

# Machine Learning and the Text of Aristotle

Mirjam Kotwick and Johannes Haubold

**Abstract** This article uses the Princeton-based AI Logion and its error detection algorithm to show that large language models can contribute to the textual criticism of Aristotle. We discuss seven case studies from the *Metaphysics*, *Poetics*, and *De motu animalium* to demonstrate that Logion can (i) correctly identify corruptions in the transmitted text of Aristotle and (ii) suggest plausible emendations. Even when Logion's suggestions are not viable, they can alert the human philologist to problems in the text and thus initiate a search for new solutions. We conclude that language models like Logion can contribute to the current revival in the study of Aristotle's texts, provided we use them responsibly and hold on to the fact that, while machines may make intriguing suggestions, *only* human philologists can ultimately adjudicate philological problems.

**Keywords** Machine Learning (AI); Textual criticism; Aristotle

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**Riassunto** Questo articolo utilizza *Logion*, una intelligenza artificiale sviluppata a Princeton, e il suo algoritmo di rilevamento degli errori per dimostrare come i modelli linguistici di grandi dimensioni possano contribuire alla critica testuale di Aristotele. Si analizzano sette casi di studio tratti dalla *Metafisica*, dalla *Poetica* e dal *De motu animalium*, per mostrare come *Logion* sia in grado sia di individuare correttamente le corruzioni nel testo aristotelico trasmesso sia di proporre emendamenti plausibili. Anche nei casi in cui le soluzioni suggerite da *Logion* non risultino praticabili, esse possono comunque segnalare al filologo la presenza di problematiche testuali, avviando un percorso di ricerca verso nuove soluzioni. Si conclude, dunque, che modelli linguistici come *Logion* possono offrire un contributo significativo al rinnovato interesse per lo studio del testo aristotelico, a condizione che vengano impiegati con consapevolezza e tenendo ben presente che, sebbene le macchine possano avanzare suggerimenti stimolanti, solo il filologo può, in ultima istanza, valutare e risolvere le questioni filologiche.

**Parole chiave** Machine learning (IA); Critica testuale; Aristotele

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# Machine Learning and the Text of Aristotle\*

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## *Introduction*

This article explores the contribution that large language models can make to the textual criticism of Aristotle. It takes one such model, the Princeton-based AI Logion, and uses its error detection algorithm to review known manuscript variants, reassess existing conjectures, and identify hitherto unknown corruptions in the text of Aristotle. Logion has so far been tested on the works of the Byzantine author Michael Psellos, where it was found to yield significant results.<sup>1</sup> The present article marks a departure from previous work in that it focuses on a classical author whose text has been subject to much more extensive study and poses challenges of a different kind.

Logion is a large language model developed at Princeton University to support the work of human philologists on premodern Greek texts.<sup>2</sup> It currently has three main applications. First, it may be used to fill lacunae which result from mechanical damage to medieval manuscripts. Secondly, it may prompt critics to revise manuscript readings and review known textual variants. And thirdly, Logion can help identify hitherto unknown textual corruptions and suggest possible emendations. Only the second and third of these applications are relevant to the present article. Both are based on Logion's capacity to identify words that are mathematically unlikely and replace them with more likely alternatives. In practice, it does this by applying the so-called 'chance-confidence ratio', an algorithm designed by Charlie Cowen-Breen and Creston Brooks specifically for this purpose.<sup>3</sup> Briefly put, the chance-confidence ratio takes the machine's

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<sup>1</sup> BATTEZZATO, GRAZIOSI, HAUBOLD 2025 (forthcoming).

<sup>2</sup> GRAZIOSI *et alii* 2023, <https://www.logionproject.princeton.edu/>.

<sup>3</sup> COWEN-BREEN *et alii* 2023.

confidence in its own suggestion and divides it by the chance of the transmitted text occurring in the context where it is found. A large chance-confidence ratio thus indicates not just that a word is unlikely but also that a more plausible replacement is available, forcing the machine to disregard words that are merely rare (names, *hapax legomena*, etc.) but in fact perfectly sound. The results of this procedure are then filtered further by enforcing a low Levenshtein distance between the extant text and the model's suggestion. Levenshtein distance refers to the number of changes that are required to transform one string of characters into another, such that the word λόγος, for example, is at Levenshtein distance 1 from the word λόχος, at Levenshtein distance 2 from the word λέχος, at Levenshtein distance 3 from the word τέκος, etc. In principle, Logion can be set to any Levenshtein distance, though in practice only reports filtered by Levenshtein distance 1 to 3 have been found to yield significant results. The results presented in this article are all filtered by Levenshtein distance 1.

Logion, it will have been noted, does something that is frowned upon by scholars of the medieval manuscript transmission when replacing statistically less likely with more likely readings. Those scholars have long pointed out that, when it comes to reconstructing a premodern Greek text from variant readings in the (mostly medieval) manuscripts, the mathematically *less* likely reading, also known as the *lectio difficilior*, often has a better chance of being correct.<sup>4</sup> Medieval scribes are not above making trivial errors, but often they go wrong when they encounter an unfamiliar word or expression which they then seek to normalize. We thus see a tension between the way that Logion functions and what we know about the scribes who preserved premodern Greek texts. This tension is less of an issue in non-classical authors like Psellos, where a sizeable crop of scribal corruptions that are fairly trivial in nature remains to be identified and corrected. The text of Aristotle poses challenges of a different kind. Here the main task is not to spot trivial manuscript errors but to support a new wave of philological and editorial work which stems from the realization that many editions of Aristotelian texts fail to consider all extant textual witnesses. Several important Aristotelian works have therefore either been re-edited in recent years or are currently in the process of being re-edited.<sup>5</sup> The question arises of whether a language model like Logion can be useful to the critics engaging in this work.

On the face of it, the signs do not look promising. Logion is fundamentally

<sup>4</sup> For this important principle see PASQUALI 1952<sup>2</sup>, p. 10, MAAS 1958, p. 13, WEST 1973, p. 51. BENTLEY 1977 discusses its history.

<sup>5</sup> E.g. *Poetics* (KASSEL 1965; re-edited GUTAS, TARÁN 2012), *Metaphysics* (ROSS 1924, JAEGER 1957), currently being re-edited by Oliver Primavesi and Marwan Rashed; *De motu* (NUSSBAUM 1978, re-edited by Oliver Primavesi in PRIMAVESI, CORCILUS 2018 and PRIMAVESI 2020), *PN*

unsubtle in how it goes about its task, as we have seen: the reading that is mathematically most likely will invariably win out. Moreover, Logion is incapable of philological argumentation, and since the character of the Aristotelian text is such that any remaining problems are highly intricate and can be tackled *only* on the basis of sophisticated philological reasoning and a good grasp of the philosophical implications, the chances of Logion making a positive contribution seem slim indeed. And yet, that is precisely what we wish to argue in this article. Unlikely as it may seem, our contention is that language models like Logion *can* contribute to the current revival in the study of the Aristotelian text – provided we use them responsibly and hold on to the fact that, while machines may make intriguing suggestions, *only* human philologists can ultimately adjudicate philological problems.<sup>6</sup>

Logion's suggestions for changes to the Aristotelian text can be grouped into three different categories:

- (i) a flag and correction that is confirmed (wholly or in part) by another line of the direct or indirect tradition
- (ii) a flag and correction that has already been suggested by a human scholar but lacks manuscript support
- (iii) a flag and correction that is new (i.e., not attested in any of the textual sources, and has never been proposed)

Cases in categories (i) and (ii) demonstrate that Logion's suggestions are worthy of serious philological and philosophical consideration and may offer useful corrections to Aristotle's text as transmitted to us. The more cases we have in categories (i) and (ii), the more confident we can be about cases in category (iii), where we lack external support for Logion's suggestions. In the end, those will be the most interesting for the philologist and the philosopher, but they can only carry conviction if they are backed up by cases in categories (i) and (ii). We therefore begin with those before moving on to category (iii).

(Ross 1955, currently being re-edited by Justin Winzenrieth), *GC* (RASHED 2020), *De anima* (Ross 1961, SIWEK 1965, currently being re-edited under the supervision of Klaus Corcilius).

<sup>6</sup> It should be clearly understood that many of Logion's suggestions are without philological merit. What we present here is a selection made by human philologists from hundreds of machine-generated 'flags' of varying quality; for further discussion see BATTEZZATO, GRAZIOSI, HAUBOLD 2025 (forthcoming).

