before the ninth century, *indirect* witnesses of an earlier date are of tremendous importance. The most important extant indirect witness to the *Metaphysics* text is the commentary by Alexander of Aphrodisias.

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[14] See Harlfinger 1979, Frede and Patzig 1988, and Primavesi 2012.

[15] For the terminology of the reconstructed versions of the text see Kotwick 2016, xi–xii. On the history of the text of the *Metaphysics* see Primavesi 2012.

[16] On the dating of $\omega^{\alpha\beta}$ see Kotwick 2016, 1-19 and 279-281.

[17] The earliest manuscript is the Vindobonesis phil. gr. 100 (= J) dated to the ninth century CE.

Alexander's continuous commentary was written about 200 CE. Its first five books have been preserved in Greek, and its twelfth book in Arabic excerpts by Averroes. Alexander's commentary is so valuable because it offers us access to, first, a *Metaphysics* text of the second century CE (which may be called $\omega^{\mathbf{AL}}$), and, second, a source of emendations that have been made to the *Metaphysics* text in the course of its transmission through antiquity and the Middle Ages. Although the importance of Alexander's commentary for the constitution of the *Metaphysics* text has often been proclaimed by *Metaphysics* editors, the actual relation of Alexander's *Metaphysics* text to our *Metaphysics* text, as well as the relationship of Alexander's commentary itself to the tradition of *Metaphysics*, has been investigated only recently.[18]

Regarding the passage at issue, the evidence that can be found in Alexander's commentary has thus far not been studied satisfactorily with an eye to establishing the correct text of the *Metaphysics* and its interpretation.[19] Alexander's comments on our passage contain valuable information not only on the *original* reading of line 994b26, but also on *how* and *why* the text of our manuscripts ($\omega^{\alpha\beta}$) has been corrupted. A close examination of Alexander's commentary will reveal that his *Metaphysics* text read in line 994b26 not the words ἐν κινουμένῳ that we find in our manuscripts, but rather the pure dative form κινουμένῳ (i.e. without the preposition ἐν). Furthermore, Alexander's comments on the passage reveal that he, as so many modern commentators, had trouble making sense of this passage. Alexander took the dative κινουμένῳ as instrumental, rather than, as we take it, as complementing ἀνάγκη and

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[18] Kotwick 2016 offers an extensive study on how Alexander's *Metaphysics* text as well as his commentary relate to the *Metaphysics* text transmitted in our manuscripts.

[19] Rashed 2007, 315-316 n. 861 offers a brief but sharp explication of the evidence in Alexander's commentary, yet he does not draw from this the necessary consequences for the reconstruction of the Aristotelian text. And so he does not include this case among his suggestions (see p. 356) for corrections to the text of Aristotle's *Metaphysics*.

stating the *person* for whom it is necessary to do something. In order to express his own understanding of the passage more clearly, Alexander suggests changing the wording slightly by adding to κινουμένῳ the preposition ἐν. This suggested emendation of Alexander, then, was adopted into the text of $\boldsymbol{\omega^{\alpha\beta}}$, the ancestor of our directly transmitted version of the *Metaphysics,* and thus became the reading of our text.[20]

Alexander's comments on the *Metaphysics* passage (2.2, 994b21-27) can be divided into two sections. Section 1 of Alexander's commentary reads thus (Alex.Aphr., *In Metaph*. 164.15-23 Hayduck):[21]

> 994b25-6 Ἀλλὰ καὶ τὴν ὕλην κινουμένην νοεῖν ἀνάγκη. Τοῦ τὸ ἄπειρον ἄγνωστον εἶναι τῇ αὐτοῦ φύσει παρατίθεται σημεῖον τὴν ὕλην, ἐπεὶ δοκεῖ κατὰ τὸν αὐτῆς λόγον ἄπειρος εἶναι, ἀσχημάτιστος οὖσα κατὰ τὴν ἰδίαν φύσιν καὶ οἰκεῖον πέρας οὐκ ἔχουσα. τῷ δὴ τοιαύτην αὐτὴν εἶναι οὐδὲ ἐπιστήμην αὐτῆς ἔχομεν· **κινουμένῳ** γάρ τινι γιγνώσκομεν αὐτήν·δοξαστὴ γάρ ἐστι καὶ οὐκ ἐπιστητή, καὶ ὡς μὲν ὁ Πλάτων φησί, νόθῳ λογισμῷ γνωστή, ὡς δὲ Ἀριστοτέλης, ἀναλογίᾳ γνωστὴ καὶ δοξαστή, ὡς καὶ τοῦτο εἴρηκεν ἐν τοῖς Φυσικοῖς. τὸ αὐτὸ δὲ σημαίνοι ἂν καὶ εἰ εἴη γεγραμμένον 'ἀλλὰ καὶ τὴν ὕλην **ἐν κινουμένῳ** νοεῖν ἀνάγκη'.
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> 15 νοεῖν A O S : om. P^b ‖ 17 αὐτῆς A O S : αὐτῆς P^b ‖ 18 οὐκ A O S : om. P^b ‖ 19 αὐτὴν εἶναι A O : εἶναι αὐτὴν P^b ‖ 22 σημαίνοι P^b : σημαίνει O : σημαίν~ A ‖ 22-23 εἰ εἴη P^b S(*si scriptum sit*) Bonitz : εἰ ᾖ Brandis : εἴη A O

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[20] This has been suggested by Rashed 2007, 316 n. 861. That our *Metaphysics* manuscripts unanimously ($\omega^{\alpha\beta}$) have a reading that was not authored by Aristotle but instead by Alexander is (*pace* Rashed) no isolated incident. For further examples see Kotwick 2016, 178-206.

[21] The text of Alexander's commentary is based on new collations of all manuscripts by Pantelis Golitsis, who is currently working on a new critical edition of the authentic part of Alexander's commentary. In Golitsis 2016 he argues that three independent manuscripts of Alexander's commentary are extant: **A** (*Parisinus gr.* 1876), **O** (*Laurentianus plut.* 85.1) and **P^b** (*Parisinus gr.* 1878). The commentary text presented here is based on the evidence of these three manuscripts as well as the evidence in the Latin translation of the commentary by Sepúlveda 1527. Cf. also Kotwick 2016, 20-29. The English translation is by Dooley 1992, but has been modified.

'But it is also necessary to think the matter in motion': As an indication that the infinite is unknowable by its very nature, Aristotle adds a reference to matter, since matter seems by its definition to be infinite, having no shape in virtue of its own proper nature nor any limit peculiar to it. Because then it is this sort of thing, we do not have scientific knowledge of it, for we know it (only) through something *that is in motion*. For matter is the object of opinion and not of scientific knowledge, and as Plato says, it is known by a kind of bastard reason [*Tim*. 52bb], and as Aristotle says also in the *Physics* [191a8], it can be known by analogy and through opinion. The same might be expressed also when the above text would have been written thus: 'but it is also necessary to think the matter in something *in motion*.'

The commentary passage begins with a *lemma*, indicating the passage on which Alexander is commenting. The *Metaphysics* line quoted in the lemma is precisely the line that interests us. However, in Alexander's lemma we read τὴν ὕλην **κινουμένην** νοεῖν ('to think the matter *in motion*') instead of τὴν ὕλην **ἐν κινουμένῳ** νοεῖν ('to think the matter in something that is *in motion*'), which is the text of our manuscripts. For now, we will brush over this difference, but we will come back to it when analyzing the second section of Alexander's commentary.

