The epistemic value of 'κατά τόν λόγον': Meteorology 1.7

By

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Τὸν μὲν οὖν Ἀναξαγόραν φασὶν ἀποκρίνασθαι πρός τινα διαποροῦντα τοιαῦτ᾽ἄττα καὶ διερωτῶντα τίνος ἕνεκ᾽ἄν τις ἕλοιτο γενέσθαι μᾶλλον ἢ μὴ γενέσθαι ‘τοῦ᾽ φάναι ‘‘θεωρῆσαι τὸν οὐρανὸν καὶ τὴν περὶ τὸν ὅλον κόσμον τάξιν’’.

(Aristotle, E.E I, 1216a12–14*).*

Contents

Abstract

I will attempt to shed some light on the troubling matter of the obscure particulars — treated by Aristotle in *Meteorology* — (τῶν ἀφανῶν τῇ αἰσθήσει), that is, phenomena which are not apparent to the senses in their full extent (*Meteorology* 344a5). In the framework of the present paper, the aim is to highlight the use of κατά τόν λόγον which appears in the first lines of chapter I.7 of Aristotle's *Meteorology*, by focusing on two philosophical questions: one ontological (what is the ontological status of obscure phenomena?) and one epistemological (can we come to the knowledge of such phenomena, and if so, in which way?). Aristotle proposes two answers to these questions in the text, respectively: The *meteora* (and therefore the comets discussed in chapter I.7 of *Meteorology*) are natural entities. However, phenomena discussed in *Meteorology*, although particulars, cannot be fully observed by the senses. Also, one can come to the knowledge of them by giving a reasonable account (κατά τόν λόγον) which requires the use of analogy. I will show that Aristotle, indeed, places comets in the sublunary world and that the reasonable account — which includes an analogy — is of epistemic value. Such arguments are not justification arguments; however, rather they are a part of Aristotle's method of discovery, and they serve as something more than an explanation and/or illustration. I am confident that this reasonable account lies in the context of a 'heuristic process'. I will show that when it comes to justification in terms of a 'correctness' of a theory Aristotle turns to empirical observations, since we cannot speak of justifying something that is so prone to error as phenomena hidden from our senses, such as comets.

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Introduction

I strongly believe that Aristotle's *Meteorology* is relevant to anyone working on Aristotle's natural philosophy since it can give us insights which were for a long time disregarded by other scholars. The most prominent one (within the contents of *Meteorology*) is that of the difference of approach between obscure and non-obscure phenomena.

A fine example is one regarding Aristotle's epistemology. Michael Frede in his paper '*Aristotle's rationalism*' does not — for sure — dismiss the role of perception in Aristotle's natural philosophy, nor does he think little of its role in the process of natural investigation. However, the case he makes is that Aristotle is a rationalist and goes as far as arguing, that for Aristotle, knowledge without perception would have been possible. If that was really the case then *Meteorology* — which does not rely much on perception — would have been one of the most interesting texts of the Aristotelian corpus in terms of the fine and positive complexity of its arguments.

However, it is not. Frede argues that for Aristotle knowledge (properly speaking) is based causally and not epistemically on perception and experience, but the textual evidence throughout the Aristotelian corpus suggests otherwise, and this interpretation can be compromised.[1] For Aristotle's claim in the *Generation of Animal*s is "we should accept what is evident to the senses rather than [mere] reasoning, and reasoning only if it agrees with the observed facts"

[1] Michael Frede, 'Aristotle's rationalism' in eds. Michael Frede and Gisela Striker, *Rationality in Greek Thought*, (Oxford: Oxford University Press, 1996), 157-173.

(*GA* 760b29-33). This last passage from the *Generation of Animals* is also very useful for my purposes here because it is there where Aristotle discusses the generation of bees — for which he had limited observational data. This is the case also in *Meteorology* 1.7.

The opening lines from Aristotle's *Meteorology* 1.7 read:

'Επεὶ δὲ περὶ τῶν ἀφανῶν τῇ αἰσθήσει νομίζομεν ἱκανῶς ἀποδεδεῖχθαι κατά τόν λόγον, ἐάν εἰς τό δυνατόν ἀναγάγωμεν, ἔκ τε τῶν νῦν φαινομένων ὑπολάβοι τις ἂν ὧδε περὶ τούτων μάλιστα συμβαίνειν.' 'Since, we believe, with respect to those which are hidden from our sense, that we have sufficiently made known according to reason (κατά τόν λόγον), when we reduce (our thoughts) to what is possible. Even from phenomena now available someone would assume that this happens with respect to these things especially' (*Meteorology* 1.7, 344a5-8).[2]

'Κατά τόν λόγον' appears in Aristotle's treatment of obscure phenomena (τῶν ἀφανῶν τῇ αἰσθήσει), viz. phenomena which are not apparent to the senses (*Metr*. 344a5). In the present paper, my aim is to highlight the use of 'κατά τόν λόγον' in I.7 of Aristotle's *Meteorology* by focusing on two philosophical questions, one ontological and one epistemological:

i) what is the ontological status of obscure phenomena?

[2] From now on, '*Metr*.'. I use Aristotle's *Meteorology*, revised text, with Index of Words, by F. H. Fobes, printed by Harvard University Press, Cambridge, Mass., U.S.A., 1919. This translation is mine. All the other translations I use here are from Aristotle, *Meteorology*, trans. E. W. Webster, in Aristotle, *The Complete Works of Aristotle*, ed. J. Barnes, 2 vols. (Princeton, 1984).

ii) can we come to the knowledge[3] of such phenomena, and if so, in which way?

Aristotle proposes two answers to these questions in the text, respectively:

i) The meteora (and therefore the comets discussed in chapter I.7 of *Meteorology*) are natural bodies.

ii) One can come to the knowledge of such phenomena by giving a reasonable account (κατά τόν λόγον, ἐάν εἰς τό δυνατόν ἀναγάγωμεν) which requires the use of analogy by likeness.

Regarding the ontological question one can be puzzled over the status of comets; because comets, unlike most sensible particulars, are not apparent to the senses in their full extent; but this is not the only peculiarity they present when compared to other sensible particulars, as their occurrence is also irregular. I will respond to Wilson's claim that Aristotle is not explicit regarding the region of occurrence of obscure phenomena.[4] I argue (in part I of this essay) that meteora, including comets — which are the subject matter of my inquiry — cannot be celestial bodies but are rather particulars occurring in the sublunary world; and Aristotle is explicit about this matter.

Regarding the epistemological question, I will show (in part II of this essay) that, regarding obscure particulars, it is not clear whether and how the principles of natural investigation outlined in other parts of the corpus are to be extended to *Meteorology*. The problem, therefore, is one of identifying the appropriate

[3] By 'knowledge' here I mean 'some knowledge' in distinction to 'knowledge strictly speaking' i.e, science.