1. *Logion's flag and correction is confirmed by a line of the tradition that was not included in Logion's training*

1.1. *Metaphysics M 2, 1076b27*

To start with a straightforward example, Logion finds typos in the edition on which it was fine-tuned. In the case of the *Metaphysics* this is Ross's 1924 (corr. 1953) Oxford edition. For instance, in M 2, 1076b27, Logion makes the following correction to the text printed by Ross:

<i>Metaphysics</i> M 2, 1076b24-8	Transl. Ross
<p>πάλιν [25] τοίνυν τούτων τῶν ἐπιπέδων ἔσονται γραμμαί, ὧν πρότερον [26] δεήσει ἑτέρας γραμμὰς καὶ στιγμὰς εἶναι διὰ τὸν αὐτὸν [27] λόγον· καὶ τούτων &lt;τῶν&gt; <b>ἐκ</b> ταῖς προτέραις γραμμαῖς ἑτέρας [28] προτέρας στιγμὰς, ὧν οὐκέτι πρότεραι ἕτεραι.</p>	<p>Again, therefore, there will be, belonging to these planes, lines, and prior to them there will have to be, by the same argument, other lines and points; and prior to these points <b>in</b> the prior lines there will have to be other points, though there will be no others prior to these.</p>
27 <τῶν> ci. Bonitz    ἐκ Ross : ἐν codd. Bekker Bonitz Christ Jaeger <b>Logion</b>	

The preposition ἐκ is clearly faulty, whereas ἐν is correct and what all our witnesses have. The correct reading is printed in Jaeger's 1957 edition as well as in BEKKER 1831, BONITZ 1848, and CHRIST 1886, and none of them indicates any variant reading in the apparatus. We are hence dealing with a simple typo in Ross's edition. Logion, having been trained on Ross, correctly flags the preposition ἐκ as an error and correctly suggests reading ἐν instead.

1.2. *De motu animalium 2, 698b25*

<i>De motu animalium</i> 2, 698b21-6 (ed. Jaeger)	Transl. Morison (modified to fit Jaeger's text)
<p>μαρτύριον δὲ τούτου τὸ ἀπορούμενον, διὰ τί ποτε [22] τὸ πλοῖον ἔξωθεν μέν, ἂν τις ὥθῃ τῷ κοντῷ τὸν ἰστὸν ἢ τι [23] ἄλλο προσβάλλον μόριον, κινεῖ ῥαδίως, ἐὰν δ' ἐν αὐτῷ τις [24] ὧν τῷ πλοίῳ τοῦτο πειράται πράττειν, οὐκ ἂν κινήσειεν <b>οὐδ'</b> [25] <b>ἂν</b> ὁ Τιτυὸς <b>οὐθ'</b> ὁ Βορέας πνέων ἔσωθεν ἐκ τοῦ πλοίου, εἰ τύ- [26]χοι πνέων τὸν τρόπον τοῦτον ὄνπερ οἱ γραφεῖς ποιοῦσιν·</p>	<p>Evidence for this is the difficulty of why it is that one can easily move the boat from outside – if someone were to push it with a pole, striking the mast or some other part of it – whereas if someone who is in the boat itself tries to do this, he would not move it, nor would Tityus or Boreas blowing from within the boat, if he happened to be trying to blow in the way that the painters make him.</p>
<p>23 ἐν αὐτῷ α Jaeger : ἐπ' αὐτῷ β Primavesi    24-5 οὐδ' ἂν ... οὐθ' Jaeger : οὐτ' ἂν ... οὐθ' α : οὐδ' ... οὐδ' β Primavesi : οὐδ' ἂν ... οὐδ' <b>Logion</b>    26 πνέων α Jaeger : πλέων β Primavesi</p>	

Logion is finetuned on Jaeger's text of *De motu animalium* (1913), which is printed above. The apparatus, on the other hand, is based on Primavesi's recent

edition (2020). Jaeger reads οὐδ' ἄν ὁ Τίτυος οὐθ' ὁ Βορέας (“nor would Tityus and not Boreas”), following not a manuscript but the Latin translation of Nicolaus Leonicus, a Renaissance scholar from Venice (1456-1531).<sup>7</sup> All manuscripts at Jaeger’s disposal read οὐτ' ἄν ... οὐθ' (“neither Tityus nor Boreas”). This reading represents what Primavesi 2020 calls the α-branch of the transmission. However, the β-branch, newly discovered by Primavesi, reads οὐδ' ... οὐδ' (“nor would Tityus and not even Boreas”), which is what Primavesi prints in his text. Logion flags the reading in Jaeger’s text as faulty and instead suggests οὐδ' ἄν ... οὐδ'. It thus agrees with the β-text on the semantically most consequential detail of the passage (οὐδ' instead of οὐθ'), though it does retain the particle ἄν, which is in the α-branch but not in the β-branch.<sup>8</sup>

Let us then evaluate these readings. That of α is indeed problematic since it makes Τίτυος the subject of the verb κινήσειεν – somewhat surprisingly, for that verb already has a subject, τις (“someone”), which is stated in the protasis (ἐὰν δ' ἐν αὐτῷ τις, b23). The train of thought is: if someone *on* the boat tries to move it, then *that someone* cannot do it. It seems impossible to accept that Aristotle wanted to say: if someone on the boat tries to move it, then Tityos (or someone else) cannot do it. Jaeger recognized the problem and suggested to read (in line with “tr.”, the Latin translation of Nicolaus Leonicus) οὐδ' ἄν instead of οὐτ' ἄν. With this reading, the text says “*and* not Tityos”. This removes the problem of the α-reading but also creates a new one. The sequence οὐδ' ... οὐθ' is not just uncommon but in fact impossible according to the standard rules of Greek grammar (see LSJ s.v. οὐδέ A.III: “οὐτε cannot follow οὐδέ”).<sup>9</sup> Logion suggests changing οὐτ' to οὐδ'. This creates a grammatically correct text:<sup>10</sup> οὐκ ἄν

<sup>7</sup> See JAEGER 1913, *conspectus siglorum*. PRIMAVESI 2020, p. 142 states, however, *coniecit Jaeger*.

<sup>8</sup> ἄν<sup>2</sup> in b25 has no function other than repeating ἄν<sup>1</sup> in b24. This may be legitimate, given that the verb remains the same; cf. LSJ s.v. ἄν D.III (“in apodosis ἄν may be used twice or even three times with the same verb, either to make the condition felt throughout a long sentence, or to emphasize certain words”) and CGCG 60.12. Alternatively, it may be argued that ἄν<sup>2</sup> belongs to a separate clause and should therefore not be allowed to stand; cf. BONITZ 1870, p. 41a59-60: *non rara sunt exempla iteratae in eodem membro particulae ἄν* (our emphasis) and cf. LSJ s.v. ἄν D.IV (“when an apodosis consists of several co-ordinate clauses, ἄν is generally used only in the first and understood in the others”). We are grateful to the anonymous referees for pointing this alternative out to us.

<sup>9</sup> Aristotle adheres to that rule, as a TLG search indicates. We could not identify a single instance where he uses οὐτε ... οὐδέ in place of οὐτε ... οὐτε.

<sup>10</sup> Cf. LSJ s.v. οὐδέ A.II.2 “but οὐδέ . . . οὐδέ never means neither . . . nor (like οὐτε . . . οὐτε); where this combination occurs, the first οὐδέ is used without reference to the second, e.g., καὶ μὴν οὐδ' ἡ ἐπιτείχισις οὐδὲ τὸ ναυτικὸν ἄξιον φοβηθῆναι and moreover we have no reason to fear their fortifications, nor yet their navy, Th.1.142.”

κινήσειεν οὐδ' ὁ Τιτυὸς οὐδ' ὁ Βορέας, “he would not move it, nor would Tityus and not even Boreas”. Logion’s text is in this regard identical with the β-reading that Primavesi prints. The only difference is the word ἄν, which is not read in the β-text but retained by Logion.

### 1.3. *Metaphysics* Γ 2, 1003b22

<i>Metaphysics</i> Γ 2, 1003b19-22	Transl. Ross, modified (acc. to Menn)
ἅπαντος δὲ γένους καὶ αἰσθησις μία ἐνὸς [20] καὶ ἐπιστήμη, οἷον ἡ γραμματικὴ μία οὕσα πάσας θεωρεῖ [21] τὰς φωνάς· διὸ καὶ τοῦ ὄντος ὅσα εἶδη θεωρῆσαι μᾶς [22] ἐστὶν ἐπιστήμης τῷ γένει, τὰ <b>τε</b> εἶδη τῶν εἰδῶν.	Now for each single genus, as there is a single sense perception, so there is one science. Thus for instance grammar, being one, considers all articulate sounds. Therefore, to consider however many species of being [there are] is the work of a science which is generically one, <b>and</b> to investigate the species is the work of the species [of the science].
20 ἡ γραμματικὴ β Al. <sup>p</sup> 245.10 Bekker Bonitz Christ Jaeger : γραμματικὴ α Ross    21 ὅσα α Al. <sup>l</sup> 245.20 Bekker Bonitz : ἧ ὄν ὅσα β Al. <sup>p</sup> 245.24-25 Christ Ross Jaeger : τὰ Al. <sup>c</sup> 251.5    22 τε] δὲ Al. <sup>l</sup> 245.21 Al. <sup>c</sup> 245.25 Al. <sup>c</sup> 251.5 Bonitz <b>Logion</b>	

As noted above, Logion is finetuned on Ross’s text of the *Metaphysics*. In line with the entire manuscript tradition and all editors except BONITZ 1848, Ross reads τὰ **τε** εἶδη τῶν εἰδῶν in 1003b22. Logion suggests reading τὰ **δὲ** εἶδη τῶν εἰδῶν instead. This is identical to the reading that Alexander attests for the *Metaphysics* exemplar he used in the late second or early third century CE.<sup>11</sup> Alexander quotes the text on two different occasions in his commentary (Al.<sup>c</sup> 245.25 and Al.<sup>c</sup> 251.5 Hayduck) and once in a lemma (Al.<sup>l</sup> 245.21 Hayduck), which together amounts to very strong evidence that he indeed read this text.<sup>12</sup> Bonitz, who not only edited Aristotle’s *Metaphysics* (1848-1849) but also Alexander’s commentary (1847), was familiar with this divergent reading and followed Alexander’s testimony against our manuscripts in his own *Metaphysics* edition. Bonitz’ reliance on Alexander is corroborated by numerous other instances where Alexander’s text is correct, while that of our manuscripts is faulty.<sup>13</sup> Is it also correct in the present case?