In the ensuing commentary, Alexander presents his understanding of Aristotle's argument. According to Alexander, Aristotle illustrates the unknowability of something that is ἄπειρον with the example of matter. Matter as such is unknowable (οὐδὲ ἐπιστήμην αὐτῆς ἔχομεν, 164.19) and an object of mere opinion (δοξαστή, 164.20), and we know matter only through something that changes (κινουμένῳ … τινι, 164.19). When reproducing Aristotle's words, Alexander uses the simple dative case (κινουμένῳ) without the preposition ἐν, which

we find in our text of the *Metaphysics*.[22] Does this mean that Alexander read in his *Metaphysics* text (ω^AL) κινουμένῳ instead of ἐν κινουμένῳ? What can be said with certainty is that Alexander understands the single dative *as if* it meant ἐν κινουμένῳ, because he interprets the participle as instrumental dative, indicating that we think the matter *in/ through/ by way of something* that is in motion.[23] Since Alexander furthermore proposes (164.23) the phrase ἐν κινουμένῳ as a better way of expressing Aristotle's thought, we may be justified in assuming that he read in fact κινουμένῳ without the ἐν in his text.[24]

Looking back at the lemma that reads κινουμένην we might want to ask whether this rather than κινουμένῳ reflects the reading of ω^AL. Since κινουμένῳ, as suggested by Alexander's paraphrase, coincides neither with the direct transmission (ἐν κινουμένῳ) nor with the reading in the lemma (κινουμένην), one might suspect that the simple dative form κινουμένῳ goes back to Alexander's own spontaneity,[25] and not to his text of the *Metaphysics*.

An *earlier* section of his commentary, in which Alexander actually quotes the sentence in question, will show that Alexander indeed read κινουμένῳ, and not κινουμένην, in his *Metaphysics* text. In 148.12-13, Alexander refers to the present passage in the following way:

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[22] In Greek, the means or instrument through which an action is accomplished can be expressed by the simple dative case without preposition. With verbs of sensation and recognition the dative can express the instrument by which something is recognized (Hom. *Od.* 18.228 θυμῷ νοέω) or the object (taken as a medium) through which something is recognizable (Hom. *Il.* 5.182 ἀσπίδι γινώσκων). In Alexander's paraphrase (and according to his interpretation) the dative form κινουμένῳ has the latter sense.

[23] Kühner/Gerth I, § 431, 1,3) a); p. 465: "In der Prosa, besonders bei Xenophon, wird ἐν vom Mittel gebraucht bei den Ausdrücken: δηλοῦν, δῆλον εἶναι, σημαίνειν ἔν τινι, offenbaren in etwas = durch etw."

[24] Rashed 2007, 315 n. 861 somewhat hesitantly: "Il paraît donc probable que le texte de base d'Alexandre était: ἀλλὰ καὶ τὴν ὕλην κινουμένῳ νοεῖν ἀνάγκη."

[25] Bonitz 1848: "κινουμένῳ videtur interpretari Alex."

τὴν γὰρ ὕλην, ὡς προελθὼν ἐρεῖ, **κινουμένων** εἶναι ἀνάγκη ('For, as Aristotle is going to say in what follows, matter must be of things *in motion*.') This is how Alexander's words are transmitted by the manuscripts that Hayduck examined and also by the manuscript O (*Laurentianus* 85,1) and P[b] (*Parisinus gr*. 1878).[26] However, as Marwan Rashed points out, the sequence of letters that we read in the commentary text Κ Ι Ν Ο Υ Μ Ε Ν Ω **Ν Ε Ι Ν Α Ι Α** Ν Α Γ Κ Η resulted from a perhaps easily explicable scribal error.[27] The original letter sequence seems rather to have been Κ Ι Ν Ο Υ Μ Ε Ν Ω Ι **Ν Ο Ε Ι Ν Α** Ν Α Γ Κ Η.[28] Alexander's reference then would read: **τὴν γὰρ ὕλην**, ὡς προελθὼν ἐρεῖ, **κινουμένῳ νοεῖν ἀνάγκη**. Thus, this sentence reveals itself to be a quote of the forthcoming Aristotelian sentence that interests us. That Alexander indeed quotes and not merely anticipates our passage is indicated by his words ὡς προελθὼν ἐρεῖ ('as he will go on to say'), which are meant to introduce a quotation rather than a vague paraphrase.[29]

Rashed's paleographical argument for the correction of this line in Alexander's commentary seems to rest only on a hypothesis of scribal errors. But we can add another crucial piece of evidence that corroborates Rashed's conclusion. This evidence is given by the context of the commentary passage (148.10-16). In this passage, Alexander comments on *Metaph.* II.993b24-27 and hence deals with the *intelligibility* of matter, rather than the question of its

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[26] We would like to thank Pantelis Golitsis for providing this information to us.

[27] Rashed 2007, 315-316 n. 861.

[28] As Rashed explains, this amounts to a haplography of round letters (OE becomes E) and a dittography of A to AIA. Rashed does not write an iota adscript after the omega in his diplomatic transcription and does not include it into his error analysis.

[29] On quotations in Alexander's commentary see Kotwick 2016, 50-54.

existence.[30] This clearly suggests that νοεῖν, not εἶναι, is the right verb here, and that the word immediately preceding this verb must thus be κινουμένῳ instead of κινουμένων. The restored quotation in 148.12-13, then, taken together with Alexander's paraphrase in our commentary passage (164.19), is strong enough evidence for the conclusion that line 994b26 in *ω*[AL] read in fact τὴν ὕλην κινουμένῳ νοεῖν ἀνάγκη.

Let us return to Alexander's disappointment with the pure dative κινουμένῳ given in his text. In lines 164.22-23, he proposes to change the text slightly; this change should facilitate our understanding of Alexander's interpretation of the passage. The way in which Alexander formulates his suggestion makes it clear that the reading ἐν κινουμένῳ is not a *varia lectio*[31] which Alexander might have found in another text or a marginal note. It is also unreasonable to think that Alexander refers here to a conjecture suggested by another commentator. For at 164.24 he will do just that and will clearly mark this suggestion accordingly. We may therefore conclude that line 164.23 is Alexander's own suggestion for a minor correction of *ω*[AL]: the addition of the preposition ἐν to the dative κινουμένῳ. Since Alexander's own suggestion of how the text should be modified is exactly the reading that we find in our directly transmitted

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[30] Commenting on *Metaph.* 2.2, 993b24-27, Alexander states (*In Metaph.* 148.10-13) that the things differ according to the degree to which they can be known. Some are objects of scientific knowledge (ἐπιστητά), others only of opinion (δοξαστά). This Alexander illustrates with a reference to our passage in 164.15-23.

[31] The optative in the protasis (καὶ εἰ εἴη γεγραμμένον) expresses a "bloße Vorstellung" and "etwas willkürlich Angenommenes" (Kühner/Gerth II, § 576; p. 477). Bonitz's correction εἰ εἴη for εἴη (A O) was based on the Latin translation S and is now, thanks to the new collations by Golitsis, confirmed by P[b]; the loss of εἰ is due to haplography. Rashed 2007, 316 n. 861: "Ce qui veut dire, si le grec a un sens, que cette variante n'est pas textuellement *attestée….*" Jaeger 1957 (*app. crit. ad loc.*), by contrast, states that Alexander knew ἐν κινουμένῳ as a *varia lectio.*

Metaphysics text, we may thereby infer that the reading of our manuscripts goes back to Alexander's conjecture.