[4] Malcolm Wilson, *Structure and Method in Aristotle's 'Meteorologica': A More Disorderly Nature* (Cambridge, New York: Cambridge University Press, 2013), 135.

epistemic access to the relevant natural bodies that otherwise remain inaccessible via perception. I will agree with Karbowski that κατά τόν λόγον §is of great epistemic value but I will also respond to Karbowski's claim that the use of 'κατά τόν λόγον' is justificatory [5] and argue that it is not metatheoretical, but rather is a part of the heuristic process.[6]

I

An Ontological Question

Meteorology is one of Aristotle's treatises concerning issues that fall under the general title 'Natural Philosophy' — as Aristotle places this work after *Physics*, *On the Heavens* and *On Generation and Corruption* (*Metr.* 338a20-26).[7] This work deals with the meteora, viz. natural phenomena which occur in the sublunary world; however, their region of occurrence borders most nearly with the region in which the heavenly bodies occur (*Metr*. 338b21-22, περὶ τὸν γειτνιῶντα μάλιστα τόπον τῇ φορᾷ τῇ τῶν ἄστρων). Specifically, the meteora are (i) natural phenomena (*Metr*. 338b20, κατὰ φύσιν) that are characterized by (ii) presenting a regularity less than the regularity of the heavenly bodies

[5] Joseph Karbowski, 'Justification 'by Argument' in Aristotle's Natural Science,' in *Oxford Studies in Ancient Philosophy*, ed. Victor Caston., vol 51 (Oxford: Oxford University Press, 2016), 119.

[6] Normally heuristics bring us to a position where we can go ahead and formulate proofs etc. – some strict scientific theory. Here we do not have this additional phase. I use 'heuristics' here, as heuristics without this further edifice. For a distinction between what can be understood as metatheoretical and what can be part of a heuristic process, see part II.

[7] In these first lines, Aristotle summarizes the contents of what he calls 'Natural philosophy' and he also includes *Meteorology*.

(338b20, ἀτακτοτέραν) and (iii) are far from the surface of earth and thus are inaccessible to observation (*Metr*. 338b21-22). Aristotle says:

"This world necessarily has a certain continuity with the upper motions: consequently all its power and order is derived from them. […] So we must treat fire and earth and the elements like them as the material causes of the events in this world (meaning by material what is subject and is affected), but must assign causality in the sense of the originating principle of motion to the influence of the eternally moving bodies".[8] (*Metr*. 339a20-35)

Aristotle drew a distinction between natural bodies and artifacts in *Physics* II and he made clear that natural philosophy revolves around phenomena which involve bodies having an internal principle of motion and rest. Still, if one turns to other parts of the Aristotelian corpus, one finds that the natural bodies *are subject to change* (σώματα in *Metaphysics* 1026a12). Natural entities are: (i) bodies and magnitudes,[9] (ii) beings which have of body and magnitude,[10] and (iii) the principles or causes of these beings.[11] Natural bodies tend to fall into two distinct, even *mutually exclusive*, categories of being; according to Aristotle, this is the case when distinguishing between different kinds of motion (*DC* I.2). Thus, according to Aristotle, some phenomena are everlasting, i.e.

[8] Aristotle, *Meteorology*, trans. E. W. Webster, in Aristotle, *The Complete Works of Aristotle*, ed. J. Barnes, 2 vols. (Princeton, 1984).
[9] Aristotle here probably refers to basic elements (such as fire) and simple compounds (such as wood).
[10] Aristotle here probably refers to animated beings (including plants).
[11] "Η περὶ φύσεως ἐπιστήμη σχεδὸν ἡ πλείστη φαίνεται περί τε σώματα καὶ μεγέθη καὶ τὰ τούτων οὖσα πάθη καὶ τὰς κινήσεις, ἔτι δὲ περὶ τὰς ἀρχάς, ὅσαι τῆς τοιαύτης οὐσίας εἰσίν· τῶν γὰρ φύσει συνεστώτων τὰ μέν ἐστι σώματα καὶ μεγέθη, τὰ δ᾽ ἔχει σῶμα καὶ μέγεθος, τὰ δ᾽ ἀρχαὶ τῶν ἐχόντων εἰσίν." *On the Heavens* 268a1-7. For additional examples see *Physics* I.1, III.1 and also *On the Heavens* 305b17, 305b32, 306a20 etc..

having no beginning and no end in time, and yet are remote from our senses, whereas others come into being and perish, yet they are themselves close at hand. Heavenly bodies and the elements and their compounds are illustrative of this dichotomy, given that the former are everlasting and remote, while the latter are generable and perishable and close at hand. This exclusive dichotomy, however, leaves the meteora in a precarious place, and a question arises about how best to classify the meteora among phenomena.

Wilson argues that Aristotle is not explicit regarding the ontological status of the comets; stating that Aristotle is not very clear about whether comets (and the Milky Way) are celestial or sublunary. He does concede that Aristotle implies that they are sublunary and that this implication is to be found in Aristotle's criticism of his predecessors.[12] Wilson is right — comets are indeed sublunary bodies — though insteadI believe that Aristotle is absolutely clear about this.

I turn now to *Meteorology* I.7 to show the underlying ontology of the comets. Comets are considered to be natural bodies and Aristotle is placing them in the sublunar world since his theory regarding comets is based upon the existence of a fiery principle (*Metr.* 344a17, ἀρχή πυρώδης) which is responsible for their generation. We know from *On the Heavens*, *On Generation and Corruption* and from the *Meteorology* that the presence of fire in the celestial region would be absurd according to Aristotle—since the only element present in the celestial region is the aether. Also, the generation of comets

[12] Malcolm Wilson, *Structure and Method in Aristotle's 'Meteorologica': A More Disorderly Nature*, 135.

requires a well-mixed, dry-hot exhalation (*Metr*. 344a20, εὔκρατον ἀναθυμίασιν) which is present in the upper sublunar region as Aristotle has stated in the previous chapters of *Meteorology*. Finally, Aristotle does not ascribe the characteristic of circular motion to these phenomena as he does with the heavenly bodies.[13]

It is worth examining what Thomas Aquinas wrote about this matter in his commentary on the Meteorology:

"[…] he[14] enumerates the things to be considered in this doctrine. These are seen to be divided into four groups. For there are some things that are produced in the highest region, nearest to the heavenly body. Such things are, namely, those concerning which it still remains to be considered, things that happen indeed according to nature, but not an ordered nature and, as some claimed, by chance. This more irregular nature is not, however, the nature which belongs to the 'first element of bodies,' i.e., the celestial body, called 'element,' because it is a part of the whole corporeal universe, although it does not enter into the composition of mixed bodies, as do the elements. The nature according to which these things occur is more unordered than the nature of the celestial body, since the things in the celestial body always behave in the same way, whereas in the transmutations affecting the lower bodies much variation occurs. It was on this account that some have believed that these occurred, not by nature, but by chance, failing to consider that there is produced by nature, not only those things

[13] After answering the epistemological question about comets I will be able to give a fourth reason why Aristotle is, in fact, explicit about the comets' region of occurrence.
[14] Aristotle. Aquinas, in this stage lays out the purpose and contents of *Meteorology* according to Aristotle.

