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## **Aristotle on dialectic and definition in scientific inquiry**

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MIÉ, F. (2022). Aristotle on dialectic and definition in scientific inquiry. *Archai* 32, e-03216.

**Abstract:** By framing Aristotle’s dialectic in the broader context of scientific inquiry and demonstration, this paper is aimed at showing of what use the “reputable opinions” can be for grasping the principles of sciences, as declared in *Topics* I.2. It argues that such a use cannot imply – at any stage of inquiry – a replacement of the logic and intrinsic goals of demonstration by those proper to dialectic. However, it also defends a substantive (but still modest) contribution of dialectic – beyond its well-attested methodological role in

discarding contradictory opinions and its (possible though not germane to the context of *Topics* I.2) application to proving the principle of non-contradiction by means of refutation. This contribution consists in providing the preliminary accounts of facts in order to have scientific inquiry started, as required in *Posterior Analytics* II.8. To better appreciate how the proposed location of dialectic in a pre-demonstrative stage of inquiry is operational, the paper finally examines *Physics* IV.1-5.

**Keywords:** Dialectic, refutation, definition, scientific inquiry, principles, proofs.

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## 1. Introducing the debate on Aristotle's methodology

Aristotle did not write a treatise on method. By several statements in the *corpus*, however, he shows a particular interest in this topic, notably in *Physics* I.1 and *On the Parts of Animals* I. Since the Symposium Aristotelicum (1960) dealing with the problems of method definitely stirred the Aristotelian scholars' attention on this topic, opposite views about both Aristotle's stance on method and the method (or methods) actually applied in his treatises have been endorsed. The different views span from granting him a "self-conscious attention to method which is displayed in nearly all of Aristotle's major works" (Bolton 1991, 1) to rather occasionally describing him as reflecting and almost as a dilettante about how to do what he is in fact doing quite well without any need to theorize about it (Barnes 1980, 511). Such disagreements are easily understandable for when Aristotle considers method and applies some procedures, he largely deals with more than narrow methodic issues, as it can be easily confirmed in the two aforementioned texts. Among other things, he comes there to speak about the natural way of getting to know principles from what is more familiar to us, and about the priority of formal and final causes over material ones in

providing a correct explanation of animals. But there is an even stronger disagreement among scholars in relation to which method Aristotle is supposed to actually apply. This debate is still dominated by the apparently complete absence of the prescriptions provided in the *Analytics* from Aristotle's own treatises. Recently, this last diagnosis resulted in dialecticism – the position according to which the dialectic of the *Topics* is the method and logic of science.<sup>1</sup>

In this paper, I aim to address this complex debate by focusing on the role that the dialectic can play in providing the preliminary accounts required to start scientific inquiry. I proceed with this work in four steps. First, I consider some aspects of dialectical reasoning, within which the dialectical concern with definitions is easy to be explained in contrast to the requirements on definition raised by demonstration. I side partially with traditionalists, who resist conflating any stage of scientific inquiry with dialectic.<sup>2</sup> But since I also hold that, in order to grasp explainable facts by means of an account, the inquirer must take advantage of the dialectical examination of reputable opinions (*endoxa*). I consider, then, the widely debated passage on the scientific use of dialectic in *Topics* I.2. 101a34-b4. I controvert the received view that it is a proof by refutation of the so-called common principles what is there at stake (as held by Smith 1993; and Berti 1995). The following section is devoted to present the framework of *Posterior Analytics* II.8, within

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<sup>1</sup> Barnes, 1981, p. 57-9 holds that the theory of inference presented in the *Topics* is not only enough to do justice to Aristotelian science, but, crucially, that logic unlocks apodeictic from the “scientific sterility” of the formal syllogistic and its constraints on necessary entailment.

<sup>2</sup> Best represented by Solmsen, 1929, p. 38-58 and *Anhang* I. Traditionalists typically contend that the scientific syllogism (*APo.* I.2 71b18) has little to do with the dialectical syllogism, whose *topoi* (i.e. the points of departure to face problems in dialectical reasoning, see *Top.* I.4 101b11-18, VII.5 155a37-38) cannot be principles of demonstration (Solmsen, 1929, 47 on *Top.* VIII.1 155b7-16). For traditionalism, dialectic represents an old-fashioned way of thought directed towards refuting the opponent and avoiding inconsistencies. Solmsen's developmental contention that the theory of demonstration preceded the theory of the syllogism was admirably argued by Barnes (1981) (even though with consequences that are different from Solmsen's).

which one can still grant dialectic a substantive use to pave the way to the principles of sciences – a use which goes beyond the extensive methodological application of diaporematic aimed at refuting contradictory opinions and discarding wrong views. In the last section, I show how the integral role of dialectic in scientific inquiry is operative in Aristotle's discussion about place in *Physics* IV.1-5 – whose usual association with the dialectical method of *Nichomachean Ethics* VII.1 is also rejected.<sup>3</sup>