The line in question has been understood in two different ways. Ross 1924 and MENN in draft understand the phrase τὰ τε εἶδη τῶν εἰδῶν to mean “and

<sup>11</sup> On Alexander’s *Metaphysics* exemplar and its relation to the text of our manuscript tradition see KOTWICK 2016.

<sup>12</sup> On the reliability of the evidence in Alexander’s commentary see KOTWICK 2016, pp. 33-98.

<sup>13</sup> See KOTWICK 2016 and 2021.



to consider the species belongs to the species [of the science]” (transl. Menn).<sup>14</sup> According to this understanding, there is an implied contrast between the generically unified investigation of what kinds of being there are on the one hand, and the sciences that study different kinds of substances on the other.<sup>15</sup> This understanding does not only follow most naturally from the preceding analogy with grammar as the study of all articulate sounds, but also fits with Aristotle’s discussion of philosophy and its parts in the wider context of the passage (on which see MENN in draft, pp. 29-33).<sup>16</sup> By contrast, KIRWAN 1993 (in his translation) and HECQUET-DEVIIENNE 2008 understand the phrase τὰ τε εἶδη τῶν εἰδῶν to mean “and the species of those species”.<sup>17</sup> According to this understanding, Aristotle would say that the generically single science of being considers how many species of being there are and also the species of those species. This understanding is less convincing in context, and seems to be at odds with Aristotle’s emphasis on the *generic* (τῷ γένει) unity of that science.<sup>18</sup>

Returning then to the alternative readings τε and δέ, we can say that even though the semantic difference between them seems small, printing τὰ δέ εἶδη τῶν εἰδῶν with Alexander, Bonitz, and Logion has clear advantages. The particle δέ, “but”, better expresses the distinction between a generically single science and the parts of that science, each of which treat a different species of the generically unified subject matter that defines the science. A mere τε, “and”, seems too weak to capture the contrast between the two different levels of genus and species. Moreover, Aristotle rarely uses τε simply to add on a word or phrase.<sup>19</sup> And even though on our understanding the words τὰ εἶδη τῶν εἰδῶν represent a whole (if elliptically expressed) clause, the types of Aristotelian uses of τε that Bonitz’s index lists are quite different from the present case, in that τε introduces a *series of arguments* (often also ἔτι τε), or is part of an (often extended) τε ... καὶ construction. Overall, then, the reading espoused by

<sup>14</sup> Cf. Ross: “and to investigate the several species is the work of the specific parts of the science.”

<sup>15</sup> See MENN in draft, pp. 31-2. We would like to thank Stephen Menn for sharing with us his draft chapter.

<sup>16</sup> Cf. Ross 1924 ad loc., p. 257. This reading fits especially well if we assume with MENN (cf. also Jaeger) that lines 1004a2-9 follow immediately upon our section (1003b19-22). See also MENN in draft for a discussion of the analogy with grammar and the question of what the generically single science is (philosophy).

<sup>17</sup> Kirwan translates εἶδη as “forms” (also HECQUET-DEVIIENNE 2008, p. 111: “formes”).

<sup>18</sup> KIRWAN 1993, p. 82 adopts this interpretation in his translation but concedes in his commentary that “a different translation [...] is possible.” His alternative chimes with the translation of Ross and Menn, which we adopt here.

<sup>19</sup> See BONITZ 1870, pp. 749b19-750a17: *raro usurpatur ad coniungenda singula vocabula*.

Alexander, Bonitz, and Logion seems preferable also from a grammatical point of view.

The case of τὰ τε εἶδη τῶν εἰδῶν vs τὰ δὲ εἶδη τῶν εἰδῶν suggests that Logion does not just favor whatever token combination appears most frequently in the corpus. There are eight instances of the token sequence τὰ τε εἶδη in the genuine writings of Aristotle, and only two instances of the token sequence τὰ δὲ εἶδη (*Cat.* 2b21, and *Ph.* 224b11). Nonetheless, Logion favors the latter – correctly, as we submit.

#### 1.4. *Poetics* 25, 1461a16

<i>Poetics</i> 25, 1461a16-21	
<p>τὸ δὲ κατὰ μεταφορὰν εἴρηται, οἷον ‘πάντες μὲν [17] ῥα θεοὶ τε καὶ ἄνδρες εὖδον παννύχιοι· ἅμα δὲ φησιν [18] “ἢ τοι ὄτ’ ἐς πεδῖον τὸ Τρωικὸν ἀθρήσειεν, αὐλῶν συρίγγων [19] τε ὄμαδον”. τὸ γὰρ πάντες ἀντὶ τοῦ πολλοὶ κατὰ μετα-[20]φορὰν εἴρηται, τὸ γὰρ πᾶν πολὺ τι. καὶ τὸ “οἷη δ’ ἄμμο-[21]ρος” κατὰ μεταφορὰν, τὸ γὰρ γνῶριμώτατον μόνον.</p>	<p>Some (expression) is used metaphorically, as for instance “all gods and men slept all night long”. But at the same time he says “when he looked over the Trojan plain, [he marveled at] the din of flutes and pipes”. For “all” is said metaphorically for “many” since “all” is a kind of “much”. Also “it [sc. the constellation Ursa Major] alone has no share [in Ocean’s bath]” is said metaphorically, for what is known best is “alone”.</p>
16 τὸ δὲ] τὰ δὲ Σ, ci. Spengel <b>Logion</b>	

In chapter 25 of the *Poetics*, Aristotle gives a summary version of his own (only fragmentarily preserved) *Homeric Problems*. In this treatise Aristotle discussed questions and problems raised by passages in Homer as well as possible solutions to them.<sup>20</sup> Accordingly, in *Po.* 25 Aristotle gives a short overview of the kinds of problems and solutions discussed by Homeric critics.<sup>21</sup> He discusses six solutions to problems that concern the art itself (πρὸς αὐτὴν τὴν τέχνην), and six that concern diction (πρὸς τὴν λέξιν). The passage above gives the second type of solution to problems of diction, which consists of detecting metaphorical language. This section is introduced as τὸ δὲ κατὰ μεταφορὰν εἴρηται... in all our manuscripts. The Syriac translation of the *Poetics* is most likely based on a Greek text that read τὰ δὲ κατὰ ... instead.<sup>22</sup> The editor Leonhard von Spengel (1803-1880) emended the text to the same effect, without knowledge of the Syriac

<sup>20</sup> See MAYHEW 2019.

<sup>21</sup> MAYHEW 2019, pp. 9-23.

<sup>22</sup> For the Syriac see GUTAS, TARÁN 2012.

reading.<sup>23</sup> Logion, without knowledge of either the Syriac version or Spengel's emendation, again suggests correcting to τὰ δέ.

The structure of Aristotle's discussion speaks in favor of the reading attested in the Syriac translation and suggested independently by Spengel and Logion, respectively. The section on solutions to problems of diction begins with τὰ δέ πρὸς τὴν λέξιν ὁρῶντα (1461a9-10); the second solution is the passage under discussion (16); the third begins κατὰ δέ προσῳδίαν..., and covers prosody (21-3); the fourth begins with τὰ δέ διαιρέσει ... (23-4); the fifth begins with the words τὰ δέ ἀμφιβολία ... (25), and finally the sixth with τὰ δέ κατὰ τὸ ἔθος τῆς λέξεως (27). New types of solutions are in all cases introduced with plural τὰ δέ except in our passage (and the third instance, where the formulation is entirely different). The Syriac reading and Spengel/Logion restore consistency across the list. This seems well justified, as Aristotle uses the introductory formula τὰ δέ regardless of whether he presents one or more examples from poetry to illustrate the case. Three of the four solutions that are introduced with τὰ δέ feature more than one example (including the passage under discussion), though there is one where Aristotle adduces only one verse (τὰ δέ διαιρέσει, οἷον ... , 23-4). Still, even here he introduces the type of solution represented by that one example with the words τὰ δέ.

## 2. Logion's flag and correction has also been suggested by a human scholar but lacks manuscript support

In this section, we discuss cases in which Logion suggests a correction that is identical with a correction that a human scholar has previously proposed and that is not attested in any of our witnesses.