which happen always, but also those which happen for the most part. These, I say, occur in the region nearest the 'carrying of the stars,' i.e., the stars that are circularly moved. This he sets down to distinguish them from those that follow. As an example he mentions the 'Milk,' i.e., the milky circle called the 'galaxy,' and the stars called 'comets,' and the 'phantoms,' i.e. the apparitions, fiery and moving, called 'falling stars'[15] [meteors]".[16]

It is evident now, for Aristotle, that comets are not considered a third sort of thing (that is, apart from the celestial bodies and bodies which are generable and perishable). Though, at first glance, they do not seem to 'fit' into either paradigm *because* they are remote from the senses while they are at the same time being subject to generation and perishing—however, they are natural bodies. If we are indeed to distinguish between the celestial and sublunary, as Aristotle does, and then to place meteora within the sublunary, we are committing ourselves to the idea that meteora are indeed comparable, via analogy or some other method, to those phenomena within our daily, proximate experience. For both, daily proximate phenomena, and meteora, occur in the sublunary realm. As I understand meteora, they are, in virtue of being sublunary, objects sufficiently similar to immediately observable objects that they can be compared to such. Also due to the rather unique character of meteora, I limit the discussion of analogy to the *Meterology* alone. Yet though the ontological status of comets is now clear, the epistemological questions still need address.

[15] It must be noted that for Aristotle the shooting stars, the comets and the Milky Way are three different manifestations of the same activity.
[16] Thomas Aquinas, *On Meteorology*, trans. Conway, Pierre, and F.R. Larcher. 1964, pro manuscripto.

Is it possible for (some) knowledge to be acquired over (some) such phenomena?

II

An Epistemological Question

We know from the first lines of *Metaphysics* that sense is indeed our chief source of knowledge about particulars (*Met.* I.1 & *APo.* I.18) and we also know from *On the Heavens* that the goal in the case of natural science, is to (know)[17] the phenomenon that it is always, properly apparent to the sense:

'It is *neither* reasonable for it to turn out that one element alone [earth] has no part in the transformation [of the elements into each other], *nor* is it apparent on the basis of *sense*; *but it seems that all the elements should change equally into each other*. As a result, [the Platonists] offer accounts which concern the phenomena while their accounts are not in agreement with the phenomena. The reason for this is that *they have taken hold of the principles in a manner that is not fine*; rather, they were determined to bring everything into conformity with certain fixed ideas. *For surely the first principles*[18] *of sensible things ought to be sensible, those of eternal things ought to be eternal, those of perishable things ought to be perishable; in general, principles ought to be of the same*

[17] Alternatively, 'to understand' viz., to be able to give an explanation of the appearance.
[18] 'First principles' in the sense of 'elements'.

type as their subjects. But because of their affection for their *theories*, they proceed like people who are defending their *theories* in *public talks*. *They accept the conclusion, which is produced by their principles*, not seeing that it is necessary to judge some *of their theories* in the light of their consequences, in particular of *their goal*. *The goal* in the case of productive knowledge is [*to make*] the product; in the case of natural science, *is to* [*know*][19] *the phenomenon that it is always*[20]*, properly apparent to the sense*.'[21] (*On the Heavens 3.7*, 306a3-18).

Having in mind the above mentioned texts, regarding phenomena which are hidden from our senses, there are at least three possible answers on whether we can know them: (i) we can know them — since they are particulars — by following the method proposed in *Physics*; (ii) we can come to the knowledge of such phenomena in a different way, and (iii) finally, we cannot know them — since the senses are our chief sources of knowledge regarding particulars and since the very purpose of natural science is to investigate phenomena which are properly exposed to the senses. I am going to argue that we can know them in a different way but not to their full extent; i.e, we can assume something about them but these assumptions are only provisional. If we are able to grasp obscure particulars provisionally, this is because we have empirical evidence of

[19] Aristotle's point is that in science we are trying to understand the observable world, which is why we can tell that something has gone wrong when the scientific theory ends up predicting something which perception tells us is false. At this point, I need to thank Benjamin Morison for helping me with his insightful comments.
[20] 'Always' in the sense of 'at all times'.
[21] Translation by Bolton (2009) with several changes by me. *Italics* are mine.

phenomena that are close at hand and our theoretical framework for explaining them allows for treating the obscure phenomena, since both phenomena occur in the same region. Aristotle argues that since comets cannot be observed in their full extent, it is sufficient to give a reasonable account for them (κατά τόν λόγον, ἐάν εἰς τό δυνατόν ἀναγάγωμεν).[22]

In *On the Heavens* III.7 Aristotle is arguing against a thesis expressed in the Platonic *Timaeus*.[23] In the *Timaeus* Plato is interested in explaining how the sensible things are generated. He claims that there are four elements (fire, earth, air, water) — this is the most elementary form of creation encountered in the universe — and that the Demiurge endowed these primary bodies with regular geometric shapes. These geometric shapes are composed of two main triangles, the isosceles and the scalene. The regular solids — constructed out of the triangles — are four: the pyramid (tetrahedron), the octahedron, the icosahedron and the cube. These regular solids constitute the best geometric shapes that could exist, so as to accomplish perfection in nature. Three out of them are composed of scalene triangles, while the cube is made of isosceles triangles. These solids correspond to the four elements. The tetrahedron is fire, the cube is earth, the icosahedron is water and the octahedron is air. Plato makes a claim that this (the tetrahedron) is the first principle not only of fire, but of the other elements as well. Aristotle objects to this on an ontological basis; that is, the

[22] This is clearly a very modest statement on Aristotle's behalf; he is not going to claim that he has scientific knowledge of such phenomena thus it is safe to suppose that what follows is not demonstrable as *APo* propose that (every scientific theory) should be.
[23] I have defended the following thesis in my talk, 'Aristotle on the Purpose, Content and Method of Natural Science: *On the Heavens* 3.7', at the 4th Panhellenic Philosophy of Science Conference (hosted and organized by the National and Kapodistrian University of Athens), 2 December, 2016.

Platonic elements are not composed of matter and form (as all sensible elements) but constructed out of triangles (geometric objects). The four elements, according to Plato, are transformed into one another, with the exception of earth. Earth's exclusion from this circle of transformation is a consequence of Plato's choice to attribute the geometric shape of the cube to this element and immediately attaches to earth a metaphysical (as well as an ontological) priority (*Timaeus*, 54a3-b3 and 53d). Earth, in this sense, seems to be metaphysically superior to the other elements and its uniqueness is associated with the lack of transformation. In other words, Plato qualifies earth as indestructible; since no other element can be generated from earth, apart from earth. Aristotle does not object to earth's involvement in the transformation process of the elements (because we can actually *see* earth transforming into other elements), and this objection probably led him to criticize Plato's views on a methodological basis. Earth's exclusion, as Aristotle states it, is *unreasonable* and has *not* been imposed by *observation*.

Aristotle there states that every theory must be (i) reasonable and that the phenomena examined in the preliminary stage of natural investigation must be (ii) apparent on the basis of sense. Aristotle argues that it is *neither reasonable* (for it to turn out that one element alone has no part in the transformation of the elements into each other) *nor* does it *appear so* on the basis of *sense* (*DC* 306a3-18, Οὔτε γὰρ εὔλογον . . . οὔτε φαίνεται κατὰ τὴν αἴσθησιν). That is, Plato's theory is unreasonable, and our senses do tell us that this theory is wrong. Aristotle uses εὔλογον as the necessary qualification which every theory needs

to meet. And I take εὔλογον to be equivalent to κατά τόν λόγον in this case; they both convey the same thing, viz. 'according to reason'.