Problems do not lie in the idea that Aristotle makes an extensive methodological use of both dialectical refutation and dialectical instruments (*Topics* I.13) in doing science. Dialectical examination and refutation come to be at the service of “discerning the true and the false in any subject” (101a35-36);<sup>4</sup> and diaporematic (which consists in the examination of opposite views) regularly helps to discard several claims that contradict the most commonly held beliefs (as stressed by Brunschwig, 1967; Brunschwig, 2000; and Primavesi, 1996, 35ff. On diaporematic, see Cleary, 1995; and Rossi, 2017). Further, the principle of non-contradiction in *Metaphysics* Γ4 can be only proved by refutation (*apodeixai elenktikos*, 1006a11-12). (Berti, 1995, 281 (n 70); on proof by refutation, see Lear 1980, 98-114). However, this is far from making the dialectical method into the very logic of scientific inquiry and demonstration, nor does it make (as I will argue) such common principles coincide with those aimed at by the scientific use of dialectic in the challenging passage in *Top.* I.2 101a36-b4. In my view, a better explanation of the scientific use of

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<sup>3</sup> Supporters of dialecticism (inspired by Owen, <sup>2</sup>1980; and Wieland, <sup>3</sup>1992, with the antecedents of Mansion, <sup>2</sup>1987; and Le Blond, <sup>2</sup>1970) put the *Physics* under the spotlight of the dialectical method – understood as a conceptual analysis of reputable opinions or *endoxa*, which, at most, are illustrated or confirmed by empirical observations, but not at all grounded by them. This position amounts to a coherentist criterion of truth and justification (clearly in Nussbaum, 1986; see also Barnes, 1981; and Berti, 1995; and Berti, 2004). To Irwin (1988, 37ff, ch. 3), the “constructive dialectic” can reach the first principles. For a critical assessment of this view, see Smith (1993, 336-37). The method of ethics is lively discussed (for two antecedents, see Zingano, 2007; and Frede, 2012; and the echo in Zillig, 2017).

<sup>4</sup> The same method is described in detail in *Met.* B.1 995a24-b4.

dialectic and its relationship with the most important principles of demonstration, i.e. definitions (*APo.* II.17 99a21-23), requires a different framing. When it comes to explaining *Topics* I.2, then, we have to ask how the dialectical examination of reputable opinions could be of real use to discovering definitions in science. My suggestion here will be that dialectic, working together with observation, plays its own role in providing the hybrid empirical basis for inquiring into principles. Since the perception involved in the inductive basis to get principles (*Posterior Analytics* II.19; *Physics* I.1) is not just a supply of sense data, inasmuch as perception crucially involves interpretation, the interpretive resources of *endoxa* may justify my former claim about the substantive contribution of dialectic to scientific inquiry.<sup>5</sup> In fact, *endoxa* can afford a crucial ingredient of the prior knowledge required for grasping facts in a non-coincidental way (as claimed in *APo.* II.8 93a27-29)<sup>6</sup> and for further elaborating full explanatory definitional principles (which, however, can be only achieved in doing demonstrations) – as stated in II.17 99a21-23 by saying that the definition is the explanatory middle that conveys the account of the major syllogistic term (see II.8 93b12). Now, on the one hand, this runs into making all science to rely heavily upon definitions (Bolton 1987, 121); but, on the other hand, the former claims about prior knowledge require us to single out the procedure than can supply the inquirer with preliminary accounts. So, the proposal I here explore is that the *endoxa* must be placed (as a distinct source in association with perception) at the stage of experience that, as Aristotle has it in *Prior Analytics* I.30, after having established the real explainable facts (*ta hyparchonta peri hekaston*, 46a23), can provide the principles and the demonstrations

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<sup>5</sup> This is to distinguish Aristotle's from naive empiricism as well as to contrast the grounding provided by his demonstrative principles from foundationalism. Contrarily, Irwin (1988, 30ff, 35f, 117ff, 127ff, 130-33) blames Aristotle for both commitments.

<sup>6</sup> Prior knowledge is required for further elaborating intellectual knowledge, as stressed in *APo.* I.1 71a1-2. See Bronstein (2016, 15f).

(*diotimas men archas tas peri hekaston empeirias esti paradounai*, 46a17-18) (Lennox, 2011).