### 2.1 *Metaphysics* Γ 4, 1006b3

<i>Metaphysics</i> Γ 4, 1006a34-b4	Transl. Ross, modified
διαφέρει δ' οὐθὲν οὐδ' εἰ πλείω τις φαίη σημαίνειν [1006b1] μόνον δὲ ὠρισμένα, τεθεῖη γὰρ ἂν ἐφ' ἐκάστω λόγῳ ἕτερον ὄνομα λέγω δ' οἷον, εἰ μὴ φαίη τὸ ἄνθρωπος ἓν [3] σημαίνειν, πολλὰ δέ, ὧν ἐνὸς μὲν εἰς λόγος τὸ ζῶον δι-[4]που, εἶεν δὲ καὶ ἕτεροι πλείους, ὠρισμένοι δὲ τὸν ἀριθμὸν.	And it makes no difference even if one were to say a word has several meanings, if only they are limited in number; for to each formula there might be assigned a different word. For instance, we might say that 'man' has not one meaning but several, one of which would have the single definition of 'two-footed animal', while there might also be several other formulae, provided they are limited in number;
3 ἐνὸς μὲν εἰς α Bekker Bonitz Ross : εἰς μὲν εἴη β : ἐνὸς μὲν εἴη ci. Christ Jaeger <b>Logion</b>    4 εἶεν β Christ Ross Jaeger : εἰσι α Bekker Bonitz	

<sup>23</sup> The apparatus criticus in Kassel lists the conjecture by Spengel without any reference to the Syriac translation.

In *Metaphysics* Γ 4, Aristotle defends the principle of non-contradiction, according to which nothing can be F and not-F at the same time in the same respect, against those who deny it. In the lines preceding our passage, Aristotle starts out by saying that the words ‘be’ and ‘not be’ have a definite meaning such that it is impossible that everything is so and not so at the same time (1006a29-30). He then states: If ‘man’ has one definite meaning, e.g., two-footed animal, then what it is to be a man is to be a two-footed animal. And, he adds, it is not necessary that there is only one meaning of a word, as long as the number of meanings is limited. This is then spelled out for the case of ‘man’ in our passage quoted above.

At issue is the phrase (ll. 2-4), “‘man’ has not one meaning but several, one of which would be defined as ‘two-footed animal’...”, which is somewhat unsatisfactory in both versions of the direct transmission. The α-text has ὧν ἐνὸς μὲν εἷς λόγος τὸ ζῶον δίπουν “one of which would have the single definition of two-footed animal”.<sup>24</sup> Bekker, Bonitz, and Ross accept this text. But why would Aristotle stress that τὸ ζῶον δίπουν is a *single* definition (εἷς λόγος)? The point is that *one* of the limited number of meanings is “two-footed animal” and that is already expressed by ἐνός. Moreover, the α-reading lacks a verb.<sup>25</sup> Ross translates, smoothing out the problems and simplifying the Greek (by ignoring the force of εἷς and adding a verb form that is not there), “one of which would be defined as ‘two-footed animal’”. The β-reading is ὧν εἷς μὲν εἶη λόγος τὸ ζῶον δίπουν “of which would be the single definition two-footed animal.” The β-reading is clearly unsatisfactory, as it contradicts what Aristotle is trying to say. According to the β-reading, there would be one definition of the multitude of meanings that Aristotle allows, which does not make sense. No editor has accepted that text.

Faced with this situation, CHRIST 1886 conjectured ὧν ἐνὸς μὲν εἶη λόγος τὸ ζῶον δίπουν, “one of which would be defined as two-footed animal”. This conjecture takes the α-reading but changes εἷς, “one”, into the optative verb form of ‘to be’, εἶη, which is attested in the β-reading. The conjecture takes, in a sense, what is best in each of the two transmitted readings. The resulting reading restores the sense that is expected (and expressed in Ross’s *translation* of the α-reading), namely that the definition of one of the different senses of man is “two-footed animal”. Christ’s conjecture does not only yield a more satisfying text but is justified also in that it restores what is plausibly the original reading from which both differently corrupted readings of our tradition derive. According to this reasoning, in the α-text, the reading ἐνὸς μὲν εἷς can be explained as the result

<sup>24</sup> Or: “one of which would have ‘two-footed animal’ as its single definition”.

<sup>25</sup> The unstated verb could be ἐστί, “is”, but not εἶη, as Ross’s translation “would be” seems to suppose.

of a simple scribal error from the original ἐνὸς μὲν εἴη. Changing the verb form εἴη into the number εἷς, “one”, is an easy mistake to make, given the prevalence of the notion of “one” in the immediate context. A further factor that may have contributed to the error is that the optative stands here without ἄν. That ἄν is missing is not a reason to doubt the restored reading, as the subsequent optative verb (εἴεν, 1006ab4) also lacks ἄν,<sup>26</sup> and there are other instances in Aristotle of optative without ἄν.<sup>27</sup> The β-reading, εἷς μὲν εἴη, even though untenable in itself, retained the presumably original verb form εἴη, but corrupted the genitive form ἐνός, “of one”, into “one” in the nominative. Again, an intuitive corruption in the context of the passage.

Logion’s suggestion is identical with the text as emended by Christ and accepted by Jaeger. By contrast to Christ’s reasoning, Logion’s suggestion is derived solely from a correction of the α-reading that is printed in Ross’s text. In other words, Logion has no knowledge of the β-text, which attests the verb form εἴη that it proposes.

## 2.2. *Metaphysics* Γ 5, 1009b22

This passage comes from *Metaphysics* Γ 5, a chapter in which Aristotle continues to defend the principle of non-contradiction (PNC). In the context of our passage, Aristotle identifies as one of the problematic assumptions held by those who question the PNC the view that thought and sense-perception are the same, and that sense-perception is a physical alteration, a position which leads to the view that whatever appears to anyone is necessarily true (1009b12-15). Aristotle then cites several thinkers, including Empedocles, Anaxagoras, and Homer, who are taken to have expressed, in one form or another, a sensualist view. In this context, Aristotle also quotes four lines from Parmenides (B16 DK, D51 LM). These lines come from the part of Parmenides’ poem typically referred to as *Doxa*, in which Parmenides develops a cosmology of the physical world. Note that Theophrastus in *De Sensibus* 3 quotes the same lines.

<sup>26</sup> That is probably the reason why α reads εἰσι instead.

<sup>27</sup> See BONITZ 1970, 41b6-12: *aliquoties ἄν deest apud optativum potentialem*. E.g., *Politics* III 13, 1283b15; *EE* III 1, 1229b34, 38.

<i>Metaphysics</i> Γ 5, 1009b21-5	Transl. Kotwick and Haubold
καὶ Παρμενίδης δὲ ἀποφαίνει-[22]ται τὸν αὐτὸν τρόπον. ὥς γὰρ ἐκάστοτ' ἔχει <b>κρᾶσιν</b> με-[23]λέων πολυκάμπτων, τὼς νόος ἀνθρώποισι παρίσταται· τὸ [24] γὰρ αὐτὸ ἔστιν ὅπερ φρονέει μελέων φύσις ἀνθρώποισιν [25] καὶ πᾶσιν καὶ παντί· τὸ γὰρ πλέον ἐστὶ νόημα·	And Parmenides states in the same way: For, as each time, it [?] has a mixture of much- bent limbs, so thought is disposed in humans. For what the constitution of limbs thinks, is the same for all humans and each human. For, the more is thought. <sup>29</sup>
22 ἐκάστοτ' α Ross Jaeger, Theophrastus : ἐκάστῳ β : ἕκαστος Al. <sup>c</sup> 306.29; 35 Bekker Bonitz Christ    κρᾶσιν et Theophrastus] κρᾶσις ci. Stephanus <b>Logion</b>	

There has been much scholarly discussion of these difficult Parmenidean lines, regarding their meaning and their coherence with the other fragments of Parmenides.<sup>28</sup> We focus here strictly on the textual problem, to which Logion suggests the exact same solution that Stephanus had suggested in the 16<sup>th</sup> century. In our text of Aristotle, the first line of B16 reads ὥς γὰρ ἐκάστοτ' ἔχει **κρᾶσιν** μελέων πολυκάμπτων, “For, as each time, it [?] has a mixture of much-bent limbs”. The line raises two questions.<sup>29</sup> The first is whether α's ἐκάστοτ', “each time”, β's ἐκάστῳ, “for each”, or Alexander's ἕκαστος,<sup>30</sup> “each one”, should be read. The reading ἐκάστοτ' is attested in α and agrees with Theophrastus' quotation of the line. Moreover, it seems preferable in that it is easier to explain ἐκάστοτ' changing into ἐκάστῳ or ἕκαστος than the other way round.<sup>31</sup> In addition, ἐκάστοτ' makes better sense than ἐκάστῳ or ἕκαστος. ἐκάστῳ is syntactically strange, whether it be taken with κρᾶσιν or with κρᾶσις, while ἕκαστος (“each one”, singular) makes the comparison τὼς ... ἀνθρώποισι, “so it is [...] in humans” (plural) seem somewhat jarring.<sup>32</sup> Hence, most recent editors (both of Aristotle and of Parmenides) read ἐκάστοτ'.<sup>33</sup>

<sup>28</sup> See the extensive treatment in BREDLOW 2011, with most of the preceding literature.

<sup>29</sup> For a full apparatus criticus of the Parmenidean fragment see CORDERO 1984, p. 33, COXON 1986, p. 91, O'BRIEN and FRERE 1987, and BREDLOW 2011, each with discussion.

<sup>30</sup> Alexander's reading ἕκαστος could be an attempt to address the syntactical problem that the accusative κρᾶσιν creates. The α-ms. E of the Aristotelian text corrects by second hand to ἕκαστος.

<sup>31</sup> TARÁN 1965, p. 169.

<sup>32</sup> Cf. TARÁN 1965, p. 169.