He goes on to argue that *the goal* in the case of productive knowledge is (*to make*) the product; in the case of natural science, *is to* (*know*)[24] the phenomenon that it is always, properly[25] apparent to the sense. Aristotle's point is that in natural philosophy we are trying to understand the observable world, which is why we can tell that something has gone wrong with our conclusions when the scientific theory ends up showing something which the senses tell us is false.

By pointing our focus in the direction of scientific research, it becomes evident that, in chapter 3.7, we find ourselves once again face to face with the difference between Aristotelianism and Platonism, the correlation between the scope of mathematics and physics. The Platonic sublunary elements are considered, from Aristotle, as mathematical and not as natural entities. From Aristotle's standpoint, sensible bodies make up the content of natural science — its research subject matter — serving as a guideline for its ultimate purpose.

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[24] The word 'understand' is missing from the ancient text but I believe in the significance of this completion. Also, Guthrie W. K. C., *Aristotle: On the Heavens* (Cambridge, London: Harvard University Press, William Heinemann Ltd., 1939) translates 'τέλους' as 'the final result of all', Stocks, J. L., 'Aristotle: *On the Heavens,'* in *Works of Aristotle,* ed. W.D. Ross, vol 2 (Oxford: The Clarendon Press, 1922) as 'final issue'; I, clearly, prefer the Aristotelian use of the word, that is, τέλος as purpose, mainly, because the word 'end' is not contributing anything significant to the text. At this point, I need to thank Benjamin Morison for helping me with his insightful comments. See, also, *Physics* 194a27-194b9; Aristotle there makes the same distinction, that is, the productive art vs. natural philosophy.

[25] Robert Bolton, 'Two Standards For Inquiry In Aristotle's *De Caelo*,' in *New Perspectives on Aristotle's De Caelo*, edd. Bowen A.C and Christian Wildberg, (Leiden, Boston: Brill, 2009) 51-82, translates as 'authoritatively' which means 'reliable'. I think that this choice of translation endorses Bolton's idea that regarding the investigation of nature, Aristotle proceeds in two distinct ways. Either φυσικῶς (according to perception) or αναλυτικῶς (according to reason). Nevertheless, when Aristotle refers to phenomena, in this passage, does not have an (almost) infallible type of 'perceptual data' in mind so the word 'authoritatively' is unfortunate; but rather speaks of the goal (τέλος) of every natural investigation in all cases, where the phenomena can be grasped by our senses. Therefore, to me, the above-mentioned translation is misleading.

Simplicius tried to solve the problem concerning the nature of the triangles, used by Plato to explain the process of the elements' generation. The aforementioned description of the sensible bodies by Timaeus does not allow me to agree with Simplicius' view, which can be summed up in the following: the Platonic triangles are natural bodies and not mathematical entities.[26] It is still, in my opinion, open to discussion whether the chemistry of the elements constitutes a common field of natural research for both Plato and Aristotle, given the fact that the subject-matter of the Aristotelian natural research consists of natural bodies, and the Platonic triangles cannot be considered as such.

In this chapter (3.7), Aristotle clearly states that the purpose of science is to conduct research on these phenomena which can be observed in their full extent. The key idea is Aristotle's belief that the natural scientist attempts to comprehend the sensible world. Therefore — because of the nature of the subject-matter of natural research — we can detect with certainty when a scientific theory is erroneous: when it formulates something that cannot be conceived with the help of the senses. Nevertheless, Aristotle finally accepts the Platonic mathematical epistemology (viz., it is plausible to grasp some truth via mathematics). Mathematicians offer information and contribute to the research

[26] "Those who say that bodies are composed of planes or planes of lines or lines of points do not say that they are composed as if from matter and form, but as if from those things (planes, lines, points) as parts." (Simplicius, *On the Heavens*, 573.15-21) Simplicius comments on Aristotle's *On the Heavens* 287b17-19. Mueller (2009) indicated that a central feature of Simplicius' interpretation of the *Timaeus*, regarding the chemistry of the elements, is the opinion that the Platonic triangles constitute natural, rather than mathematical entities (Mueller [2009] introduction, section 7). On the one hand, Aristotle accuses Plato of 'not acting like a natural scientist' because of the ontology (of the non-existence; since for Aristotle geometrical entities and therefore mathematical entities are not regarded as autonomous physical entities that exist in the natural world) of the elements, as the ontological status of the elements prevents them from serving as a proper subject matter for the research of the natural world. Aristotle also points out that this could be the subject matter of a 'different' and 'superior' science (*On the Heavens* 3.1, 298b18-21). Simplicius finds the 'solution' to the problem and he arrives at a rather good interpretation, according to which the Platonic triangles are not mathematical, but rather natural entities. The idea is that, the ontology of these triangles (surfaces) is in full accordance with the ontology of the substances that Aristotle deems as necessary for the subject matter of natural research. However, Plato does not appear, though, to attribute the features of the Aristotelian sensible things to the triangles.

process because they address fields that are completely different from the ones in the sensory world. Respectively, sensibles do not fulfill the conditions imposed on mathematical entities. As far as Aristotle is concerned, this proves that the mathematical language constitutes a certain explanatory method, but not for this field. On the other hand, Plato, as I earlier demonstrated, suggests such an idea.

The problem detected is that starting from Aristotle's definition of the purpose of science one must leave phenomena such as the comets out of the scientific inquiry since they are not always properly[27] exposed to the senses. Does Aristotle think that there is no knowledge whatsoever to be acquired regarding these types of phenomena?

It is evident that Aristotle's argument introduced in *On the Heavens* is in total agreement with what he states in *Parts of the Animals*: 'We know more and we know better in biology than we do in astronomy' (654a1). This is because zoology as a domain of investigation treats bodies which are 'closer' to the lower part of the sublunary world in terms of the facts derived from the senses. When a sensible body is close to the surface of earth the student of nature is able to observe it, but when a sensible is inaccessible to the senses in its full extent, the student of nature can, presumably, only produce a reasonable theory.[28] This passage derived from the *Parts of Animals* can be treated as

[27] In the sense of 'in their full extent'.

[28] One can be misled by the use of the phrase 'reasonable theory'. It is not a reference to the Platonic 'eikôs mythos'. As the passage of the *On the Heavens* I used above shows, the Aristotelean criticism seems to imply that Plato and, subsequently, his adepts aspire to 'save the phenomena' by unveiling the logic pattern underneath them, but what they end up saying concerning the phenomena, according to Aristotle, is not in accordance with the phenomena themselves. Plato's aspiration to save the phenomena and use the sensible world as his starting point seems to be a paradox. As we have many times seen, the natural world, for Plato, is no part of truth or reality, as

evidence that Aristotle follows different epistemic paths when it comes to phenomena which are accessible and inaccessible to the senses.