## 2. Definition, and the logic of dialectic and science

One way to avoid any conflation of dialectic and science is to consider the different roles played by definition in each of them. Remember that definitions are the crucial principles of demonstration since, in their being a posit of the essence (*APo.* I 2.71a21, I.7, I.10) – of primary and subordinate subject-kinds (i.e. genus and species) as well as of *per se* accidents (*sumbebekota* or *pathe kath'hauta*) –, they play the proper explanatory role. Aristotle claims that knowing the essence amounts to the same as knowing the explanation (II.2 90a14-15). In describing scientific knowledge (*episteme*) in *Posterior Analytics* I.2, Aristotle already establishes that that knowing the cause and having the demonstration is a sufficient condition for having *episteme*. Yet, it is not until book II (2 90a5-7) that it will be clear that knowing the cause is attained by having the demonstrative middle term, and that for subject-kinds (like moon) as well as for demonstrable attributes (like eclipse), knowing the essence is explanatory of what these items are, although only the second kind of essence (i.e. that of demonstrable attributes) will be known through a demonstration (II.9):

We think that we have scientific knowledge of each thing without qualification [...] whenever we think that we know the cause [...] we say that we do in fact know through demonstration. And a demonstration, I say, is a scientific syllogism; and a scientific <sylogism>, I say, is one in virtue of which, by grasping it, we know scientifically. (71b9-19)<sup>7</sup>

Providing the two main features of *episteme*, i.e. causally explaining that a fact is necessarily as it is, requires, ultimately, that

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<sup>7</sup> I prefer here Bronstein's (2016, 35-8) translation; otherwise, I quote from Barnes (<sup>2</sup>1993).

demonstrative premises must fulfill several constraints (71b19-22). Crucially for Aristotle's model of science, premises must contain the cause of the conclusion (71b22) – knowing the cause amounts to grasping what is prior by nature or *simpliciter*, in that this item is explanatory of why a fact necessarily occurs as it occurs (71b30-31; *Ph.* I 1.184a10-14). This also justifies why one must have knowledge of the primitives in a higher degree (72a25-b4). Now, in the *Top.* I.1 100a34-b23 he draws the same contrast between the starting-points of demonstrations, which are true and primary and get their trustworthiness through themselves, and the dialectical starting-points, which are acceptable only in that they seem so to everyone (or to most people, or to the wise). In the same vein, *Topics* I.1 100a27-b21 (*SE* 2.165b1-4; *APr.* I.1 24a22-25; *APo.* I.19 81b18-23) characterizes the scientific *sylogismos* as being from true and primary starting-points, whereas the dialectical *sylogismos* only needs to start from reputable opinions.<sup>8</sup>

In the *Topics* as in the *Posterior Analytics* (II.5 and II.13), division is the regular procedure to define subject-kinds (like man and moon). Aristotle claims that, in order to get a definition, the definer should include, first, the genus, and, second, the *differentiae* that are predicated in what it is (VII.5 154a26-29). Similarly, in *Posterior Analytics* II.5 91b28-30 (*ho ek tes diaireseos legon ton horismon*, 91b36; *en tois diaretikois horois*, 91b39) he gives advice to avoid shortcomings in doing a division (91b24-27): assume every term in what it is; then divide by order or consecutively, and postulate the primitive (i.e. the next *differentia* downwards) not passing anything over; finally, make the whole genus fall into the next division, leaving nothing out (91b28-32); this results in getting an indivisible species (91b30-32; see the parallel in 13 97a23-26, which summarizes the procedure described and the difficulties faced in

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<sup>8</sup> Aristotle sharply distinguishes arguments according to the truth in science from arguments according to opinion in dialectic (*Top.* I.14 105b30-34, VIII.13 162b31-33; *SE* 34 183a37-39). See Smith, 1993, 336.

96b35ff).<sup>9</sup> However, the contrasting approaches to definition in dialectic and science concern the encompassing distinct logics and methods into which definition is enrolled in each of them (on this, I agree with Smith, 1993, 341-43; and Bolton, 1987, 148ff (n 43)). Let us take the *topoi* about definition considered at the beginning of *Top.* VI.1 139a24-35; they include formal aspects that rule on any practice of definition; for example, the definition must be true about everything to which a corresponding specific name is applied. Another *topos* comes close to what has been noted in 154a26-29: the definer must, first, put the genus and, then, add the *differentiae*. Further, the *definiens* must be proper to the *definiendum*; and the definition must grasp the essence. But the goal in the dialectical practice is just to consider these formal aspects as *topoi* (“places or points of argumentative attack and locations under which to file arguments”, or also “guidelines for testing claims”)<sup>10</sup> for the examination and refutation of a purported definition. In strong contrast to what happens in science, the dialectic is not at all embedded into a search for essential features than can help the inquirer to find the explanatory middle. As made clear in *Top.* VI.14 151b3-23, definition is here considered from the very different perspective of the method and goals of dialectical reasoning, which, in this case, consist in devising a further place to attack (*epicheirein*, 151b3, b5) whoever is doing definitions by means of a composition of parts. So, the place here considered consists in attacking the whole definition (made from parts) by demolishing the already known parts.