With this correction, Alexander advances his own understanding of the passage, according to which the 'thing that is moving or changing' is the means by which we must recognize the matter (ὕλη). The instrumental sense could be expressed in the dative simply and without the preposition ἐν, but it seems that Alexander wants to bring out this understanding of the text more clearly. That is, Alexander wants to understand κινουμένῳ, 'by means of something that is moving', not just as the instrument through which we recognize the matter, but even more concretely as the place where we recognize the matter ('*in* something that changes').[32] As Alexander's references to Plato's *Timaeus* and to Aristotle's *Physics*— presumably *Ph.* 1.7, 191a8, ἡ δὲ ὑποκειμένη φύσις ἐπιστητὴ κατ' ἀναλογίαν—show, Alexander wants to express the thought that there is no scientific knowledge of matter, but apprehension of matter only by analogy and opinion. Alexander points out that matter has no shape by itself, and so is unrecognizable and in a sense infinite; the only way in which it can be recognized is in something that changes.

So much for a consideration of section 1 of Alexander's commentary: Alexander's text of the *Metaphysics* read κινουμένῳ simply; ἐν κινουμένῳ is Alexander's suggestion, based on his understanding of Aristotle; and the presence of ἐν κινουμένῳ in our text goes back to Alexander's commentary. Still, the κινουμένην in Alexander's lemma remains peculiar. Let us now have a quick look at the rest of Alexander's comments (Alex.Aphr. *In Metaph.* 164.24-26; 165.1-5 Hayduck):[33]

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[32] See also note 23.

[33] Emphasis in Greek text by Hayduck. The English translation is by Dooley 1992, but has been modified.

τινὲς δὲ κ ι ν ο υ μ έ ν η ν γράφουσι, καὶ ἐξηγοῦνται τὴν λέξιν ὅτι οὐκ ἔστιν ἄπειρος ὡς τὰ ἐνεργείᾳ ἄπειρα. διὸ ἐκεῖνα μὲν ἄγνωστα, αὕτη δὲ ἄπειρος οὖσα καὶ λεγομένη κατὰ τὸ ἀεὶ ἐν κινήσει καὶ μεταβολῇ τινι νοῆσαι (τῷ γὰρ μὴ ἔχειν οἰκεῖον σχῆμα ἤ τινα ποιότητα, ἄλλοτε ἄλλο εἶδος ἀμείβειν καὶ μεταβάλλειν), οὕτω δὴ οὖσα ἄπειρος ὡς διὰ τὸ κινεῖσθαι συνεχῶς λέγεσθαι τοιαύτη νοητή τέ ἐστι καὶ ἐπιστητή· οὐ γὰρ ὁμοίως τοῖς ἀγνώστοις ἄπειρος· ἵνα ἴσον ᾖ τὸ εἰρημένον τῷ ἀλλὰ καὶ τὴν ὕλην κινουμένην ἀεὶ καὶ ἐν ῥύσει οὖσαν καὶ διὰ τοῦτο ἄπειρον εἶναι λεγομένην, ὥσπερ καὶ τὴν γραμμὴν διὰ τὰς τομὰς νοεῖν ἀνάγκη, ἐπεὶ μὴ ἐκείνως ἐστὶν ἄπειρος. ἢ κ ι ν ο υ μ έ ν η ν νοεῖν ἀνάγκη ἀντὶ τοῦ ὡς κινουμένην καὶ ἐν ῥύσει καὶ τῇ τοιαύτῃ ἀπειρίᾳ οὖσαν· διὰ τοῦτο γὰρ οὐδὲ ἡ ὕλη ἐπιστητή.

25 διὸ A O : δι' ὃ Pᵇ ‖ 26 νοῆσαι A O : νοεῖσθαι Pᵇ ‖ 27 ἄλλοτε O Pᵇ S : ἄλλη τε A ‖ 28 ἀμείβειν καὶ μεταβάλλειν A O : ἀμείβει καὶ μεταβάλλει Pᵇ ‖ 3 τὴν γραμμὴν M : ἡ γραμμὴ A O Pᵇ ‖ 3-4 ἐπεὶ … ἀνάγκη O S : om. A Pᵇ ‖ 5 τῇ A O : ἐν Pᵇ

Some, however, write 'the matter in motion', and interpret the text to mean that matter is not infinite in the way that actually infinite things are. Hence these latter are [truly] unknowable whereas matter is and is said to be infinite by reason of the fact that it is always in motion and undergoing some change, because, having no shape of its own nor any quality, it assumes at one time a form which at another time it exchanges for some other form, and [thus] changes. Being infinite, then, in this way, inasmuch, that is, as it is said to be such because of its continuous motion, matter is intelligible and knowable; for it is not infinite in the same way as those things that are [truly] unknowable. [Interpreted thus], Aristotle's statement is equivalent to saying that matter is constantly in motion and flux, and for this reason is said to be infinite, just as the line too must be thought of by means of its [actual] divisions, since it is not infinite with respect to them.

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Or [Aristotle says], 'it is necessary to think the matter in motion' instead of 'as it is in motion and flux and subject to this kind of infinity'; for this reason matter is not the object of scientific knowledge'.

Alexander knows of yet another reading of our passage from other commentators or even editors, as is indicated by his reference to τινές ('some'). That these τινές are Alexander's scholarly colleagues is made clear by the fact that they are the subject of γράφουσι ('they write') and ἐξηγοῦνται ('they interpret'). These scholars emended the text (γράφουσι) according to their own interpretation (ἐξηγοῦνται).[34] According to the conjecture of these scholars, our passage reads (994b25-26): ἀλλὰ καὶ τὴν ὕλην **κινουμένην** νοεῖν ἀνάγκη ('but it is also necessary to think the matter *in motion*').

Given that Alexander introduces this reading as an emendation by others, its presence in Alexander's lemma (164.15) is somewhat troublesome. However, the lemmata in Alexander's commentary did suffer occasional corruption and therefore do not always attest to the reading that Alexander actually had in ω^{AL}.[35] And so the first result to be drawn about section 2 of Alexander's commentary on these lines is that the reading κινουμένην, which we find in Alexander's lemma, does not lead us back to the original reading, but to a reading suggested by ancient commentators or editors.

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[34] Kotwick 2016, 89-98 analyzes all passages where Alexander refers to text-critical work of his predecessors. From this analysis it is clear that Alexander refers in our passages to what he believes is a conjecture by earlier scholars rather than a *varia lectio* attested in another manuscript.

[35] On the reliability of the evidence in Alexander's lemmata see Kotwick 2016, 38-50. See also Rashed 2007, 315 n. 861, who suggests that this reading is a *varia lectio* from another manuscript ("Alexandre signale cette leçon comme un γράφεται alternatif").

In light of the evidence found in Alexander's commentary, we can therefore reconstruct the following reading of line 994b26 (Arist. *Metaph.* 2.2, 994b21-27):[36]

καὶ τὸ γιγνώσκειν οὐκ ἔστιν, τὰ γὰρ οὕτως ἄπειρα πῶς ἐνδέχεται νοεῖν; οὐ γὰρ ὅμοιον ἐπὶ τῆς γραμμῆς, ἣ κατὰ τὰς διαιρέσεις μὲν οὐχ ἵσταται, νοῆσαι δ᾽ οὐκ ἔστι μὴ στήσαντα (διόπερ οὐκ ἀριθμήσει τὰς τομὰς ὁ τὴν ἄπειρον διεξιών), ἀλλὰ καὶ τὴν ὕλην **κινουμένῳ** νοεῖν ἀνάγκη. καὶ ἀπείρῳ οὐδενὶ ἔστιν εἶναι· εἰ δὲ μή, οὐκ ἄπειρόν γ᾽ ἐστὶ τὸ ἀπείρῳ εἶναι.