<sup>33</sup> It should be noted that this is the earliest attestation of ἐκάστοτε in Greek literature. LSJ lists as next instances the mid- to late fifth-century authors Herodotus (1.90), Antiphon (6.13), and Aristophanes (*Nu.* 1280).

A second, related problem concerns the form κῤῥᾱσιν “mixture” (accusative), which both Aristotle and Theophrastus read without alternative. The problem with κῤῥᾱσιν is that it is not clear what the subject of ἔχει is. The potential candidate ἕκαστος, “each one”, creates other problems, as we have seen. Moreover, Diels’s suggestion (1897), accepted by COXON 1986, to take νόος in the second line (the so-part of the comparison) as subject also of the first line (the as-part of the comparison) cannot convince: If νόος is the subject in both parts of the comparison, then the so-part adds little that has explanatory value. In light of these difficulties, already Stephanus in 1573 suggested to emend κῤῥᾱσιν to the nominative κῤῥᾱσις. And so does Logion. It flags κῤῥᾱσιν as faulty and suggests reading κῤῥᾱσις instead. Several editors of Parmenides (TARÁN 1965; MOURELATOS 1970; KIRK, RAVEN, SCHOFIELD 1957; SIDER, JOHNSTONE 1986, O’BRIEN, FRERE 1987) as well as scholars discussing the passage (BREDLOW 2011) have accepted that conjecture.<sup>34</sup> With the correction, the sense is improved and ἕκαστοτ’ can be retained, as κῤῥᾱσις now appears as a very natural subject of ἔχει: ὥς γὰρ ἕκαστοτ’ ἔχει κῤῥᾱσις μελέων πολυκάμπτων, “For as each time is the mixture of much-bent limbs”. The erroneous accusative κῤῥᾱσιν may have been suggested by preceding ἔχει, which could naturally be followed by a direct object in the accusative.

3. *A correction by Logion that has not been made by previous human scholars nor finds support in the transmission*

In the following passage Logion flags our text as erroneous and suggests a different reading. The passage is unanimously transmitted in our manuscripts and has, as far as we know, never been considered corrupt by a human scholar. Logion, we argue, correctly detects a problem, though its suggested solution requires revision by a human philologist.

<sup>34</sup> DIELS, KRANZ 1951 as well as LAKS, MOST 2016 retain κῤῥᾱσιν, the former with ἕκαστος, the latter with an unspecified “it” as the subject.



*Metaphysics B4, 1000a15*

<i>Metaphysics B 4, 1000a9-18</i>	Transl. Ross, modified
οἱ μὲν οὖν περὶ Ἡσίοδον καὶ πάντες ὅσοι θεολόγοι [10] μόνον ἐφρόντισαν τοῦ πιθανοῦ τοῦ πρὸς αὐτούς, ἡμῶν δ' ὠλι- [11]γώρησαν (θεοὺς γὰρ ποιοῦντες τὰς ἀρχὰς καὶ ἐκ θεῶν γε-[12]γονέναι, τὰ μὴ γευσάμενα τοῦ νέκταρος καὶ τῆς ἀμβρο- [13]σίας θνητὰ γενέσθαι φασίν, δῆλον ὡς ταῦτα τὰ ὀνόματα [14] γνῶριμα λέγοντες αὐτοῖς· καίτοι περὶ αὐτῆς τῆς προσφο- [15]ρᾶς τῶν αἰτίων τούτων ὑπὲρ ἡμᾶς εἰρήκασιν· εἰ μὲν γὰρ [16] χάριν ἡδονῆς αὐτῶν θιγγάνουσιν, οὐθὲν αἷτια τοῦ εἶναι τὸ [17] νέκταρ καὶ ἡ ἀμβροσία, εἰ δὲ τοῦ εἶναι, πῶς ἂν εἶεν αἰ-[18]διοι δεόμενοι τροφῆς)·	The school of Hesiod and all the mythologists thought only of what was plausible to themselves and had no regard for us. For asserting the first principles to be gods and born of gods, they say that the beings which did not taste nectar and ambrosia became mortal; and clearly, they are using words which are familiar to themselves, yet what they say about the consumption itself of these <b>causes</b> goes beyond our comprehension. For if the gods taste them [i.e., nectar and ambrosia] for their pleasure, they are in no wise causes of their existence; and if they taste them to maintain their existence, how can gods who need food be eternal?
αἰτίων] σιτίων <b>Logion</b> : del. τῶν αἰτίων Kotwick and Haubold	

This passage comes from the tenth aporia in *Metaphysics B*. The question that Aristotle raises is this: Are the principles (ἀρχαί) of perishable and imperishable things the same or different? In the first part of his discussion, he focusses on the claim that the principles are the same, and asks “how are some things imperishable and others perishable, and for what reason (διὰ τίν’ αἰτίαν)?” (1000a5-b21). Our passage follows immediately upon the formulation of that sub-question. Aristotle brings in Hesiod and the mythologists as an example of how not to talk and think about first principles. According to Aristotle, they make the gods first principles (τὰς ἀρχὰς) of everything, and then offer a very strange reason for why some of their descendants became mortal and others immortal: Those beings that have not tasted nectar and ambrosia become mortal, whereas – we as reader can conclude – those who do eat nectar and ambrosia become immortal.

The relevant sentence is in lines 14-15: καίτοι περὶ αὐτῆς τῆς προσφορᾶς τῶν αἰτίων τούτων ὑπὲρ ἡμᾶς εἰρήκασιν, which can be translated as “yet what they say about the eating itself of these causes goes beyond our comprehension”. This is how recent commentators have tended to take the sentence, in contrast with previous translators such as Ross, for instance, who rendered the noun προσφορά in a more abstract way as “the very application of these causes”, avoiding the idea of gods “consuming” or “eating up” causes.<sup>35</sup> WILDBERG

<sup>35</sup> See also BONITZ, SEIDL 1989, p. 107: “was sie von der Anwendung selbst dieser Ursachen gesagt haben...”.



2009, p. 160, translates “the eating’ of these causes”, commenting on the strangeness of this notion:

προσφορά (‘ingestion’) is translated as ‘application’ (by Ross [...]) or ‘contribution’ (by Madigan [...]). These choices of translating the word in this context are too abstract; προσφέρεισθαι means ‘to take in food or drink’ (see LSJ s.v. προσφέρω C), and the sense of the noun is still concrete. Aristotle is clearly poking fun at Hesiod’s gods ‘eating’ the principles of their own eternal being.” (WILDBERG 2009, p. 160 n. 10).

It is correct that the most plausible way of understanding προσφορά here is as literal “consumption”, or “taking-in” of food. This is strongly supported by the fact that in all other instances in which Aristotle uses the noun προσφορά, it has this concrete, literal meaning. There are three in total in his genuine works, all found in the biological writings: First, *De somno et vigilia* 458a22, where Aristotle discusses the role of food in causing sleep, μετὰ τὴν τῆς τροφῆς προσφοράν, “after the ingestion of food”; second, *De spiritu* 481a7, in a phrase very similar to the first, κατὰ τὴν τῆς τροφῆς προσφοράν, “following upon the ingestion of food”; and finally, *PA* 671a12-14: δι’ ὀλιγότητά τε τῆς τοῦ ὑγροῦ προσφοράς, “because of the small amount of liquid that they imbibe”. In short, each time Aristotle uses the word προσφορά it refers to the consumption of actual nourishment.

In our passage, Aristotle seems to use the word in the same sense, yet what is consumed by the ingesting beings, in this case the gods, is different. It is “these causes” (τῶν αἰτίων τούτων) rather than food. Is this to be read as some form of joke on Aristotle’s part? Does he want to draw attention to the absurdity of the mythologists’ view that the gods are immortal because they consume nectar and ambrosia? That is indeed how scholars commenting on the passage have taken it. But there are problems with this reading.

Before we discuss what the problems are, let us look at what Logion flags in the passage: Logion flags αἰτίων, “causes”, and suggests that we read σιτίων, “foods”, instead. Lines 14-15 would then read: καίτοι περὶ αὐτῆς τῆς προσφοράς τῶν **σιτίων** τούτων ὑπὲρ ἡμᾶς εἰρήκασιν, “yet what they say about the consumption itself of these **foods** goes beyond our comprehension”. At first, this may seem to be a straightforward normalization that Logion suggests because of the context in which words associated with food consumption are frequent (γενεσάμενα τοῦ νέκταρος καὶ τῆς ἀμβροσίας, 12-13; τῆς προσφοράς, 14-15; τροφῆς 18). Against this initial explanation, we will argue that Logion’s flagging of the text as problematic is worthy of serious consideration, and that even though its suggestion (σιτίων) may not be right, we can, with the help of Alexander of Aphrodisias’ commentary, develop a better solution, which is to delete τῶν αἰτίων as a later intrusion. The argument proceeds in two steps. First, we will show that the transmitted reading is problematic in subtle ways and that it cannot

be defended as a *lectio difficilior*. We then turn to Alexander of Aphrodisias' second-century CE commentary, which gives us indirect access to a much older version of the *Metaphysics* than that preserved by our manuscripts. Alexander's commentary confirms that the text of the extant manuscripts is indeed faulty where Logion flags it and that τῶν αἰτίων was most likely not in the original text.