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<sup>9</sup> See Ross, 1949, 620; Detel, 1993, II 597. Definition by division is also blamed by Aristotle for begging the question by inadvertently putting the definition in the middle term (*APo.* II.4 91a31, 91b7-11). But still, he acknowledges that the definer can show or make something known (91b35). It is particularly problematic which kind of reasoning division is (it cannot be a deduction: *APo.* II.5 91b35-a5, 7 92a35-38) for, besides deduction, induction is the only other one valid (*APr.* II.23 68b13-14; *APo.* I.1 71a5-6, II.5 91b33-35; *EN* VI.3 1139b26-28). Clearly, division seems to be neither of them.

<sup>10</sup> The first translation is Smith’s (1997, xxviii); the second is Bolton’s (1987, 149). On *topos*, see Smith, 1997, xxiv-xxxiv; Smith, 1993, 348-49; Primavesi 1996, 83-113. For a skeleton of the dialectical argumentation, see Smith 1997, xxviii; and Solmsen 1929, 52; for a different emphasis, see Bolton 1999, 66-73.

As I said, the rule of setting nothing aside and excluding whatever is redundant to get a *definiens* correctly (151b20-23) may lead to an outcome partially similar to *Posterior Analytics* II.13 (96b35ff, together with the three rules to establish a definition in 97a23-26). But still, the important point is that while the purpose in the *Analytics* is to frame definitions by division in the search for the explanatory essence (for a congenial view, see Lennox, 1987), the true goal in the *Topics* is just to foster the practice of the dialectician: “so that one is better supplied with means of attacking” (151b22-23).

The above presented clear-cut between the scientific and the dialectical treatment of definition may be challenged by *Top.* VII.3 153a11-12, a23-24, where Aristotle contends that definitions cannot be reached by deduction and are just assumed as principles in science (153a8-11). He then suggests that there could be some deduction of the definition and the essence (153a12-15). This may be a controversial reference to a central claim about essences that are known only by or through demonstration, as made in *APo.* II.8 93b15-20.<sup>11</sup> It is a matter of controversy, however, how this possible reference to the *Analytics* should be interpreted.<sup>12</sup> Be that as it may, the relevant point to me is that where the *Topics* addresses some issues that are crucial for scientific inquiry, as definition it is, it immediately demarcates the limits of their dialectical treatment. In fact, the dialectic is concerned neither with the problem of deducing a definition nor with locating it within the task of demonstration, but rather with establishing definitions (153a7) in view of the dialectical purposes, which are served by the *topoi* considered in 153a26ff. In *Top.* VIII.1 156a27-b3, the dialectician’s goal in looking for definitions is just to grasp universal premises in order to avoid easy and misleading objections (156a27-28, b3). And in *Topics* VII.5, definition is studied by means of the *topoi* (155a37) in view of the

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<sup>11</sup> A demonstrable attribute (e.g. eclipse) is known by showing “the causal relation among the items signified by the syllogism’s three terms” (Bronstein 2016, 150f).

<sup>12</sup> Barnes, 1981, 45f assumes that, contrarily to what is stated here in the *Top.*, the *APo.* rejects any deduction of definitions whatsoever, and so he believes to find here grist for his mill: the *Top.* are not familiar with the syllogistic of the *Analytics*.

two overwhelming goals of dialectical argumentation, i.e. to establish or to overthrow (*kataskeuazein e anaskeuazein*, 154a23) the interlocutor's claims.<sup>13</sup>

On the face of this, the logic underlying the *Topics* can hardly be thought to bear demonstrations. Consider the following argument. If it is true, first, that according to the proper method and goals of the practice of dialectical argumentation, dialectical procedures have their own logic – i.e. the several logical forms of argument related to the *topoi* – (Smith 1997, xxxiv; on the dialectical syllogism, see Primavesi 1996, 59-82), and, second, granted that demonstration has a different purpose and requires another logic,<sup>14</sup> then it seems plausible that dialectic can hardly provide the logic and method for knowing the proper principles of science just because dialectical inferences cannot be the logic used by the inquirer in doing demonstrative proofs. However, this is exactly where dialecticists pick up the ball by claiming that dialectic is still the method followed by Aristotle in the discovery of the principles, while demonstration and its syllogistic background are just a device for the exposition and