26 ὕλην *ω^{αβ}* Al.¹ 164,15 Al.ᶜ 164.23 Bekker Bonitz Christ Jaeger : ὅλην ci. Ross ‖ κινουμένῳ *ω^{AL}* : ἐν κινουμένῳ ci. Al. 164.23 *ω^{αβ}* Bekker Bonitz Christ Jaeger : κινουμένην Al.¹ 164.15 (ci. τινὲς secundum Al. 164.24) : οὐ κινουμένῳ ci. Ross

And knowledge becomes impossible; for how can one think things that are infinite in this way? For this is not like the case of the line, to whose divisibility there is no stop,

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[36] According to our understanding of the passage, ἀλλὰ καὶ … νοεῖν ἀνάγκη (25-26) answers to νοῆσαι οὐκ ἔστι μὴ στήσαντα (24): 'It is not possible to think unless one …, but it is also necessary to think while one ...'. The infinitive νοῆσαι corresponds with the infinitive νοεῖν syntactically and semantically. The subject in the participle στήσαντα is identical to the subject in the participle κινουμένῳ. (The parenthesis in between the two parts of the sentence just illustrates the point made by μὴ στήσαντα.) Both participles (στήσαντα, κινουμένῳ), whose common subject might be best translated with 'one' or a general 'we', lack the article. On the omission of the article with the substantivized participle see Kühner/Gehrt I §462, l, pp. 608-609: "Ein substantivisch gebrauchtes … Partizip entbehrt des Artikels, wenn der Begriff ganz allgemein bezeichnet werden soll." Such a general sense is certainly given in our passage. Examples of this usage abound: e.g., S. *El.* 697 δύναιτ᾽ ἂν οὐδ᾽ ἂν ἰσχύων ('a strong person', 'if someone is strong') φυγεῖν. X. *An.* 2.3.23: ἀδικοῦντα ('someone who commits a crime', 'if someone commits a crime')… πειρασόμεθα … ἀμύνασθαι. Pl. *Lg.* 795b: διαφέρει πάμπολυ μαθὼν ('a learner') μὴ μαθόντος ('from a learner'). Arist. *Metaph.* 2.2, 994a30: ὅτι γίγνεται ἐκ μανθάνοντος ('out of a learner') ἐπιστήμων.

In sum, two things are necessary in order to think something infinite: one has to stop making divisions, but one also (ἀλλὰ καὶ…) has to think the matter of the line while moving (along the line).

but which one cannot think of if one does not make a stop, (this is why the one who is traversing the infinitely divisible line cannot be counting the sections), **but one must also think the matter while moving.** And it is not possible that there is something which *is* infinite; but if it was possible, being infinite is not infinite

Before stating our interpretation in the next section, let us explain why we believe that Alexander's interpretation of the text is not satisfactory.[37] As we said above, Alexander believes that Aristotle illustrates the unknowability of something that is ἄπειρον with the example of matter. Matter as such is not knowable and, therefore, we come to know matter only through something that moves. The point Alexander wants to make is that matter is no object of scientific knowledge.

The problem with Alexander's interpretation is twofold. First, it removes any connection to the first part of the sentence. Aristotle discusses the infinite in the case of the line and the passage under consideration, whatever it exactly means, clearly is meant as an answer to the question of how one can think the infinite divisibility of the line. But it is hard to see how Alexander's interpretation is an answer to *this* question. For Alexander only makes the general

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[37] Alexander presents two explications of the reading τὴν ὕλην **κινουμένην** νοεῖν ἀνάγκη (164.24-165.4) proposed by other scholars. The first one is that given by those who changed the text in this way; the second seems to be Alexander's own understanding of the proposed reading. According to those who proposed the reading τὴν ὕλην **κινουμένην** νοεῖν ἀνάγκη (164.24-165.4), matter is thinkable because it is in constant motion. By being in constant motion and constantly assuming different shapes, but having no shape of its own, matter is in a sense infinite. Why is being in constant motion a reason for matter's intelligibility? Presumably because assuming these different shapes, one understands that there must be some substrate whose essence is distinct from the attributes and which underlies the changes. As for Alexander's interpretation of the alternative reading, it amounts to the same interpretation that motivated him to conjecture ἐν κινουμένῳ: matter is no object of scientific knowledge. See above.

point that matter is no object of scientific knowledge. This leads to a second point of critique. Alexander's interpretation gets things the wrong way around. According to Alexander, Aristotle wants to argue that the infinite is unknowable and the case of matter is an illustration of this (164.16-18). But, in fact, Aristotle uses the example of matter to show how it is in fact possible to know the infinite. Thus, although it may be true that matter is not an object of scientific understanding, Alexander's interpretation of *Metaph.* 2.2, 994b26 is not satisfactory.

3.2 Interpreting the Text: Thinking the Infinite

Now that we have reconstructed the original text of the passage, we want to show that Aristotle's claim that 'one must think the matter while moving' makes perfect sense as an answer to the question 'What does thinking the infinite in the case of the line consist in?' By adducing evidence from Aristotle's *Physics,* we will show that this is exactly what Aristotle *should* say, given his views on infinite divisibility. The main focus in the rest of the paper is, therefore, to give a philosophical justification of the occurrence of 'matter' (ὕλην) and 'while moving' (κινουμένῳ) in *Metaph.* 2.2, 994b26. However, this passage also makes a novel point about *thinking* the infinite and, in this respect, goes beyond what we know from the *Physics.* For in the *Physics,* Aristotle attempts to answer the question 'whether [the infinite] exists or not, and, if it does, what it is' (*Ph.* 3.4, 202b35-6) and is thus interested in a definitional project. In *Metaph.* 2.2, however, the leading question is 'how it is possible to think, i.e. mentally grasp and comprehend, something infinite?'. By using the expression 'thinking the infinite', we want to stress that this is an epistemological question. An answer to this must not only take into account the nature of the infinite (the project of the *Physics*), but also explain how we can have cognitive access to the infinite, given that the infinite has this nature. Our passage answers this question with respect to one instance of the infinite – the infinite divisibility of a line.

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In the following, we will first show in what way the infinite is connected to matter (3.2.1). The infinite is a property of an extended magnitude. An extended magnitude is infinitely divisible in virtue of its matter. Thus, thinking the infinite implies thinking the matter of an object. Secondly, the infinite is a property whose essence is captured by a process-like feature, namely, the possibility that the process of division could go on. In section 3.2.2 we argue that the reference to someone moving is meant to elucidate this feature. In this sense, Aristotle's answer to Zeno's paradox in *Physics* 8.8 provides a model for thinking the infinite.

3.2.1 The Infinite and Matter

In his discussion of the infinite in *Ph. 3*.4, 204a2-7, Aristotle lists several ways in which the infinite is said. He concludes his list with the statement that 'everything that is infinite is so either by addition or by division or both.'[38] In *Ph*. 3.5 and 6 Aristotle argues that (potential) infinite divisibility is the only way in which the infinite exists.[39]

With this background in place we turn to *Metaph*. 2.2, 994b26. According to our reconstruction of the text, Aristotle asserts that to understand the infinite one has to think the matter of the line. As pointed out above, Ross objected to this reading and changed the transmitted reading τὴν ὕλην into τὴν ὅλην. So one might ask: why does Aristotle connect the infinite with *matter*?