I have shown how Aristotle treats Plato's theory by proving that the latter's theory is false and how he proceeds with his own view on the matter of discussion by employing empirical evidence and therefore by pointing out the significant role of perception. It seems that perception — even in its absence, in cases like the one I am examining now — is a significant part of Aristotle's natural investigation.

I turn now to *Meteorology* I.7 to show how Aristotle presents his view regarding obscure phenomena starting from the same argument yet by proceeding in a different way than he did in *On the Heavens*; Aristotle has no choice but to give a reasonable account. The first lines from *Meteorology* I.7 read 'since, we believe, with respect to those which are hidden from our sense, that we have sufficiently made known according to reason (κατά τόν λόγον), when we reduce (our thoughts) to what is possible. Even from phenomena now available someone would assume that this happens with respect to these things especially'.[29]

Aristotle begins this query, in chapter 7, by reminding us that the outer part of the terrestrial world lies exactly beneath the celestial revolutions. In the previous chapters, he had already shown that the sublunary region is divided into two sub-regions — one of them borders the surface of earth and the other

these notions are associated with the kingdom of Ideas. Aristotle clearly proposes a method that exceeds the boundaries of what Plato calls 'plausible story'.

[29] 'ἐπεὶ δὲ περὶ τῶν ἀφανῶν τῇ αἰσθήσει νομίζομεν ἱκανῶς ἀποδεδεῖχθαι κατὰ τὸν λόγον, ἐὰν εἰς τὸ δυνατὸν ἀναγάγωμεν, ἔκ τε τῶν νῦν φαινομένων ὑπολάβοι τις ἂν ὧδε περὶ τούτων μάλιστα συμβαίνειν'. The translation is mine.

(the outer part) borders the heavens. The latter is composed by hot-dry exhalation which is carried around the earth by the movement of the heavens, along with air. When this mixture (of exhalation and air) is well blended (εὔκρατος) it catches fire and this is how the shooting stars are created. The upper motion moves the fiery principle (ἀρχὴ πυρώδης) which is strong enough and the exhalation in a suitable consistency, and this is how the comets are created. Comets (of this type) move in accordance with the sublunary sphere and therefore fall behind the stars. Aristotle then says that the shape of the comet depends on the shape of the exhalation (long-haired if it goes to all directions or bearded if it expands lengthwise). He then makes a distinction between two types of comets: the first is the one mentioned above; the second is produced when the movement of a star gathers the exhalation (*Metr*. 344a35-344b1) and then the star itself becomes a comet and moves in accordance with the star.

So, here κατά τόν λόγον presupposes principles laid out in Aristotle's previous chapters regarding the region in which these phenomena occur. Aristotle also states that there is a mixture occurring in the same region in which the hot-dry exhalation and air is, and it is because of the motion of the heavens that this mixture burns up in fire. All these claims, as I take it, are of an ontological nature.

I agree with Karbowski for the most part of his interpretation. Perception, as Karbowski argues and as I mentioned before, plays a significant role in Aristotle's natural investigation. One would assume that this is the case, also, in *Meteorology* since it includes a fair number of observations.[30] Karbowski, in

[30] Karbowski, 'Justification 'by Argument' in Aristotle's Natural Science,' 149.

contrast to what Frede claims, starts with the idea that perception does not play a causal role in the process of gaining knowledge, but it rather furnishes data. The theses expressed during the process of natural investigation have to be justified and also harmonized with perception. Κατά τόν λόγον, according to Karbowski, is a mode of reasoning or else a mode of justification which is not the same as demonstration since it cannot prove why a thesis is in fact true. In other words, Aristotle is willing to accept the verdicts of this reasoning as long as they agree with the empirical evidence. Aristotle, as Karbowski claims, may contrast this mode of justification with the justification from perception but these two modes are not mutually exclusive. This is an attractive theory especially because one can actually see in chapter 7 that some empirical evidence does indeed dovetail nicely with what is claimed by Aristotle to be a reasonable account. As Karbowski also notices, Aristotle is not claiming that his use of κατά τόν λόγον constitutes knowledge (strictly speaking) and he is ready to revise his position in light of new empirical observations.[31]

However, it is still uncertain what Aristotle regarded as 'what is possible'. Wilson explicitly argues that 'what is possible' refers to three causes: combustion, friction and reflection.[32] Karbowski makes several negative points — that is, he makes a claim (*contra* Bolton, 2009) that modes according to reason are *not* dialectical (and I agree) since, as I mentioned earlier chapter 7, they include a number of empirical observations. Moreover, *endoxa* or else 'what is credible for us' could not be what Aristotle means here as 'what is

[31] Karbowski, 'Justification 'by Argument' in Aristotle's Natural Science,' 150.
[32] Wilson, *Structure and Method in Aristotle's 'Meteorologica': A More Disorderly Nature*, 141.

possible' since Aristotle's theory relies heavily on principles introduced earlier in his corpus. Karbowski also, ponders over the idea that 'what is possible' might be 'logically possible' but he quickly rejects this idea on the grounds that Aristotle himself is willing to reject logically possible views (see for example *Metr*. 1.6, 343a20-2). Finally, Karbowski argues that 'what is possible' here is an amalgam which depends on *endoxa*, the available empirical data and general principles. He claims that this possibility is an epistemic possibility.[33]

Karbowski argues that all the κατά τόν λόγον modes have the same structure — though he admits that 'this unity assumption is controversial' — and that such modes 'justify theses by subsuming the immediate subjects of enquiry under general principles about the wider kinds to which those subjects belong'.[34] To begin with, this theory is very general — one can find this model in every Aristotelian treatise which is not even related to κατά τόν λόγον process — and although true, it tells us nothing about the 'justification by argument' process. In fact, Aristotle says in *Meteorology* I.3, 'Let us then recall our initial assumptions and the definitions given earlier, and then proceed to discuss the . . . comets'. What follows is a list of references to perception (339b11, 339b13, 339b14, 340a9 etc.) and not to reason, at all. Specifically, Aristotle, here is justifying everything that follows by employing his previous assumptions and definitions, which are in accordance with perception. The above only prove, as Karbowski also endorses this idea, that κατά τόν λόγον is indeed not mutually

[33] Karbowski, 'Justification 'by Argument' in Aristotle's Natural Science,' 151-2.
[34] Karbowski, 'Justification 'by Argument' in Aristotle's Natural Science,' 121.

exclusive with perception. However, I am not convinced of what Karbowski defines as 'justification by argument'.

So I assume, for my purposes here, that the concept of justification includes the notions of explanation and confirmation viz. soft justification and strong justification, respectively. Karbowski's interpretation of 'justification' is rather strong since he thinks of it as a procedure that gives sufficient reasons to believe that a thesis is true.[35] However, Aristotle here is arguing about what *could be* possible and not about what *is* true. The study of the comets — as Karbowski also argues — does not result in knowledge in the strict, scientific sense. Karbowski, however, places this study in the wider examination of Natural Philosophy as Aristotle also does while he explicitly places *Meteorology* in the 'scientific works'; he admits that the results of this study can be prone to error and thus open for re-evaluation. Furthermore, the study of the comets does indeed strive for the truth of the appearances but in this case one might not be able to claim that a thesis is true since one is not able to give a reason why a thesis is true. In other words, 'what is possible' cannot be 'what is true'.