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<sup>13</sup> The *Topics* are best seen as providing recipes for choosing premises (Weil, 1975) in order to argue about any problem from reputable starting-points by means of a question-and-answer procedure (*Top.* I.10-11; *SE* 34 183a37-b1). A dialectical premise (*protasis*) is a question (*erotesis*) that asks about what is put forward for acceptance (or rejection) and takes one part of the contradiction (*Top.* I.4 101b28-36, 10 104a8-9; *SE* 10 171a38-b2, 11 172a15-20; *Apr.* I.1 24a25; *Rh.* I.1 1355a33-35) (Primavesi, 1996, 66). Asking questions about opposites is possible due to the unspecific nature of dialectic (*Rh.* I.1 1355b8-9) as well as to the fact that it does not demonstrate anything (*APo.* I.11 77a32-35; *SE* 9 170a20-36) – a feature that, in turn, is justified by the fact that dialectical starting-points are just common opinions (*koina*). Further, a dialectical proof is by refutation (*peirastike*, *SE* 11 172a11ff), unspecific, and by no means a strict demonstration (170a35-39) (Solmsen 1929, 50 n1, 52). In 172a13-15, Aristotle adds that in spite of considering common things as its starting-points, the dialectician does not possess universal (strict) knowledge (*SE* 9 170a38-40, 170b9) neither to make all things fall under one single genus nor to consider the same principles for all things. *Peirastike* is described in *SE* 34 183a37-b1 as the regular dialectical reasoning that aims at the examination of any problem from the most reputable opinions. For a different evaluation of *peirastike*, see Bolton 1999, 69-85, 98f.

<sup>14</sup> Perhaps the logic of demonstration comprehends the inferential reasoning of the *Topics*, but still it is, in the end, different from it in several crucial points.

teaching of knowledge (see Barnes 1969; and Barnes, <sup>2</sup>1993, xviii ff (demonstration is not a method for inquiry, but for teachers who provide a formal account of already achieved knowledge)). But there are reasons to think that this labor division between discovery (assigned to dialectic) and justification (assigned to demonstration), as it stands, is, in the end, untenable, because the dialectic is largely insufficient and, ultimately, inappropriate to establishing the principles of demonstration. In fact, the very logical form of the dialectical reasoning (which consists in examination and refutation of reputable opinions) can hardly afford the logical strictures that are required to demonstrate (which mainly consists in getting explanatory proper principles that can really give an account of facts).

By these very reasons, the dialectical examination of opinions cannot be enough to find the demonstrative principles; and similarly, the dialectical syllogism, whose starting-points are *endoxa*, can hardly fulfill the requirements of the scientific syllogism, whose premises, as we have seen, are of a quite different nature.<sup>15</sup> For my part, by assuming that the syllogistic is the logic that can really bear demonstrations, I only need to be committed to the rather minimal claim that the Aristotelian demonstration requires the categorical syllogistic. Besides couching demonstrations in the syllogistic schemata (*APr.* I.23 41b1-5, I.25 41b36-38) and stressing that the first syllogistic figure suits best for demonstration (*APo.* I.14), Aristotle is well aware of the connection between the cause in genuine demonstrations and the middle syllogistic term (*APo.* I.23 84b23-25, II.2 90a9-11, II.9 93b25-26). As we have seen, the syllogistic seems to frame even the description of *episteme* in *Posterior Analytics* I.2: scientific knowledge (*episteme*) is reached only by means of a demonstration (*di' apodeixeos*, 71b17), i.e. by a

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<sup>15</sup> For the general description of deduction (*sullogismos*) in terms of a reasoning in which, having put some things as premises, some other thing results as a conclusion by necessity just because those things have been put, see *APr.* I.1 14b18-23; *Top.* I.1 100a25-27. This formulation can host a stricter notion of deduction in terms of propositions having a syllogistic form and with the premises being exactly two. I follow Lear (1980, 9-11) in taking the syllogism to be a proof that is an argument with sentences functioning as premises and a conclusion that follows by necessity.

scientific deduction (*syllogismon epistemonikon*, 71b18) than can really bear the cause (*aitian*, 71b10, b29-31) in the middle term (as specified in II.8; the four causes are conveyed in the middle, II.11 94a23, a35-36), and whose starting-points must be proper principles (*hai archai oikeiai tou deknymenou*, 71b23). Aristotle also holds that all deductions and all demonstrations must be conveyed in technical syllogisms in one of the three figures (*APr.* I.23 41b1-3, I.28 44b6-8). Therefore, it seems fair to assume that the syllogism cannot be just an accidental adjunct to a syllogistic-free theory of demonstration. Now, the recognition of these facts provides the *Posterior Analytics* with a more rigorous conception of logical entailment than what we can safely draw from the *Topics*.<sup>16</sup> In any event, if in reading next *Topics* I.2 the dialectical examination of reputable opinions can be still granted with a contribution to finding the principles, I will have to duly qualify such contribution.