To understand this connection, we must note that, according to Aristotle, the infinite is not a substance, but an attribute of something. Aristotle begins his treatment of the infinite in

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[38] *Ph*. 3.4, 204a6-7.

[39] Accordingly, the literature on the infinite focuses on the case of infinite divisibility. See Lear 1979, Hintikka 1966, Coope 2012, Cooper 2016. For a discussion of why Aristotle does not accept an actual infinity see Nawar 2015. For an interpretation of Aristotle's claim that the infinite is actual 'like a day' is (*Ph*. 3.6, 216b12-15) see also Massie 2007.

Physics 3.4 by reporting that his predecessors were divided over the question whether the infinite is a substance or an attribute. Whereas Plato and the Pythagoreans believed that the infinite is a substance existing on its own, the physicists thought it is an attribute of the elements.[40] Aristotle sides with the physicists on this question, although he differs considerably from them on the question what the *per se*-subject is (*Ph.* 3.4, 204a8-9):[41] Χωριστὸν μὲν οὖν εἶναι τὸ ἄπειρον τῶν αἰσθητῶν, αὐτό τι ὂν ἄπειρον, οὐχ οἷόν τε. ('Now it is impossible that the infinite, by being in itself infinite, should be separable from the objects of sense perception.')

According to Aristotle, there is nothing that is infinite in itself, i.e. whose being is just to be infinite, and which exists separately. This is, we suggest, the reason why Aristotle adds in the passage of *Metaphysics* 2 that 'and it is not possible that there is something which *is* infinite; but if it was possible, being infinite is not infinite' (*Metaph.* 2.2, 994b26-7). Whatever it is that is infinite, what it is to be this thing is not just to be infinite. Rather, whatever it is, it is infinite by being something else.[42] The physicists saw this correctly when they assumed that the infinite must be an attribute of, e.g., water. According to this theory, the infinite exists because there is an infinite amount of water. Aristotle disagrees with the details of this theory: the infinite is not

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[40] Cf. *Ph.* 3.4, 203a4-19.

[41] The translations of the *Physics* are by Hardie and Gaye in Barnes 1984, but have been revised by the authors.

[42] For this characterization of substance vs. accidents cf. *Apo* 1.4, 73b6-9. Cf. also *Metaph.* 14.1, 1087a31-36, where Aristotle illustrates this by using, as an example, the assumption that the white is a principle. A principle is something for which there is nothing prior. Thus, a principle cannot be a principle by being something else, for 'to suggest this is like saying that the white is the first principle, not *qua* anything else but *qua* white, but yet that it is predicable of a subject, and is white as being something else; for then that subject will be prior' (*Metaph.* 14.1, 1087a32-36). If the white is predicable of, let's say, surface, the white cannot be a substance because it is predicable of surface. And the same is true of the infinite, we suggest. The infinite is like the white insofar as both are predicated of some underlying thing.

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an attribute of water, but an essential attribute of magnitude or number. But he agrees to the extent that the infinite is a feature *of* something (*Ph.* 3.4, 204a17-19):

ἔτι πῶς ἐνδέχεται εἶναί τι αὐτὸ ἄπειρον, εἴπερ μὴ καὶ ἀριθμὸν καὶ μέγεθος, ὧν ἐστι καθ᾽ αὑτὸ πάθος τι τὸ ἄπειρον; ἔτι γὰρ ἧττον ἀνάγκη ἢ τὸν ἀριθμὸν ἢ τὸ μέγεθος.

Further, how can there be something that is infinite in itself, unless both number and magnitude, of which the infinite is a per se attribute, exist in that way? For it is even less necessary that number and magnitude exist as something in itself.

The infinite is an essential attribute of number and magnitude and, consequently, in defining what the infinite is, one has to mention magnitude or number.[43] The infinite should, roughly speaking, be defined as this specific sort of property of magnitude or number.

When Aristotle speaks in *Ph.* 3.4, 204a18-19 of the infinite as a *per se* attribute of number and magnitude, he refers, thereby, to the definition in the *Posterior Analytics* of the second sense of 'in itself' or *'per se'*.[44] According to this definition, X belongs in itself to Y if

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[43] The argument seems to be (roughly) that, given number and magnitudes are not substances because they are attributes of physical substances, the infinite cannot be a substance because the infinite is an attribute of number and magnitude. For our purposes the salient point is that the infinite is said to be an attribute of number and magnitude. Here the question emerges whether there is a single unified definition of the infinite at all, given that the quote suggests that the infinite has at least two *per se hypokeimena*.

[44] Cf. *APo* 1.4, 73a34–b3: 'One thing belongs to another in itself ... if the things it belongs to themselves belong in the account which makes clear what it is—e.g. straight belongs to line and so does curved, and odd and even to number, and prime and composite, and equilateral and oblong; and for all these there belongs in the account which says what they are in the one case line, and in the others number.'

Y is in the definition of X. Odd belongs in itself to number because number is in the definition of odd: an odd number is defined as a number not divisible by two. Similarly, in the definition of the infinite, magnitudes or numbers are mentioned. This has epistemological implications: in thinking the infinite, in grasping what the infinite is, one will also have to think its subject. In our case, it implies thinking the subject of infinite divisibility, i.e. the line.

This is almost correct, but there is one further complication. The infinite, we have seen, is tied to the *matter* of the line. Although the infinite belongs to the line, it is, most precisely, the matter of the line that is infinite, since the line is infinitely divisible in virtue of its matter. Hence, to think the infinite divisibility of the line, one has to think the matter. This claim may be surprising, not least because the notion of matter involved here is prone to being misunderstood (in what sense does a mathematical line have matter?). These difficulties have probably caused Ross's drastic conjecture τὴν ὕλην οὐ κινουμένῳ (*Metaph.* 2.2, 994b26).

By contrast, we believe that the expression ὕλη not only yields an adequate explanation of how we think the infinite, but, if we consider Aristotle's account of the infinite, should not even come as a surprise. For the connection between the infinite and matter is also made explicit in *Physics* 3.6, a text which contains Aristotle's own preferred account of the infinite (*Ph.* 3.6, 207a21-26):

> ἔστι γὰρ τὸ ἄπειρον τῆς τοῦ μεγέθους τελειότητος **ὕλη** καὶ τὸ δυνάμει ὅλον,
> ἐντελεχείᾳ δ' οὔ, διαιρετὸν δ' ἐπί τε τὴν καθαίρεσιν καὶ τὴν ἀντεστραμμένην
> πρόσθεσιν, ὅλον δὲ καὶ πεπερασμένον οὐ καθ' αὑτὸ ἀλλὰ κατ' ἄλλο· καὶ οὐ περιέχει
> ἀλλὰ περιέχεται, ᾗ ἄπειρον. διὸ καὶ ἄγνωστον ᾗ ἄπειρον· εἶδος γὰρ οὐκ ἔχει ἡ ὕλη.

The infinite is in fact *the matter* of the complete magnitude, and what is potentially a whole, though not in actuality. It is divisible both in the direction of reduction and of the inverse addition. It is a whole and limited; not, however, in virtue of its own nature, but in virtue of something else. It does not contain, but, in so far as it is infinite, is contained. Consequently, also, it is unknowable, *qua* infinite; for the matter has no form.