In our discussion of why the transmitted text is problematic we look first at the immediate context of the words τῶν αἰτίων τούτων and then at the passage as a whole. We begin with the pronoun αὐτῶν, "these" (1000a16), that appears in the subsequent γάρ-clause and justifies the claim that gods eating these causes goes beyond our comprehension. If we assume that the reading in our manuscripts represents what Aristotle wrote, then the word αὐτῶν, "these", refers back to "these causes". This understanding of αὐτῶν runs into two difficulties.

The first concerns the precise meaning of αὐτῶν when taken to pick up αἰτίων. If indeed αὐτῶν refers to "causes", as it must when we read αἰτίων, Aristotle's supposed joke is extended into the γάρ-clause. We then read: "For if the gods taste these (i.e., causes) for their pleasure", which makes it difficult to take the sentence seriously as an explanation (NB γάρ). Particularly irritating is the fact that, as used here, the verb θιγγάνουσιν, "they handle", "they taste", suggests a literal touching and handling of food and not of "causes". Even if θιγγάνω can be used metaphorically (e.g., to touch on sth. in discourse),<sup>36</sup> Aristotle here does not use it in this way, as his reference to "pleasure" makes clear. The thought is: If X is eaten/handled just *for pleasure*, then X is not a *necessary* nutriment. This conclusion is only valid if we understand "handle" (θιγγάνω) literally. If then θιγγάνουσιν is meant to describe the gods' "handling" or "tasting" of food, then the thing they handle is something concrete to eat, and so αὐτῶν must mean "food" (and not "causes"). Clearly, the joke (if there ever was one) is over at this point; otherwise, Aristotle would be undermining his own explanation. In short, the reader expects αὐτῶν to refer to something like "food" and Aristotle to say, "For if the gods taste *nectar and ambrosia* for their pleasure". In fact, this is just what modern translators take him to say. For instance, Ross writes: "For if the gods taste these (i.e., nectar and ambrosia) for their pleasure", and Wildberg (2009: 160): "For if <the gods> consume *nectar and ambrosia* for the sake of pleasure" (our italics). If we agree that αὐτῶν refers to nectar and ambrosia and therefore to "food" that can be eaten, we must ask why Aristotle did not just say that. The most plausible answer is that he felt comfortable using the pronoun αὐτῶν because he said τούτων (*without* τῶν αἰτίων) in line 15, referring back to νέκταρ and ἀμβροσία in 12-13.

Another oddity becomes apparent when we look more closely at the second

<sup>36</sup> Arist. *Metaph.* A 7, 988a23, *Pol.* 1323b38, etc.

half of the γάρ-clause. If one were to reject our previous argument, one could say: αὐτῶν refers back to αἰτίων and means “causes” in the sense of “*pseudo-causes*”. However, if we grant this special sense of “causes” for αἰτίων and hence also for αὐτῶν, it would be strange that Aristotle in the apodosis of the γάρ-clause uses the word αἴτια in its literal, indeed technical Aristotelian sense without marking it in any way as distinct from the previous use. He would then say: “For if the gods touch these pseudo-causes (αὐτῶν, referring back to αἰτίων, understood as “causes in quotation marks”) for their pleasure, nectar and ambrosia are in no wise causes (αἴτια, in the technical Aristotelian sense) of their existence”. While this does not seem impossible in principle, we would expect some indication that Aristotle switches from a figurative to a technical use of “cause” within the same sentence, especially since we are in an if-then-clause that carries the weight of an argument.<sup>37</sup>

Zooming out of the details of these formulations in their immediate context, we can look at the passage as a whole. Aristotle considers Hesiod a proponent of the idea that perishable and imperishable substances have the same principles (ἀρχαί). If they have the same principles, he asks, what is the reason (διὰ τίν’ αἰτίαν) that some are immortal and others mortal? Hesiod and the theologians offer an explanation that is ill-conceived from Aristotle’s point of view. The theologians say *that beings who do not eat nectar and ambrosia become mortal* (τὰ μὴ γευσάμενα ... θνητὰ γενέσθαι φασίν, 12-13). This seems to imply that beings become *immortal* when they eat nectar and ambrosia. Note, however, that Aristotle’s formulation is deliberately cautious here leaving open the question of whether there is a causal connection between eating and immortality or only a correlation. In other words, it is unclear at this point whether Aristotle would allow the theologians’ statement to count at all as a causal explanation and nectar and ambrosia to be causes of some kind.<sup>38</sup> Aristotle continues by saying that in pointing to the gods’ *very eating* as an explanation for their immortality, the theologians use unclear words. Aristotle then demonstrates why considering “the consumption itself” (περὶ αὐτῆς τῆς προσφορᾶς) of these, i.e. nectar and ambrosia, the reason for their immortality does not make any sense (lit. is beyond

<sup>37</sup> The argument could be spelled out as follows: 1<sup>st</sup> premise: They eat N and A for pleasure; [2<sup>nd</sup> premise, unstated: What you eat for pleasure cannot be a cause of your being;] Conclusion: N and A are not causes. If we read τῶν αἰτίων, this becomes: 1: they eat their “causes” for pleasure; 2: what you eat for pleasure cannot be a cause; c: these “causes” are not causes.

<sup>38</sup> Aristotle never explicitly introduces nectar and ambrosia as “causes”. There is nothing that could function as a reference-point for the seemingly retrospective “*these causes*” (τῶν αἰτίων τούτων) in line 15 of our text.

us).<sup>39</sup> He gives two reasons, both of which focus on an aspect of the consumption and neither of which requires that what they consume is causes. First, if the gods eat them for pleasure, nectar and ambrosia cannot be causes of their continued existence (αἷτια τοῦ εἶναι); second, if they eat them because they need them to survive (τοῦ εἶναι), they themselves can't be immortal. In both cases it is the way they consume them (with pleasure or out of necessity) that rules out the view of Hesiod and the theologians. Since the two options are exhaustive, if neither applies, the theologians' approach does not make sense.

For our purposes, the two-armed argument gives two indications. First, consumption is the main point in the sentence καίτοι περὶ αὐτῆς τῆς προσφορᾶς τῶν αἰτίων τούτων ὑπὲρ ἡμᾶς εἰρήκασιν (14-15). That idea alone is enough to disqualify the theologians' view.<sup>40</sup> It therefore seems odd that Aristotle would add a second emphasis in the form of a half-baked joke that this is the consumption of their *causes*. Second, the result of Aristotle's argument is that nectar and ambrosia cannot be causes. It would hence be confusing, if not outright question-begging, if Aristotle also called nectar and ambrosia "causes" in the sentence that precedes the very argument which settles the question of their status.<sup>41</sup>

Finally, it appears strange that Aristotle would refer to nectar and ambrosia specifically as "these causes", given that neither on Aristotle's reconstruction of the theologians' view nor on the theologians' view itself nectar and ambrosia are considered causes *tout court*. It seems then superfluous, even crude to call nectar and ambrosia "causes". Indeed, in what way could they be causes? Causes as in "causes of their coming to be"? But nectar and ambrosia are clearly not that (see lines 11-12). The only way in which they could at least hypothetically be regarded as "causes" is as a shorthand for "causes of their immortality".<sup>42</sup> But the transmitted text has just "causes" *tout court*, which against the background of the passage as a whole seems a questionable addition. Keeping the hypothetical phrase "cause of their immortality" in mind, we can now turn to Alexander.

If Alexander's *Metaphysics* exemplar read anything other than τῶν αἰτίων τούτων (our mss.), this would provide further evidence that the text of the

<sup>39</sup> On the meaning of the phrase "beyond us" in Aristotle's critique of his predecessors see KRANZELBINDER 2024.

<sup>40</sup> Recent translators often ignore the force of αὐτῆς, "itself", as a way of putting the emphasis on "consumption". It is not translated at all in WILDBERG 2009 and KRANZELBINDER 2024.

<sup>41</sup> We thank Hendrik Lorenz for drawing our attention to this point.

<sup>42</sup> When Aristotle declares invalid the supposition that nectar and ambrosia are causes of εἶναι (οὐθὲν αἷτια τοῦ εἶναι τὸ νέκταρ καὶ ἡ ἀμβροσία, 16-17), he specifies what they are cause of. They are not causes of the gods' "continued existence" (τοῦ εἶναι).

medieval manuscripts is corrupt.<sup>43</sup> Alexander paraphrases and discusses the relevant passage in his commentary on *Metaphysics* B 4 (218.29-219.7 Hayduck = 190.22-191.4 Golitsis). We argue that the way he comments on the passage indicates that he read τούτων without τῶν αἰτίων.