It is also evident that in both *On the Heavens* and *Meteorology*, strong justification comes with empirical observations. Specifically, Aristotle criticizes Plato on the basis of observations regarding the elements[36] (*DC* III.7). He also states that the evidence (τεκμήριον) 'that comets have a fiery constitution is the fact that their appearance in any number is a sign of coming wind and drought,' (*Metr*. 344b20-22). This is again, clearly, an empirical

[35] Karbowski, 'Justification 'by Argument' in Aristotle's Natural Science,' 120-21.
[36] We can *see* that earth transforms into the other elements.

observation. And then Aristotle continues by making a negative point about proof, namely, a 'disproof that the comet is not a reflection is that a comet often *appears* independently' (*Metr*. 344b12-18) and then again Aristotle provides a positive proof, namely, that multiple comets are a sign of wind and drought and this is a proof that his theory regarding the fiery constitution of comets is correct — since a dry wind is likely to sustain fire (*Metr*. 344b18-20). So in light of the foregoing, only a discussion about a soft justification (as an explanation) could be held in the context of chapter 7, but as I will show now this is hardly the case, too.

Karbowski endorses the idea (*contra* Bolton) that the limited empirical data are put into use in determining the relevant possibilities. It is evident that the ideas expressed here are in their vast majority in agreement with the views expressed both in Karbowski's paper but also in Falcon and Leunissen's.[37] In an attempt to emphasize the importance of the analogy provided in chapter 7, I argue that 'what is possible' means — at least in this case — first ontologically possible and second epistemically possible. Leunissen and Falcon argue that this possibility is ontological, whereas Karbowski sees it as epistemic; my interpretation lies somewhat in between. As I show, this possibility is firstly ontological in the sense that the two parts of the analogy are ontologically similar and thus, this analogy is both plausible and of epistemic value. My disagreement with Karbowski appears mainly terminological. I tend to believe that the use of the word 'justification' is unfortunate on Karbowski's behalf. As

[37] Mariska Leunissen and Andrea Falcon, 'The Scientific Role of Eulogos in Aristotle's Cael II 12', in ed D. Ebrey, *Theory and Practice in Aristotle's Natural Science, (*CUP, 2015) 217-240.

I claimed in the present paper's introduction, I regard 'justification' as metatheoretical viz., understood as opposed to part of the actual epistemic process or else a heuristics process. Specifically, regardless of the fact that a thesis is true or false if one is to justify a thesis, one needs to explain or confirm a thesis. Explanation and confirmation are regarded as metatheoretical since in order to explain and/or confirm one needs to understand, viz. to have some knowledge over a thesis. Thus, explanation and confirmation are not parts of the heuristic process. In other words, they are not parts of the beginning of a query but rather the results of a query. So even if Karbowski argues that 'what is possible' includes some limited empirical data, these data along with the 'κατά τόν λόγον' cannot justify a thesis. For Aristotle, perceptual experiences of the world do not first and foremost justify our thoughts but, rather, form our thoughts.

What Karbowski fails to see is that *Meteorology* I.7, where the κατά τόν λόγον appears, includes an *analogy* by 'resemblance' (παραπλήσιον, ὁμοία *Metr*. 344a25-27). The observation in question was briefly discussed by Bolton too though was not expounded in depth.[38] Aristotle argues that the comets behave like husks when someone puts a burning torch into them or just drops sparks onto them (*Metr*. 344a25-27). What matters for Aristotle now is the examination of the motion of this fiery comet. He employs the analogy to show that as A is to B, B is to C;[39] in this case: As the burning chaff is to shooting

[38] Bolton, 'Two Standards For Inquiry In Aristotle's *De Caelo*,' 76.
[39] Not to be mistaken for the standard analogy 'as A is to B, then C is to D" which refers to proportion. Also, not to be mistaken for the 'analogy' by example which resembles induction.

stars, shooting stars are to comets. Specifically, as the fire does not at once consumes the chaff but rather it remains ignited in one place for a long time ,so too is shooting of falling stars ('For in shooting stars the fire travels quickly along the length on account of the disposition, namely, in the fuel, that permits it to be easily burned; but if the flame were to tarry and not pass along by consuming the matter, or if the material were very dense, so as not to be swiftly consumed, then, as though the intermediate trajectory had been taken away, there would only be the star standing, as is the case in the beginning and end of the trajectory');[40] and as the shooting of the falling star is to the appearance of the comet ('Thus we can imagine a comet as though it were a shooting star, as such a star is at the beginning and end of its course but with no shooting motion. He therefore concludes that when the source of its consistency was 'in a lower place,' i.e., under the lunar globe, a comet is said to appear by itself, without being accompanied by any star, either wandering or fixed').[41]

It is worth noticing what Aristotle says in *Topics* 156b10-17 — although very briefly — about the argument from likeness:

"Try to secure admissions by means of likeness; for such admissions are plausible, and the universal involved is less patent; e.g. that as knowledge and ignorance of contraries is the same, so too perception of contraries is the same; or vice versa, that since the perception is the same, so is the knowledge also. This argument resembles induction, but is not the same thing; for in induction

[40] Thomas Aquinas *On Meteorology*, trans. Conway, Pierre, and F.R. Larcher. 1964, pro manuscripto. Lecture 11, 72.
[41] Thomas Aquinas *On Meteorology*, trans. Conway, Pierre, and F.R. Larcher. 1964, pro manuscripto. Lecture 11, 72

it is the universal whose admission is secured from the particulars, whereas in arguments from likeness, what is secured is not the universal under which all the like cases fall".[42]

That sort of analogical reasoning seems to be the proper one to ensure generalizations based on likeness. Another example of this use is when Aristotle is addressing the saltiness of the sea:

"Everything that grows and is naturally generated always leaves a residue, like that of things burnt, consisting in this sort of earth" (*Metr*. 358a17).

Karbowski failed to see the use of analogical reasoning here and he just focused his analysis on the Aristotelian arguments regarding causal relations. Wilson noticed that too and calls it 'unity of causes'. Wilson argues that while Aristotle is refuting the theories of his predecessors on an empirical basis, he supports his own theory metaphysically;[43] but this is not the case. Wilson discusses what he calls 'an awkward amalgam of three features, combustion, friction, and reflection'[44] for the case of comets, and although his comments are insightful, they are also irrelevant for the present purposes. He also argues that κατά τόν λόγον means that Aristotle's conclusions must be consistent with the empirical evidence; however, there are very few of those: if Aristotle wanted to show that something is inconsistent with the empirical evidence he would have employed only the empirical evidence, available as he did in *On the Heavens*

[42] Aristotle, 1984, *The Complete Works of Aristotle*, ed J. Barnes, Princeton: Princeton University Press.
[43] Wilson, *Structure and Method in Aristotle's 'Meteorologica': A More Disorderly Nature*, 139.
[44] Wilson, *Structure and Method in Aristotle's 'Meteorologica': A More Disorderly Nature*, 140.