The infinite is here called 'the matter' of the complete magnitude.[45] The same connection between infinite divisibility, magnitudes, and matter is also made in a later passage (*Ph.* 3.7, 207a32–b1):

Κατὰ λόγον δὲ συμβαίνει καὶ τὸ κατὰ πρόσθεσιν μὲν μὴ εἶναι δοκεῖν ἄπειρον οὕτως ὥστε παντὸς ὑπερβάλλειν μεγέθους, ἐπὶ τὴν διαίρεσιν δὲ εἶναι (περιέχεται γὰρ **ἡ ὕλη** ἐντὸς καὶ τὸ ἄπειρον, περιέχει δὲ τὸ εἶδος)·

It is reasonable that there should not be held to be an infinite in respect of addition such as to surpass every magnitude, but that there should be thought to be such an infinite in the direction of division. For *the matter* and the infinite are contained inside what contains them, while it is the form which contains.

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[45] For the connection between matter and the infinite see also *Ph.* 3.6, 206b12-16. On the notion of magnitude involved in the discussion of the infinite see Hussey 1983, 73.

A magnitude, e.g., a line, is infinite not in virtue of being infinitely extended, but in virtue of being infinitely divisible.[46] Again, note Aristotle's justification: The infinite is the matter and not the form of the magnitude. Both passages connect well with the phrase in our *Metaphysics* passage: if the matter is what is infinite, one clearly has to think the matter in thinking the infinite.

This does not yet tell us what Aristotle means by calling the infinite the matter of a magnitude. We suggest that the matter of magnitudes, such as lines, surfaces and bodies, is matter not in its more ordinary usage, a stuff of which things are made, such as wood or bronze. Rather, the matter is, in this context, the extension of the magnitude.[47] For, obviously, a line is not made of bronze or some other stuff; a line, for Aristotle, is a compound of a one-dimensional extension and two endpoints. In this sense, Aristotle sometimes calls the extension of a magnitude its matter.[48] In keeping with this, he calls the limit of a magnitude its form. Accordingly, magnitudes can be seen as composites of form and matter. A complete magnitude, such as a line, has some extension as matter and its two endpoints, which define it as a certain length, as its form.

The matter of a line, then, is just a certain extension, which is, as such, not limited. It is limited only insofar as it is determined by two endpoints. These features—the indeterminacy of extension and the determinacy of the limits together with its role in imposing criteria of identity—connect this specific usage of matter and form in the context of magnitudes to

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[46] To be sure, for Aristotle this is not a premise, but requires an argument. Aristotle presents several arguments against the possibility of infinitely extended magnitudes and bodies in *Ph*. 3.5, 204b1-205b1. For our purposes, we can neglect these arguments since we are only interested in what way one can think the infinitely divisible line, which is the topic of *Metaph.* 2.2.

[47] On this point see also Bowin 2007, 242.

[48] Cf. *Ph*. IV.2, 209b6-9.

Aristotle's general use of matter and form.[49] Ursula Coope brings out this connection, while commenting on the passage from the *Physics*:[50]

> Like matter, the infinite is potentially, and like matter the infinite is not a whole (207a15ff.). The infinite is also closely connected to matter because matter, as such, is infinitely divisible. I take it that Aristotle is talking about matter (this thing that is infinite, in the sense of being infinitely divisible) in the difficult lines 207a21ff., when he says that it is 'surrounded' (a25) and is 'whole and finite not in itself but in respect of something else' (a23–24). The point is that the thing that is infinite (i.e., infinitely divisible) is matter and it (matter) is, qua infinitely divisible, surrounded and that it (matter) is whole and finite in respect of something else (its form).

Especially important for our purposes is the connection Coope sees between the matter and infinite divisibility. A line is infinitely divisible in virtue of its matter, not in virtue of having a form. As said, we interpret the matter as the extension between the two endpoints that are the form. The extension between the endpoints is the subject of the process of division. Thus, to understand the infinite one has to think the matter or extension of the line, which is, as it turns out, the *per se* subject of the infinite.

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[49] It is, however, crucial not to conflate what matter and form is in the case of a perceptible substance, e.g. Socrates, and what matter and form is in the case of a magnitude, e.g. the body of Socrates. Socrates is a composite of soul, his form, and flesh and bones, his matter. (Actually, the latter claim is a matter of dispute. It is suggested by, e.g., *Metaph.* 8.4, 1044a34-5 that the matter of humans is the menstrual fluid.) But that need not concern us here. The body of Socrates, on the other hand, is a composite of limit, its form, and extension, its matter.

[50] Coope 2012, 285 n. 29.

To conclude, even if one does not follow us in the details of our identification of the matter with extension, on account of *Ph.* 3.6 and 7 it is clear *that* the infinite is intimately connected to matter. And, in contrast to Ross's conjecture, it explains why Aristotle says in *Metaph.* 2.2 that thinking the matter of the line enables us to think the infinite divisibility of the line.

3.2.2 The Infinite and Moving

Since a line is infinitely divisible in virtue of its matter and the matter is the *per se* subject of the infinite, we may wonder why Aristotle employs the image of someone moving. Why should one have to think the matter while moving? The image of the mover, we suggest, shall provide the sense in which someone has grasped something infinitely divisible without going through an infinite number of divisions.

To bring out this sense, let us begin by recalling Aristotle's famous dictum that the infinite exists only potentially.[51] What exactly he means with this has been a matter of dispute, which we do not attempt to settle here.[52] But the basic idea seems to be this: the line is infinitely divisible, yet it is never divided in such a way. The line has the capacity to be undergoing a

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[51] Cf. *Ph.* 3.6 206a19-25: 'But we must not construe potential existence in the way we do when we say that it is possible for this to be a statue—this will be a statue, but something infinite will not be in actuality. Being is spoken of in many ways, and we say that the infinite is in the sense in which we say it is day or it is the games, because one thing after another is always coming into existence. For of these things too the distinction between potential and actual existence holds. We say that there are Olympic games, both in the sense that they may occur and that they are actually occurring.'

[52] Cf. Hintikka 1966; Coope 2012; Bostock 2006; Lear 1979.

process of being divided *ad infinitum,* yet it will never be in a state of having been divided into infinitely many parts.[53] Therefore it is apt to call the infinite 'essentially incomplete'.[54]

The incompleteness of the infinite is encapsulated in Aristotle's remark in *Metaph.* 2.2 that there is no stop to the divisibility of a line. However, as we have seen, he also makes clear that it is impossible to think the infinite by (mentally) dividing the line *ad infinitum* (994b24-25). This would involve the same impossibility as the impossibility of surveying an infinite number of formal causes mentioned in the lines before. If, let's say, the concept human were to divide into animal and biped, animal again into substance and perception and so on *ad infinitum,* one would never be able to understand what it is to be a human. Thus, a successful explanation of how it is possible to think something infinite must show why the proposed explanation does not imply that one has to survey an infinite number of items.

We suggest that an answer can be found if we link *Metaph.* 2.2 to *Ph.* 8.8. The solution to the puzzle of how it is possible to traverse an infinitely divisible line is structurally the same as the solution to the puzzle of how it is possible to think an infinitely divisible line without thinking of infinitely many divisions. This is, we believe, why Aristotle speaks of someone moving (κινουμένῳ) in *Metaph.* 2.2, and it explains why the text that can be reconstructed from Alexander's commentary is what Aristotle actually wrote. The parallel structure of *Metaph.* 2.2 and *Ph.* 8.8 comes to light in both content and language.