Here is the relevant part of Alexander's commentary:

Alex. Aphrod. <i>In metaph.</i> 190.22-191.4 Golitsis (= 218.29-219.7 Hayduck); Transl. Kotwick and Haubold	
<p>ὑποθέμενοι γὰρ τὰς ἀρχὰς ἅ-[23]ιδίους τε καὶ θείας εἶναι καὶ πάντα ἐξ ἐκείνων τὰ ὄντα εἶναι καὶ γεγονέναι, [24] τὰ μὲν γευσάμενα τῆς ἀμβροσίας καὶ τοῦ νέκταρος φασὶ θεοὺς γενέσθαι, ὅσα [25] δὲ μὴ ἐγεύσατο, ταῦτα φθαρτά, πρῶτον μὲν τὴν ἀμβροσίαν καὶ τὸ νέκταρ τὰ [26] θεοποιὰ ὀνόματα αὐτοῖς ἴσως γνῶριμα λέγοντες· οὐ γὰρ δὴ ἡμῖν, τουτέστιν, ἢ [27] τῶν ἄλλων τινί.</p> <p>δεύτερον δὲ καὶ περὶ αὐτῆς τῆς προσφορᾶς <u>τούτων</u> ἀπλῶς εἶ-[28]πον καὶ οὐδαμῶς γνῶριμῶς· τίνος γὰρ χάριν ἦλθον ἐπὶ τὸ γεύσασθαι τούτων [29] ἃ αἰτία αὐτοῖς τῆς ἀθανασίας; εἰ μὲν γὰρ ἡδονῆς χάριν αὐτῶν γεύονται, οὐδὲν [191.1] αὐτοῖς εἰς τὸ εἶναι συντελεῖ τὸ νέκταρ καὶ ἡ ἀμβροσία, ὥστε οὐ διὰ τὸ γεύσα-[2]σθαι ἀθάνατα· εἰ δὲ εἰς τὸ εἶναι ἢ τούτων αὐτοῖς γεῦσις συντελεῖ, δῆλον ὡς [3] τροφῇ ἐστὶν αὐτοῖς, τὰ δὲ τρεφόμενα καὶ μὴ ἂν ὄντα εἰ μὴ τρέφοιτο, πῶς οἶόν [4] τε λέγειν αἰδία εἶναι;</p>	<p>Assuming that the principles are eternal and divine and that everything is made out of them and has come into being from them, they say that those who ate ambrosia and nectar became gods. But those who did not eat them, became perishable; in using – and this is the first problem – the god-producing terms “ambrosia and nectar”, they speak perhaps understandable to themselves, that is to say, not (understandable) to us or to anyone else.</p> <p>The second problem is that they spoke loosely<sup>46</sup> about the consumption itself of these and in no way comprehensibly. For, why did they come to eat those things, which are causes of their immortality? If they taste them for their pleasure, then nectar and ambrosia contribute nothing to their existence, and so they would not be immortal by means of the tasting. But if the consumption of these things contributes to their existence, it is obvious that it is nourishment for them. Yet, what is nourished and stops existing without nourishment, how can they call that eternal?</p>
<p>26 ὀνόματα ci. Kotwick (cf. Ascl. <i>In Metaph.</i> πρῶτον μὲν οὖν τὴν ἀμβροσίαν καὶ τὸ νέκταρ τὰ θεοποιὰ ὀνόματα αὐτοῖς ἴσως γνῶριμα λέγοντες et Arist. <i>Metaph.</i> 1000a13-14) : νάματα mss. Hayduck Golitsis   τουτέστιν LAO Ascl. Golitsis : del. A<sup>3</sup> edd., non vertit Sep</p>	

Three aspects of this passage are relevant for us: First, Alexander does not quote verbatim from the Aristotelian text, but the paraphrase he provides in lines

<sup>43</sup> For the relationship between Alexander's *Metaphysics* text and the text of our manuscripts see KOTWICK 2016.

<sup>44</sup> LSJ II.4: “generally, opp. σαφέστερον, Arist. Pol. 1341b39, al.; ὡς ἄ. εἰπεῖν ib.1285a31, EN 1115a8, al. [...] in bad sense, loosely, superficially, λιαν ἄ. Arist. *Metaph.* 987a21, GA756b17.” DOOLEY, MADIGAN 1992, p. 167 translate “without explanation”.

190.27-9 (περὶ αὐτῆς τῆς προσφορᾶς τούτων ἀπλῶς εἶπον καὶ οὐδαμῶς γνωρίμως) gives robust information about the text he has before him. Alexander's phrasing suggests that his *Metaphysics* text read τούτων rather than τῶν αἰτίων τούτων. Let us look at the two texts in parallel:

Aristotle	καίτοι περὶ αὐτῆς τῆς προσφορᾶς [τῶν αἰτίων] <b>τούτων</b> ὑπὲρ ἡμᾶς εἰρήκασιν
Alexander	καὶ περὶ αὐτῆς τῆς προσφορᾶς <b>τούτων</b> ἀπλῶς εἶπον καὶ οὐδαμῶς γνωρίμως

We can see that Alexander is very close to Aristotle's text, such that every element – except τῶν αἰτίων – is reproduced, either identically or in a reformulation. The words τῶν αἰτίων alone seem to be without equivalent (καίτοι > καὶ / περὶ αὐτῆς τῆς προσφορᾶς > περὶ αὐτῆς τῆς προσφορᾶς / **τῶν αἰτίων τούτων** > **τούτων** / ὑπὲρ ἡμᾶς εἰρήκασιν > ἀπλῶς εἶπον καὶ οὐδαμῶς γνωρίμως).

Secondly, Alexander does not see any joke here about what the gods eat but stresses the *eating itself* (αὐτῆς τῆς προσφορᾶς) as the strange part of the theologians' explanation. This is in line with Aristotle's text, where αὐτῆς τῆς προσφορᾶς (ll. 14-15) similarly marks the main point Aristotle wishes to make. It is also in line with the train of thought of the passage in its entirety, as we outlined above. Alexander identifies two problems with the way the theologians speak about the difference between gods and mortals. First, he criticizes the use of the terms “nectar and ambrosia”, and then, secondly, turns to “eating”. This follows the Aristotelian text neatly, but only if we accept that it read τούτων rather than τῶν αἰτίων τούτων. Otherwise, we would expect Alexander to highlight as strange not just the eating itself, but the fact that the gods eat *causes*.

Thirdly, though, when Alexander turns to spelling out the strangeness of the gods' eating habits, he uses a formulation that may at first sight suggest he read αἰτίων. According to him, nectar and ambrosia are in fact causes of the gods' immortality (τούτων ἃ αἰτία αὐτοῖς τῆς ἀθανασίας, “those things, which are causes of their immortality”, 28-9). Does this indicate that Alexander read αἰτίων in his text of the *Metaphysics*? Hardly.

Throughout the passage quoted above, Alexander, in line with his usual behavior as a commentator, fleshes out his paraphrase by expanding on Aristotle's terse prose (see the highlighted phrases that mark Alexander's expansions). The sentence τίνος γὰρ χάριν ἦλθον ἐπὶ τὸ γεύσασθαι τούτων ἃ αἰτία αὐτοῖς τῆς ἀθανασίας; (28-9), “For, why did they come to eat those things, which are causes of their immortality?”, is precisely such an expansion. It is meant to motivate with a question the two arguments that Aristotle provides against the view that eating nectar and ambrosia is the reason for the gods' immortality (see 1000a15-18).

To us, this indicates three things: First, the formulation τούτων ἃ αἰτία ..., “these, which are causes”, shows that Alexander's copy of the *Metaphysics* had *not* made it clear in the previous clause that τούτων refers to “causes”. If Alexander

had read τῶν αἰτίων τούτων in his copy, he would not have needed to spell out that, for him, τούτων refers to “causes”. This then indicates that Alexander read only τούτων without τῶν αἰτίων in 1000a15. Second, Alexander has a point in describing nectar and ambrosia as “causes of *their immortality*”. For if one wants to think of them as causes at all, one should state clearly what they are causes of. Nectar and ambrosia may then be called causes of the gods’ not being mortal like other beings (see above), which is exactly what Alexander says. This highlights once more that the reading in our transmitted *Metaphysics* text is oddly sloppy by making nectar and ambrosia causes *tout court*. Third, and no less important, it may well be that we find here in Alexander’s explanatory expansion of the text the very source of the intrusion into our *Metaphysics* text. In other words, Alexander’s explanation of Aristotle’s text could have caused a reader to add the words τῶν αἰτίων in the margin of the *Metaphysics* text, from where it then intruded into our tradition sometime between the third and the eighth century CE. It would not be the only time that this has happened.<sup>45</sup>

### Conclusion

In this article, we used the Princeton-based AI Logion to review known manuscript variants, reassess existing conjectures, and identify a hitherto unknown corruption in the text of Aristotle. The results, we argue, suggest that language models such as Logion can help with philological problems in even the most intensely studied of ancient Greek texts, including those of Aristotle. Machines can make potentially helpful suggestions but human philologists alone can adjudicate philological problems. As our final case study in particular confirms, Logion cannot relieve us of the need to weigh the evidence and reach our own conclusions – in that sense it seems inaccurate to describe what we have presented here as the result of ‘human-machine collaboration’.<sup>46</sup> Still, machines can draw attention to some problems that deserve philological scrutiny, and in so doing contribute, however modestly, to the long-standing goal of restoring the archive of premodern Greek texts.

<sup>45</sup> For parallel cases of Alexander-induced interpolations in our text of the *Metaphysics* see KOTWICK 2016, pp. 178–278.

<sup>46</sup> For this much-touted idea see, for example, NEWMAN, BLANCHARD 2019; DAVENPORT, MILLER 2022.