### 3. Bridging the epistemic gap between dialectic and science in *Topics* I.2

The problem of finding a scientific use for dialectic heavily relies on clarifying the contribution of *endoxa* to inquiry. This can hardly be done with new traditionalists (Smith, 1993, 344ff; Brunschwig, 1967, xxii ff, 117; Brunschwig, 2000; Primavesi, 1996, 48-58), who,

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<sup>16</sup> As claimed by Barnes (1981, 17-9, 20ff, 33-4, 57-9); *contra* Smith (1982, 327-28 (theses 1 and 3)); and Detel (1993, I 158-88). Barnes (1981, 28ff, 51f, 57-9) admits that there is often a presupposition of syllogistic competence in *APo.* – though one that lastly hamper demonstration by imposing on it the bonds of universality and necessity (Barnes, <sup>2</sup>1993, xv f). However, he still insists that *APo.* works with “a pre-Syllogistic Apodeictic” that runs into the *Topics*. Solmsen 1929, 52ff preferred to think of an autonomous early syllogistic (applied in an early theory of demonstration) that centers upon the first syllogistic figure and is based on super- and subordination of *eide*. On the opposite side, Ross (1949, 6-14, 19) is right in stressing the impact that the syllogistic should have had on the much elaborated theory of the different types of principles in *APo.* I.2, I.7-11. Then, also the assumption about the finitude of the middle terms in *APo.* I.20 could hardly be formulated without taking full account of the immediacy condition (linked to the syllogistic and the theory of predication). Detel (1993, II 158-60) rejects a weaker deduction for Aristotelian demonstrations.

by restricting dialectical exchange to being an argument directed towards attacking (*epicheirein*) the opponent's beliefs, make it to proceed in an *ad hominem* argumentation – a belief would be a reputable opinion *for someone* (Smith, 1993, p. 357, n. 16). Arguably, this description of dialectic covers the first use (designed for mental training) (*Top.* I.2 101a28-30) as well as the second (in encounters with laymen) (101a30-34; for *enteuxis*; see *Rh.* I.1 1355a29). It also matches quite well with the description of the general goal of this treatise at its very beginning: to find a method to construct deductions from reputable opinions concerning any problem that is proposed, and, when submitting to argument ourselves, not to say anything contrary (100a18-21). As we have seen in book VIII, this goal of dialectical reasoning crucially relies on instructions to make tables of opinions for the dialectician (101a31) as well as on collecting *topoi* in order to attack different sorts of opponents. However, it remains obscure how the unspecific art of critical examination and of proving by refutation could make a positive contribution to inquiry.<sup>17</sup> To face this problem, I have to consider the passage on the scientific use of dialectic (*pros de tas kata philosophian epistemas*, 101a34):

It is useful in relation to the philosophical sciences because (a) if we have the ability to go through the difficulties on either side we shall more readily discern the true as well as the false in any subject. (b) Furthermore, it is useful in connection with the first of the principles about any individual science. For if we reason from the principles appropriate to the science in question, it is impossible to make any statement about these (since these principles are first of them all), and it is by means of reputable opinions about each <science> that it is necessary to give a treatment of those <principles of science>. But this is peculiar or most appropriate to dialectic: for since in being examinative (*exetastike*) with respect to the principles

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<sup>17</sup> Primavesi (1996, 54-8) speaks of an *indirect* usefulness of dialectic by means of a previous exercise (*Vorübung*) in discussions; against dialecticians and by sharply distinguishing the *egagoge* of principles from the dialectical syllogism, he also rejects that dialectic can immediately provide the *archai* (with reference to *Rh.* I.2 1358a23-26).

of all studies, it provides a way <to them> (101a34-b4).<sup>18</sup>

To begin with, the third use of dialectical art covers two different aspects. The first (= (a)) is easily understandable: it consists in going through the difficulties on either side of opposite opinions (*pros amphotera diaporesai*, 101a35) with the intention of discerning more readily what is true and false in any subject (101a35-36; notably in VIII.14 163a36-b16, exercising, attacking, and refuting are linked to what is achieved by means of diaporematic, namely, being able to deal with difficulties and choose the right option between opposite views).<sup>19</sup> The second aspect (*eti de pros ta prota*, 101a36) (= (b)) contains what is most appropriate to dialectic (*idion e malista oikeion tes dialektikes*, 101b2). Now, this second aspect is described by means of two crucial terms: examination and scientific principles. It should be noticed that it is not said in the text that the dialectic is sufficient to reach explanatory principles; in this regard, what the text states is more modest: paving the way to the principles is the most proper service that, in its scientific use, the dialectical argumentation can provide. But then what does dialectic really examine?; and how could it help to pave the way to the principles? (*exetastike gar ousa pros tas hapason ton methodon archas hodon echei*, 101b3-4); further, which are the principles mentioned here? In keeping with the reading of the logic and goals of dialectic I have presented in the previous section, I shall explore the following *modest* answer to these questions: dialectic can really help to start the scientific discovery of principles by means of providing something of what the thing is, i.e.

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<sup>18</sup> I freely rely on Smith's two translations (with slight modifications) (1993, 352-54; 1997, 52-5). Although Smith's proposal about singling out a fourth use of dialectic in 101a37-b4 (= (b)) is controversial, he is certainly right in stressing that the relationship to the first principles and the standard diaporematic in 101a34-37 (= (a)) cannot be just taken for granted.