III.7 (and in *Metr*. I.6), and he wouldn't call it according to reason but maybe according to perception (as he did in *On the Heavens*).[45] Κατά τόν λόγον cannot — in any way — replace the role of perception, which furnishes the observer with evidence in the preliminary stage of the inquiry. Here, Aristotle does not seem to argue that his view is according to reason because we can actually *see* that comets are fiery.

It is worth looking at what Aristotle says in II. 3 of *Meteorology*; 'for we must suppose that something happens in the world as a whole analogous to what happens in the phenomena described: just as in combustion' (*Metr*. 358a12-20). The idea is that Aristotle uses analogical reasoning heuristically — mainly — in the investigation of obscure phenomena by ascribing a common cause to them both. Specifically, Aristotle isn't just ascribing a common cause but by analogical reasoning, he acquires knowledge about phenomena hidden from the senses. In other words, Aristotle is using an example of a sensible close at hand, as Taub noticed,[46] in order to be able to understand what is possible regarding comets. However, this is more than a mere example, it is, in fact, more than an empirically based illustration. Aristotle is not trying to provide an empirical base for his conclusions by examples of what is familiar and therefore he is

[45] For a discussion of this see also, Freeland, C. A. (1990) 'Scientific Explanation and Empirical Data in Aristotle's '*Meteorology''*, *Oxford Studies in Ancient Philosophy,* 8:67. Freeland's idea — although expressed very sketchy — is very clear. She argues that these first lines of chapter 7 are an interpolation and as she notes 'one which is Epicurean in tone' (p 102). Freeland's idea stems from the fact that her interpretation of the text lies heavily on the causal relations amongst the phenomena. She provides an analysis of the 'signs' or 'proofs' employed by Aristotle to show in which way his theories are in fact correct.

[46] Liba Taub, *Ancient Meteorology* (London and New York: Routledge, 2003), 98-102. Taub noticed the analogy used by Aristotle here, but she is taking the analogy to be a mere example, an illustration of Aristotle's thought.

neither trying to explain nor to justify his theory. The idea is that since both chaff and comets are parts of the sublunary world (particulars) the 'laws of nature' for both these phenomena must be the same (physics impose such a thing); that is, since chaff can catch fire then the same thing is *possible* with comets, by analogy. As Aristotle argues, we must use evidence of perceptible things in order to gain light on things which are imperceptible (*EN* 1104a1-14). He also states that no one can learn anything at all in the absence of sense (*DA* 432a7-9): even when we have to deal with things inaccessible to the senses our way of acquiring knowledge is still dependent on our perception. Aristotle is very restrained on this matter and he states that we can only give a reasonable account of what is possible when it comes to the comets; evidence of this is the fact that words such as ἐπίστασθαι or ἐπιστήμη[47] do not appear in the text.

For obvious reasons I have avoided to examine further the Aristotelian account of the analogy in texts such as the *Rhetoric*, *Topics,* and *Poetics*, however, I believe that it is worth examining Aristotle's opinion as expressed in the *Posterior Analytics*.

In the *Posterior Analytics* (II 13-17) Aristotle discusses the heuristic value of the analogical reasoning. Specifically, in II.14, he argues in favor of the application of the analogy. In order to formulate problems, Aristotle says, of a given science, i.e, the propositions or connections which one is required to prove, one must select the proper sections (of the subject-matter; the whole field must be mapped out by genera and species). However, there is another way of selection:

[47] That is the perfected state of knowledge and science, respectively.

"There is another method of selection, viz., by analogy. It is impossible to find a single name which should be applied to pounce, spine and bone; yet the fact that these too have (common) properties implies that there is a single natural substance of this kind" (98a20-24).[48]

In this example, also there is no reference to proportion. Aristotle is again claiming that as A is to B, B is to C, as pounce is to spine, spine is to bone and they all share the same features although there is no single name for them all. Here it is implied that there are things which cannot be categorized under the same name but they do share common features, analogous features; in this case it would be absurd for one to suggest that there can be a common name for chaff, shooting stars and comets, however, these all have common features (flammability). Aristotle here is implying that this analogy has epistemic value since these common features of the things compared allow for inferences to the features that follow from the analogous features.

Nevertheless, it does seem like there are some general problems for taking analogy as a part of the heuristic process in the *Meteorology*. One problem for the view that analogies confer a type of knowledge of remote meteora in light of proximate phenomena is that we should expect that Aristotle appeals to this method very frequently in the *Meteorology*. Aristotle does indeed include some analogies (as seen above) in the *Meteorology* but there is no extensive list. I tend to believe that this concern could be tackled by a more thorough research on the *Meteorology*; maybe there are a lot more analogies than the ones that I

[48] Aristotle, *Posterior Analytics*, trans. Hugh Tredennick (Harvard: Harvard University Press, 1960).

addressed here or there are various things which can be regarded as parts of a heuristic process. Probably the epistemic path towards the obscure phenomena is not limited to analogies of this sort.

Another concern is that if we take Aristotle's use of analogy as only probable, that is, it is not related to the truth in the strict sense, it is unclear how this can be considered knowledge in any sense, even if provisionally. I tend to believe that this is hardly a problem. As one can see in the *De Anima* Aristotle leaves room for erroneous thinking. Since, the phenomena discussed cannot be observed in their full extent (there are no concrete/regular observational data) and since Aristotle is engaged to give just a reasonable account for them — which includes an analogy — it can be argued that the process, in this case, is that we follow Aristotle's line of thought and not a strict scientific procedure. The passage from *De Anima* reads:

"Since, the soul can be defined mainly in respect of two differences, through the locomotion and through thinking, understanding, and perceiving.[49] It is believed that both thinking and understanding are something like perceiving (because in both these processes the soul can judge and recognize that something exists). And the ancients used to say that understanding and perceiving is the same thing. As Empedocles said, 'When something is present, the thought of men is raising' and then elsewhere, 'when different thoughts continually present themselves to them', and the same is shown by what Homer said 'such is the mind of men'. All this shows that these (men) take that thinking is something corporeal as perception and take understanding to be similar as

[49] "[…] καὶ τῷ νοεῖν καὶ φρονεῖν καὶ αἰσθάνεσθαι", respectively.

perceiving, as we said at the beginning of this discussion, (yet they should say simultaneously, also, that it can be deceived, since deception is more common in animals, and their soul 'spends' much more time being in deception. Hence, in their view, everything that appears must be true, as some say, or the apprehension of the unlike is a deception, for this is the opposite of recognizing like by like. But deception and knowledge seem to be the same in respect of the opposites).[50] So, it is evident that perceiving and understanding is not the same thing, for all animals have a share in the former but very few in the latter".[51]

There are scholars who argue that the process of the νοεῖν can only be taken as true. However, in the above passage, the distinction between thinking and understanding is one that thinking can be right or wrong but understanding can only be true. Since 'understanding' is related to science in its strict sense (knowing the why of a thing), I am arguing that in this chapter of *Meteorology* we are only dealing with 'thinking'/analogical reasoning.