*Bibliography*

- BATTEZZATO, GRAZIOSI, HAUBOLD 2025 (forthcoming): L. BATTEZZATO, B. GRAZIOSI, J. HAUBOLD, *Artificial Intelligence and Greek Philology: An Experiment*, Pisa 2025 (forthcoming).
- BEKKER 1831: I. BEKKER, *Aristotelis Opera*, Leipzig 1831.
- BENTLEY 1978: J. H. BENTLEY, *Erasmus, Jean Le Clerc, and the principle of the harder reading*, «Renaissance Quarterly», 1978, pp. 309-21.
- BONITZ 1847: H. BONITZ, *Alexandri Aphrodisiensis commentarius in libros Metaphysicos Aristotelis*, Berlin 1847.
- BONITZ 1848: H. BONITZ, *Aristotelis Metaphysica. Pars prior*, Bonn 1848.
- BONITZ 1849: H. BONITZ, *Aristotelis Metaphysica. Pars posterior*, Bonn 1849.
- BONITZ 1870: H. BONITZ, *Index Aristotelicus*, Berlin 1870.
- BONITZ, SEIDL 1989: H. BONITZ, H. SEIDL, *Aristoteles' Metaphysik*. Neubearbeitung der Übersetzung von H. Bonitz, mit Einleitung und Kommentar herausgegeben von H. Seidl, Hamburg 1989.
- BREDLOW 2011: L. A. BREDLOW, *Aristotle, Theophrastus, and Parmenides' theory of cognition (B16)*, «Apeiron», 2011, pp. 219-63.
- CHRIST 1886: W. V. CHRIST, *Aristotelis Metaphysica*, Leipzig 1886.
- CODE 2000: A. CODE, *Some remarks on Metaphysics  $\Lambda$  5*, in *Aristotle's Metaphysics Lambda. Symposium Aristotelicum*, ed. by M. Frede and D. Charles, Oxford 2000, pp. 161-79.
- CORDERO 1984: N.-L. CORDERO, *Les deux chemins de Parménide*, Paris 1984.
- COWEN-BREEN *et alii* 2012: C. COWEN-BREEN, C. BROOKS, J. HAUBOLD, B. GRAZIOSI, *Logion: Machine-learning based detection and correction of textual errors in Greek philology*, «Proceedings of the Ancient Language Processing Workshop», 2023, pp. 170-8.
- COXON 1986: A. H. COXON, *The Fragments of Parmenides*, Assen-Maastricht 1986.
- DAVENPORT, MILLER 2022: T. H. DAVENPORT, S. M. MILLER, *Working with AI: Real Stories of Human-Machine Collaboration*, Cambridge/MA 2022.
- DIELS 1897: H. DIELS, *Parmenides Lehrgedicht*, Berlin 1897.
- DIELS, KRANZ 1951: H. DIELS, W. KRANZ, *Die Fragmente der Vorsokratiker*, Zürich 1951<sup>6</sup>.
- DOOLEY, MADIGAN 1992: W. E. DOOLEY, A. MADIGAN, *Alexander of Aphrodisias, On Aristotle Metaphysics 2 & 3*, London 1992.
- GRAZIOSI *et alii* 2023: B. GRAZIOSI, J. HAUBOLD, C. COWEN-BREEN, C. BROOKS, *Machine learning and the future of philology: a case study*, «Transactions of the American Philological Association», 2023, pp. 253-84.
- GUTAS, TARÁN 2012: D. GUTAS, L. TARÁN, *Aristotle Poetics. Editio Maior of the Greek Text with Historical Introductions and Philological Commentaries*, Leiden 2012.
- HAYDUCK 1888: M. HAYDUCK, *Asclepii in Aristotelis metaphysicorum libros A-Z*



- Commentaria, consilio et auctoritate Academiae Litterarum Regiae Borussicae*, Berlin 1888.
- HAYDUCK 1891: M. HAYDUCK, *Alexandri Aphrodisiensis in Aristotelis Metaphysica Commentaria, consilio et auctoritate Academiae Litterarum Regiae Borussicae*, Berlin 1891.
- HECQUET-DEVIEENNE 2008: M. HECQUET-DEVIEENNE, *Introduction, texte grec et traduction*, in *Aristote: Métaphysique gamma. Édition, traduction, études*, par M. Hecquet- Devienne, A. Stevens, Louvain-la-Neuve 2008, pp. 1-169.
- JAEGER 1913: W. JAEGER, *Aristotelis De animalium motione et De animalium incessu, Ps-Aristotelis De spiritu libellus*, Leipzig 1913.
- JAEGER 1957: W. JAEGER, *Aristotelis Metaphysica*, Oxford 1957.
- KASSEL 1965: R. KASSEL, *Aristotelis De arte poetica liber*, Oxford 1965.
- KIRK, RAVEN, SCHOFIELD 1957: G. S. KIRK, J. E. RAVEN, M. SCHOFIELD, *The Presocratic Philosophers. A Critical History with a Selection of Texts*. Second Edition, Cambridge 1957.
- KIRWAN 1993: C. KIRWAN, *Aristotle Metaphysics Books Γ, Δ, and Ε*, translated with Notes, Oxford 1993<sup>2</sup>.
- KOTWICK 2016: M. E. KOTWICK, *Alexander of Aphrodisias and the Text of Aristotle's Metaphysics*, Berkeley 2016.
- KOTWICK 2021: M. E. KOTWICK, *Aristotle, Metaphysics A 10, 993a13-15: A new reading and its implication for the unity of book Alpha*, «Classical Quarterly», 2021, pp. 183-8.
- KRANZELBINDER 2024: D. KRANZELBINDER, *Aristotle on What is 'Beyond Us' (ὕπερ ἡμᾶς)*, «Ancient Philosophy», 2024, pp. 469-85.
- LAKS, MOST 2016: A. LAKS, G. MOST, *Early Greek Philosophy*, Volume V, Western Greek Thinkers, Part 2, Cambridge-London 2016.
- MAYHEW 2019: R. MAYHEW, *Aristotle's Lost Homeric Problems. Textual Studies*, Oxford 2019.
- MAAS 1958: P. MAAS, *Textual Criticism*, tr. B. Flower, Oxford 1958.
- MENN in draft: S. MENN, *Γ1-2, 1003a21-b22 (and 1004a2-9)*, in *Aristotle's Metaphysics Gamma, Symposium Aristotelicum* (Geneva, Switzerland, July 22-28, 2024), ed. by P. Crivelli, Oxford, in draft.
- MOURELATOS 1970: A. MOURELATOS, *The Route of Parmenides: A Study of Word, Images, and Argument in the Fragments*, New Haven 1970.
- NEWMAN, BLANCHARD 2019: D. NEWMAN, O. BLANCHARD, *Human/Machine: The Future of Our Partnership with Machines*, London 2019.
- NUSSBAUM 1978: M. C. NUSSBAUM, *Aristotle's De motu animalium. Text with Translation, Commentary, and Interpretive Essays*, Princeton 1978.
- O'BRIEN, FRÈRE 1987: D. O'BRIEN, J. FRÈRE, *Le Poème de Parménide. vol. 1*, ed. by P. Aubenque, Paris 1987.
- PASQUALI 1952: G. PASQUALI, *Storia della tradizione e critica del testo*, Florence 1952<sup>2</sup>.
- PRIMAVESI 2020: O. PRIMAVESI, *Aristotelis De motu animalium. A new Critical Edition of*

- the Greek Text* by Oliver Primavesi. With an English Translation by Benjamin Morison, in *Aristotle's De Motu Animalium*, ed. by C. Rapp and O. PRIMAVESI, Oxford 2020, pp. 157-202.
- PRIMAVESI, CORCILIUS 2018: O. PRIMAVESI, K. CORCILIUS, *Aristoteles, De motu animalium – Über die Bewegung der Lebewesen. Historisch-kritische Edition des griechischen Textes und philologische Einleitung von Oliver Primavesi. Deutsche Übersetzung, philosophische Einleitung und erklärende Anmerkungen von Klaus Corcilius. Griechisch – Deutsch*, Hamburg 2018.
- RASHED 2020: M. RASHED, *Aristote. De la génération et la corruption*, Paris 2020.
- ROSS 1924: D. ROSS, *Aristotle's Metaphysics. A Revised Text with Introduction and Commentary*, Oxford 1924.
- ROSS 1955: D. ROSS, *Aristotle Parva Naturalia. A Revised Text with Introduction and Commentary*, Oxford 1955.
- ROSS 1961: D. ROSS, *Aristotle De Anima. Edited with Introduction and Commentary*, Oxford 1961.
- SIDER, JOHNSTONE 1986: D. SIDER, H. W. JOHNSTONE, *The Fragments of Parmenides*, Bryn Mawr 1986.
- SIWEK 1965: P. SIWEK, *Tractatus De Anima, Graece et Latine*, Rome 1965.
- TARÁN 1965: L. TARÁN, *Parmenides. A Text with Translation, Commentary, and Critical Essays*. Princeton 1965.
- WEST 1973: M. L. WEST, *Textual Criticism and Editorial Technique*, Stuttgart 1973.
- WILDBERG 2009: C. WILDBERG, *Aporiai 9-10*, in *Aristotle's Metaphysics Beta. Symposium Aristotelicum*, ed. by M. Crubellier, A. Laks, Oxford 2009, pp. 151-74.