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[53] On the notion of 'to be undergoing a process' see the comment by Coope 2012, 281: "A process is something that is by its very nature incomplete while it is going on. To be undergoing a process is always to be doing something that, in a certain sense, points beyond itself. This is why Aristotle holds that when a magnitude is being divided ad infinitum, its potential for division is only being incompletely fulfilled, even though this potential is being fulfilled as completely as possible."

[54] Coope 2012, 282.

In *Ph.* 8.8, Aristotle returns to the topic of Zeno's paradoxes, something he has already dealt with in book 6.[55] Expressing some doubts about his previous answer to the dichotomy paradox, Aristotle attempts to provide another, more satisfactory, solution.[56] The challenge posed by Zeno in the dichotomy paradox regards how it is possible to traverse a continuous line if something continuous has infinitely many parts. Below we cite the whole passage and highlight those phrases that are also used in *Metaph.* 2.2 (*Ph.* 8.8, 263a23–b9):

ἐὰν γάρ τις τὴν συνεχῆ διαιρῇ εἰς δύο ἡμίση, οὗτος τῷ ἑνὶ σημείῳ ὡς δυσὶ χρῆται· ποιεῖ γὰρ αὐτὸ ἀρχὴν καὶ τελευτήν. οὕτω δὲ ποιεῖ ὅ τε ἀριθμῶν καὶ ὁ εἰς τὰ ἡμίση διαιρῶν. οὕτω δὲ διαιροῦντος οὐκ ἔσται συνεχὴς οὔθ' ἡ γραμμὴ οὔθ' ἡ κίνησις· ἡ γὰρ συνεχὴς κίνησις συνεχοῦς ἐστιν, ἐν δὲ τῷ συνεχεῖ ἔνεστι μὲν ἄπειρα ἡμίση, ἀλλ' οὐκ ἐντελεχείᾳ ἀλλὰ δυνάμει. ἂν δὲ ποιῇ ἐντελεχείᾳ, οὐ ποιήσει συνεχῆ, ἀλλὰ **στήσει**, ὅπερ **ἐπὶ τοῦ ἀριθμοῦντος τὰ ἡμίσεα** φανερόν ἐστιν ὅτι συμβαίνει· τὸ γὰρ ἓν σημεῖον ἀνάγκη αὐτῷ ἀριθμεῖν δύο· τοῦ μὲν γὰρ ἑτέρου τελευτὴ ἡμίσεος τοῦ δ' ἑτέρου ἀρχὴ ἔσται, ἂν μὴ μίαν ἀριθμῇ τὴν συνεχῆ, ἀλλὰ δύο ἡμισείας. ὥστε λεκτέον πρὸς τὸν ἐρωτῶντα εἰ ἐνδέχεται **ἄπειρα διεξελθεῖν** ἢ ἐν χρόνῳ ἢ ἐν μήκει, ὅτι ἔστιν ὡς, ἔστιν δ' ὡς οὔ. ἐντελεχείᾳ μὲν γὰρ ὄντα οὐκ ἐνδέχεται, δυνάμει δὲ ἐνδέχεται· **ὁ** γὰρ συνεχῶς **κινούμενος** κατὰ συμβεβηκὸς **ἄπειρα διελήλυθεν**, ἁπλῶς δ' οὔ· συμβέβηκε γὰρ τῇ γραμμῇ ἄπειρα ἡμίσεα εἶναι, ἡ δ' οὐσία ἐστὶν ἑτέρα καὶ τὸ εἶναι.

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[55] *Ph.* 6.2, 233a21–b15; 6.9, 239b5-240a18. See Bostock 2006 for the connection to Zeno.

[56] In his solution in book 6, Aristotle pointed out that, if both magnitude and time are infinitely divisible, one could traverse an infinitely divisible magnitude because time is also infinite in this way. Cf. *Ph.* 6.2, 233a21-31. The reason why Aristotle is dissatisfied lies in the fact that this solution only shows that one can traverse an infinitely divisible line *given* time is infinitely divisible, too. But it does not show that it is possible to traverse something that is infinitely divisible *tout court*. Cf. *Ph.* 8.8, 263a15-22.

Whenever one divides the continuous line into two halves one treats the one point as two, since one makes it a beginning and an end; and this same result is produced when one counts the halves as well as when one divides the line into halves. But if one makes divisions in this way, neither the line nor the movement will be continuous; for movement if it is to be continuous must relate to what is continuous; and though what is continuous contains an infinite number of halves, they are not actual but potential halves. If he makes the halves actual, he will not make a continuous movement but *will make a stop*, which is clearly what happens to the one who *counts the halves*; for it is necessary for him to count one point as two: it will be the end of the one half and the beginning of the other, if he counts not the one continuous line but the two halves. Therefore to the question whether it is possible *to pass through an infinite number* of halves either of time or of distance we must reply that in a sense it is and in a sense it is not. If the halves are actual, it is not possible; if they are potential, it is possible. For *the one who moves* continuously *has traversed an infinite number of halves accidentally but not in an unqualified way*; for though it is an accidental characteristic of the line to be an infinite number of halves, its essence and being are different.

Aristotle points out that, if one divides a line, one thereby creates two new lines. The point of division serves as the endpoint of one line and the beginning of the other. In the case of motion, the division results in an intermittent rather than a continuous motion. For, when actually dividing the line, one creates two distances, corresponding to the two halves, which have to be crossed. In this sense, the mover is making two motions, or an intermittent motion, and not a continuous motion. Thus, Aristotle will conclude, in one sense it is not possible to traverse the

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infinite—namely, if one makes the divisions actual—and in another sense it will be—namely if one does not actually divide the line.

Attention should be given to how closely parallel this is to *Metaph.* 2.2. In both texts Aristotle emphasizes that one cannot *count* the halves. For in counting the halves, one treats one point both as the endpoint of one half and as the beginning of the other half. In this way, one does not count one line, but rather two. Since the line is infinitely divisible, one would have to count an infinite number. Therefore, Aristotle concludes, it is impossible in this way either to think something infinite—the conclusion of *Metaph.* 2.2—or to traverse it—the conclusion of *Physics* 8.8.[57] Moreover, in *Metaph.* 2.2 Aristotle switches immediately from the claim that one cannot *count* an infinite number of divisions to his solution that is stated in terms of *motion* along a line. However, as *Ph.* 8.8, 263a4-11[58] shows, Aristotle considers this to be exactly the same puzzle, differing only in the way it is expressed. This is a further reason to believe that we find in the *Physics* a fuller discussion of a very similar point.

In what way, then, is it possible to traverse the infinite? Aristotle explains that it is only possible if the halves are potential. If the mover were to actualize the halves by making a stop,

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[57] It is noteworthy that in *Physics* 8 Aristotle provides an explicit reason for the impossibility, whereas in the *Metaphysics* he merely states the conclusion.