<sup>19</sup> The inquirer's commitment with what is really held (*ta dokounta*) and what is thought not to be false is stressed in *Top.* VIII.5 159a28-30. The rule of giving priority to the most reputable opinions is Aristotle's formalization of dialectical encounters in view of both testing and inquiry (*peiras kai skepseos*) (159a32-37). See Smith 1997, 129. The examination of opposed views is broader than the proof by refutation. On examination and refutation, see Rossitto, 2000, 271ff.

a *preliminary account* of the essence. This can be deemed a *substantive* contribution indeed to be done by means of the examination of reputable opinions in a reasoning that attacks the opponent's views and that, by applying the regular diaporematic procedure, aims at distinguishing what is held to be true. Admittedly, this suggestion is, to some extent, speculative; but it could be made plausible if, by its means, one can provide a better explanation of the inquirer's practice (staged in Aristotle's treatises) without going beyond the limits of the dialectical reasoning. To put it more bluntly, my suggestion is that the outcome of examining reputable opinions in diaporematic can be put at the service of the proper goals of science; to that extent, the dialectical reasoning turns out to be an integral part of the method and logic proper to science, which is inquiry into the principles and demonstration of facts.<sup>20</sup>

For bridging the gap between dialectic and science we only need to grant dialectic a special use with regard to the discovery of scientific proper principles by means of its regular examinative capacity (*exetastike*, 101b3). By the same token, the very fact that the examination of *endoxa* can provide the inquirer with some elements of a preliminary account allows us not to overrate dialectic. This suggestion also indicates which concrete method can be used by dialectic to fulfill such a special contribution: examining reputable opinions – a procedure which is sufficiently familiar in many starts of Aristotelian treatises, where he is up to find out preliminary accounts.<sup>21</sup> In any case, the textual evidence in *Topics* I.2 does not recommend taking *protai archai (hapanton)* in 101a39 to refer to

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<sup>20</sup> It is an outcome of this (and not its explanation) that the expert's claims (whenever they do not contradict what is noted or reputed; otherwise, they are paradoxical opinions, *Top.* I.11 104b19-20) are among the dialectical premises (*Top.* I.1 100b22, 10 104a11-15, a33-37, 14 105a36, b1).

<sup>21</sup> It is not necessary to rely on any special set of reputable opinions that could ground demonstrative principles. Bolton (1999, 95-99; 2009, 70ff) argues that, on the basis of the most reputable opinions, *peirastic* (*Top.* VIII.14 163b32, 37, 164a3, 7-11; *SE* 11.172a29-34 etc.) provides us with a reasonable (*eulogos*) justification, particularly when there is a lack of observational data. Although I can generally agree on this, I doubt that *peirastic* dialectic (which implements a proof by refutation) really explains the scientific use of *endoxa*.

*common* principles; in fact, *hapanton* may stand there just for the entire set of demonstrative principles, which are referred to by means of *oikeion* in 101a37-38, fairly meaning *proper* principles. Thus, the sentence from 101b37-b2 (“For if we reason from the principles appropriate to the science in question, it is impossible to make any statement about these [...]”) would just insist on the fact – likely related to the theory of principles of *APo.* I.2-3 – that the principles cannot be proved because they are primitives. Again, the most natural reading of *peri hekasten epistemen*, in 101a37 recommends taking “each science” as referring to *particular* sciences; and similarly, the parallel use in *pros tas hapason ton methodon archas* (101b3-4) suggests that the reference in view of which the contribution of dialectic must be considered is the principles belonging to each particular science (mathematical principles for mathematics, etc.). Hence, I can confirm that there is no compelling reason to find here the so-called common principles involved as the very objects of a dialectical proof by refutation. Quite the contrary, if the dialectic has a road to the scientific principles, I suggest, then this road must lead the inquirer towards the items distinguished in *Posterior Analytics* II.1-2.<sup>22</sup>

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<sup>22</sup> According to the received view (see Smith, 1993, 352), the unrestricted field of dialectic is linked to the universality of axioms. But besides being far from evident that the *archai* and *protai* of the *Topics* passage correspond to the *axiomata* of *APo.* I.10 76a37-b2, b14-15, the common principles are not considered in the stages of inquiry (as mentioned in *APo.* II.1-2). One may object that in I.11 77a26-35 Aristotle links dialectic and common principles. However, upon reflection, it is not explicitly said there that the *koina* are demonstrative principles (as the proper principles undoubtedly are), but rather that they are just used by sciences as that from which they prove something (*koina [...] hois chrontai hos ek touton apodeiknentes*, 77a27-28). In spite of being declared primitives from which (*ex hon proton*) demonstrations proceed (76b14-15), the axioms are not assumed in the premises (77a10-11), and so their role is justifiably a source of controversy among interpreters (see Ross 1949, 56). We can safely state, at most, that the *axiomata* apply analogically to different sciences (76a38-39), and that the concern of dialectic with all sciences (77a29-30) can be by means of a proof of the axioms by refutation (*ei ti katholou peiroito deiknynai ta koina*). Notwithstanding, it remains true that this does not oblige us to project such proof back to *Top.* I.2.