Related to this concern is why Aristotle would appeal to only a single analogy and not multiple ones, if his account is meant to be tentative. That is, in the case of comets why couldn't Aristotle offer the analogy of someone swinging a torch of burning bitumen just as he does the analogy of burning chaff? Couldn't both, and others perhaps we could devise, capture something about comets? Of comparative interest in this regard is Epicurus' *Letter to Pythocles*. Of course, Epicurus is committed to the principle of understanding

[50] Because the opposites are inseparable, if one knows one, knows the other two, and if one is deceived in respect of one of them then he is deceived in respect of the other, too. Giving an account of successful thinking requires an account of unsuccessful thinking, too.
[51] *De Anima* III.3, 427a17 onwards. The translation is mine.

the heavenly in light of the earthly in order to ally our fears about the divine orchestration of the celestial. But he is careful to admonish us not to accept just one theory or analogy which harmonizes with the phenomena when any other theory or analogy could do just as well. Epicurus, as I take it, is not trying to justify his understanding of any particular celestial phenomenon, rather he is trying to understand, by offering multiple analogical suggestions, what is going on in the heavenly realm. This perhaps might prompt us to wonder why Aristotle, if his analogy is not justificatory, only offers one heuristic analogy, a move identified and condemned as dogmatic by Epicurus and a 'descent into myth' (ἐπὶ τὸν μῦθον καταρρεῖ, 87). This concern can be tackled in two ways. One, Aristotle never actually argued that in light of acquiring knowledge over particulars, multiple analogies could be of use. It seems rather out of context to search for multiple analogies (or for multiples possibilities) when Aristotle himself never addressed this issue. Secondly, it could be rather hasty to compare Aristotle with Epicurus since their goals over the matter of the investigation of nature differ. Epicurus does not seem very eager to discover the truth of the appearances, even more the reason why.

There is also a difficulty of analogy and knowledge. Since the idea is that since both chaff and comets are parts of the sublunary world (particulars) the laws of nature for both these phenomena must be the same, that is, since chaff can catch fire then the same thing is possible with comets, by analogy. It is interesting to consider what 'possible' means in our context of analogy. This is to consider what the tenuousness of this 'knowledge' consists in. Does the tentative nature of this 'knowledge' owe to the nature of analogy or to the nature

of meteora? Is the process of analogy properly or primarily ontological and then epistemic? That is, does the analogy first come about as a description of how things actually are, and then knowledge rides in on the ontological coattails? This seems to leave the option that analogy is primarily epistemological and as a result delivers to us the ontology of meteora. This is a good point to introduce a distinction among analogies. Some analogies, perhaps most, are symmetrical. To take one of Aristotle's own examples: sight is to eye as soul is to body. Both sides of this analogy deal with the matter (eye/body) and the form (sight/soul). Other analogies, such as we see here in the *Meteorology*, are asymmetrical and thus non-proportional. The particular asymmetry is that comets are far from us, while burning chaff is or can be readily experienced by us. In this case the element to which we are building an analogy, the comet, is completely parasitic upon the first element, the burning chaff. We have no relation with the comet, epistemological or otherwise, except by what the burning chaff can tell us about it. Thus, the burning chaff side of the analogy bears a heavy epistemological burden, which extends to shooting stars in order to result in comets. It is because of this asymmetry that the epistemological heavy lifting of the analogy is carried by the source, the burning chaff, and then this understanding is pawned off to the case of the comet, as if we were learning something about the comet. The shortcoming of this kind of analogy about remote phenomena is that its knowledge rests not on the phenomenon itself, but on the analogy. This then, is why knowledge about the sensible particular, normally grounded in the phenomenon itself, is instead in the case of remote sensible particulars, dependent on the (partly) un-empirical heuristic of the analogy. This theory

could be attractive since the knowledge could solely be depended on the phenomenon itself only if the phenomenon itself could be observed in its full extent or if the bodies discussed are celestial — and thus they require a whole other epistemological theory. I do not particularly disagree with the idea that the epistemological burden here needs to be carried by the analogy itself. It would also be interesting to examine every other analogy which *Meteorology* has to offer, in order to investigate whether such an interpretation holds.

One last observation, still in the same line of thought as the previous one, about comets should be made in this regard. At least some characteristics of the comets are able to be acquired empirically as I showed earlier, e.g. that a comet is moving, that a comet is on fire. It is arguable then, that we do move from the phenomenon to the analogy, rather than from the analogy to the phenomenon. The question then is whether we are placing the comets' movement, fieryness, etc. into the machinery of the analogy to produce some knowledge about the comet, or whether that knowledge was there in some sense all along, and the analogy is merely making it clear. That interpretation implies that the analogy at hand serves as a mere illustration or representation of the phenomenon. I tend to believe that as I showed above that couldn't be the case regarding comets since the analogy at issue seems to be the only way to acquire some knowledge over these phenomena. For sure one can see that a comet is indeed moving or that it is fiery but one can connect the dots between its movement and its fieriness only by the employment of such an analogy. An illustration or representation of the phenomenon would have been of much more use if Aristotle had provided a scientific explanation before that — including the

reason why. Then the illustration would have been by far more interesting, clear and explicit.

Concluding Remarks

I am aware of the many instances in which κατά τον λόγον appears in Aristotle's works and of its various purposes; I only use this text (due to lack of space and) because Aristotle here explicitly says that what follows is *actually* a reasonable account.

I have attempted to shed some light on the troubling matter of the obscure particulars and thus over the philosophical questions which surround them. I have shown that Aristotle places comets in the sublunar world and that κατά τόν λόγον arguments which include an analogy are of epistemic value. Such arguments are not justification arguments; however, rather they are a part of Aristotle's method of discovery, and they serve as something more than an explanation and illustration. I showed that such arguments are not employed simply to convince us of the truth of theorems nor of the truth of principles. Specifically such arguments are not related to the truth (in the strict sense) in any way, however, Aristotle is employing them in order to understand obscure phenomena; I am confident that these arguments are 'heuristic arguments'. I have shown that when it comes to justification in terms of a 'correctness' of a theory Aristotle turns to empirical observations since we cannot speak of

justifying something that is so prone to error as phenomena hidden from our senses, such as comets, are.

It is natural to ask whether this argument is sufficient for the soundness of its conclusions. In other words, it is natural to ask whether such arguments are reliable and successful; the answer is no. By comparing those arguments with Aristotle's deductive reasoning one can see that analogical reasoning is only based on a conjecture. In this particular text the analogy is relatively weak and thus the similarity vague since the phenomena compared are both sensibles yet it is superficial to assume that they are both governed by the same natural laws. An argument in favor of that view could be that both phenomena are indeed parts of the sublunar world however their region of occurrence and magnitude differ.

I have strategically avoided examining whether such arguments are dialectical or rhetorical and thus I also avoided to cite the relevant texts — which discuss the argument from likeness — from *Topics* (156b10–17 and 108a13) since I have only focused here on the heuristic function of such arguments, that is their epistemic value regarding obscure particulars. I believe that the discussion about the nature of such arguments is the matter of another essay.

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