[58] Arist. *Ph.* 8.8, 263a4-11: 'The same method should also be adopted in replying to those who ask, in the terms of Zeno's argument, whether we admit that before any distance can be traversed half the distance must be traversed, that these half-distances are infinite in number, and that it is impossible to traverse distances infinite in number— or some put the same argument in another form, and would have us grant that in the time during which a motion is in progress we should first count the half-motion for every half-distance that we get, so that we have the result that when the whole distance is traversed we have counted an infinite number, which is admittedly impossible.'

she would never reach the end.[59] However, if someone moves along a line (without ever making a stop or counting all the possible divisions), she traverses an infinite number of points, but in an accidental way. For 'though it is an accidental characteristic of the line to be an infinite number of halves, its essence and being are different' (263b7-9). We suggest the following interpretation of this difficult remark: a line is defined by being a certain length marked by two endpoints. To traverse the line is to traverse this specific length. Crucially, this is distinct from *first* traversing one half of the line and *then* traversing the other half. It is, of course, true that one has traversed both halves. But one has traversed them accidentally because the motion one has performed is a single motion from one endpoint to the other, not two motions. This interpretation can be supported by a passage in *Metaphysics* 7.10 where Aristotle distinguishes between the parts of a thing that are contained in the definition and those that are not (*Metaph.* 7.10, 1035a9-22):

διὸ ὁ μὲν τοῦ κύκλου λόγος οὐκ ἔχει τὸν τῶν τμημάτων, ὁ δὲ τῆς συλλαβῆς ἔχει τὸν τῶν στοιχείων· τὰ μὲν γὰρ στοιχεῖα τοῦ λόγου μέρη τοῦ εἴδους καὶ οὐχ ὕλη, τὰ δὲ τμήματα οὕτως μέρη ὡς ὕλη ἐφ᾽ ἧς ἐπιγίγνεται· ἐγγυτέρω μέντοι τοῦ εἴδους ἢ ὁ χαλκὸς ὅταν ἐν χαλκῷ ἡ στρογγυλότης ἐγγένηται. ἔστι δ᾽ ὡς οὐδὲ τὰ στοιχεῖα πάντα

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[59] It is not entirely clear what one has to do to actualize halves or the point between them. We believe that Bostock 2006, 119 rightly mentions the three basic ways in which a point is actualized: "A point in a line may be actualized by a body's coming to rest at that point, or by a division actually being made at that point, or indeed by the point's being merely counted." However, we think that for Aristotle these are not three separate ways. Rather counting a point is a way of stopping and dividing. And the same holds for the other two.

The critique by Charlton 2003, 138 of Bostock ("it is unfair to attribute to Aristotle the vague idea that a body actualizes a point by 'doing something' at it. He has the quite precise idea (262ᵃ22–25) that a body actualizes a point by coming to rest at it") is, given Bostock's explicit remarks that we have just quoted, equally unfair.

τῆς συλλαβῆς ἐν τῷ λόγῳ ἐνέσται, οἷον ταδὶ τὰ κήρινα ἢ τὰ ἐν τῷ ἀέρι· ἤδη γὰρ καὶ ταῦτα μέρος τῆς συλλαβῆς ὡς ὕλη αἰσθητή. καὶ γὰρ ἡ γραμμὴ οὐκ εἰ διαιρουμένη εἰς τὰ ἡμίση φθείρεται, ἢ ὁ ἄνθρωπος εἰς τὰ ὀστᾶ καὶ νεῦρα καὶ σάρκας, διὰ τοῦτο καὶ εἰσὶν ἐκ τούτων οὕτως ὡς ὄντων τῆς οὐσίας μερῶν, ἀλλ᾽ ὡς ἐξ ὕλης, καὶ τοῦ μὲν συνόλου μέρη, τοῦ εἴδους δὲ καὶ οὗ ὁ λόγος οὐκέτι· διόπερ οὐδ᾽ ἐν τοῖς λόγοις.

And so the formula of the circle does not include that of the segments, but the formula of the syllable includes that of the letters; for the letters are parts of the formula of the form, and not matter, but the segments are parts, in the sense of matter, on which the form supervenes; yet they are nearer the form than the bronze is when roundness is produced in bronze. But in a sense not even every kind of letter will be present in the formula of the syllable, e.g. particular waxen letters or the letters as sounds in the air; for these also are part of the syllable only in the sense that they are its perceptible matter. For even if the line when divided passes away into its halves, or the man into bones and muscles and flesh, it does not follow that they are composed of these as parts of their substance, but rather as matter; and these are parts of the concrete thing, but not of the form, i.e. of that to which the formula refers; and therefore they will not be in the formulae either.

We cannot offer a detailed interpretation here, but the overall point seems reasonably clear. Although the line segments are parts of the line, they are so only as matter. In the definition of the line they are not mentioned. By contrast, if we define the syllable BA, the B and the A are mentioned in the definition. This provides, from a slightly different angle, the sense in which it

is true to say that the line-segments are an accidental characteristic of the line, but not part of its essence. The matter of the line is infinitely divisible, but a line is not defined as such.[60]

According to our interpretation of *Metaph.* 2.2, Aristotle deliberately uses the expression 'while moving' (κινουμένῳ) in order to refer his reader back to the *Physics*. If we were to follow Alexander's conjecture ἐν κινουμένῳ, referring to an object in motion rather than to someone moving, this reference to the *Physics* would be lost. In *Metaph.* 2.2 Aristotle does not explicitly state *how* moving along a line enables the mover to grasp something infinite. But, after having reviewed *Ph.* 8.8, the following explanation suggests itself: since counting the divisions implies making a stop and by stopping it is impossible both to think and to traverse the infinite, the motion must be continuous. This is explicitly stated in the *Physics* passage. What, then, is it specifically about a continuous motion that allows one to grasp the infinite? By moving continuously, i.e., without actually making a division, one traverses the line as it were in one go. Since a continuous line is 'divisible into divisibles that are always divisible' (*Ph.* 6.1, 231b16), we can be assured that the mover has in fact traversed infinitely many line-parts, since, if the mover had made a division, the resulting line-parts would be themselves divisible. Crucially, however, the mover has not counted these line parts, stopped at them or *thought* them. Rather, the content of the thought is the essence of the line. And, as we have seen, the line-segments are not part of the essence of the line. If the mover thinks the matter *by continuously moving*, she grasps what it is to be a certain extension, an extension which is in fact infinitely divisible. In this way, then, the image of someone moving continuously helps to describe the thoughts by which we are able to grasp something infinite. We think the infinite

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[60] Bowin 2007, 249 reaches the same conclusion, though on a different route. He relies in his argument on the fact that the infinite is a per se attribute, and per se attributes do not occur in the definition of their subjects.

not by surveying infinitely many items, but by thinking something which is such as to be infinitely divisible.

4 Conclusion

In this paper, we have proposed a new reading and interpretation of *Metaph.* 2.2, 994b21-7. In the first part, we surveyed the textual evidence, in particular the indirect evidence that can be found in Alexander's commentary. We argued that the text of line 26 as transmitted by the mediaeval manuscripts is corrupted, and that it should instead read τὴν ὕλην κινουμένῳ νοεῖν ἀνάγκη, as it did in Alexander's *Metaphysics* exemplar. In the second part of our paper, we showed that this reading is indeed what Aristotle himself wrote, because it is to be preferred from a philosophical perspective. In order to show this we first gave a philosophical reconstruction of the doctrine contained in *Metaph.* 2.2. We argued that the reconstructed text and our interpretation are not only consistent with, but in fact strongly supported by parallel passages in the *Physics*.[61] Thus, once the text is appropriately reconstructed, it contains an intriguing piece of philosophical thinking on the infinite, which deserves to be studied along the more commonly discussed texts on the nature of the infinite in the *Physics*.[62]

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[61] For the possible original connection of *Metaphysics* 2 and *Physics* that the final sentence of *Metaph.* 2.3 suggests, see n. 2 above.

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