Finally, it is worth stressing that, according to my suggestion, dialectic dispenses just a *preliminary* account. This is so because an account that gathers its data from *endoxa* (and perceptions) still lacks what can provide us with the *full explanatory* account. An example may make this clearer: “noise in the clouds” is the sort of *preliminary* (or *partial*) account of *what* thunder is, and (as we will see next) it allows the inquirer to establish *that* there is something like thunder (*APo.* II.8 93a21-29). In a sense, “noise” and “thunder” are not interchangeable names for the major syllogistic term (in spite of 93b9-12), because only the former conveys our initial grasp on what can be then singled out by the more specific “thunder.” Two points are called for at this juncture. First, preliminary accounts are both useful and necessary because they allow the inquirer to distinguish, for instance, thunder from other possible similar facts (noises) that may occur in the clouds. And second, if the *endoxa* that stand after examination can really provide such preliminary accounts, then dialectic can be still of some help to start the inquiry into principles.

#### **4. *Endoxa* in the preliminary accounts of inquiry: *Posterior Analytics* II.8**

Until now, I have suggested that *endoxa* are epistemologically located at the first stage in the bottom-up process of inquiry, which sometimes Aristotle refers to as starting from what is more intelligible to us (in contrast to principles, which are more intelligible without qualification, see *Posterior Analytics* I.2 71b4-72a5). More particularly, by conceptually framing our perceptions the *endoxa* can bestow the interpretive feature that is proper to experience. But I still have to explicate the scientific framework in which the dialectic can be of use to get principles from reputable opinions. This is what I aim to do in the two last sections of this paper.

In *Posterior Analytics* II.8-10, Aristotle answers to the difficulties raised in II.3-7 about definition and demonstration (mainly, what definition is, and whether that of which there is a definition can be also a demonstration, or rather not; 93a2-3). At a

critical point in 93a27-29, he claims that some understanding of the essence is required to establish that something is the case. Recall the four items of inquiry in II.2 90a9-14: (1) *if S is P*; (2) *why S is P*; (3) *if there is such a thing as an S*; (4) *what S is* (Barnes, <sup>2</sup>1993, 203; Bronstein, 2016, ch. 7). My proposal is that the dialectical examination of *endoxa* can contribute to the scientist's goals, i.e. to determine the account of what we find in questions (1) and (3), by providing the prior knowledge required to finally grasp *what S is* (i.e. question (4)) and so to give an explanation of why *P* holds of *S* (question (2)).<sup>23</sup> This is not the place for a full treatment of *Posterior Analytics*; so taking this picture for granted, I will restrict myself here to clarify which the *substantive* contribution of *endoxa* could be within these stages. Let me begin by stressing that in *Posterior Analytics* II.8 Aristotle claims that the inquirer cannot really get the knowledge of facts without grasping something of *what* the thing is – on the contrary, an incidental grasp does not provide the inquirer with the required previous knowledge:

But as to whether it exists, sometimes we grasp this incidentally, and sometimes by grasping something of the object itself – e.g. of thunder, that it is a sort of noise in the clouds [...] When we know incidentally that something exists, necessarily we have no grasp on what it is; for we do not even know that it exists [...] But when we grasp something of the object, the business is easier. Hence in so far as we grasp that it exists, to that extent we also have some grasp on what it is. (II.8 93a21-29)

As Aristotle states here, the explanatory business is easier when we have some grasp on what it is (93a28-29). This is the import of non-accidentally knowing that something is the case by being aware of (something of) what it is. As it is made clear later in the chapter, grasping something of the thing itself (*echontes ti autou tou pragmatos*, 93a22) is attained by means of descriptions like “a sort of privation of light” about eclipse, or “a sort of animal” about man

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<sup>23</sup> For the suggestion that the explanation of why *P* holds of *S* (eclipse holds of moon) depends ultimately on the essence of *S*, see Bronstein, 2016, 48 (*passim*).

(93a22-24).<sup>24</sup> So, having such accounts is necessary in order to set the most proper step of causal inquiry into motion:

When we grasp that this exists, we seek why it is. But it is difficult to take anything in this way if we do not know that it exists. (II.10 93b32-33)

One way of taking something in that way is by means of a name-like account that states what something means (93b30-32), i.e. an account of what it is.<sup>25</sup> This is the first sort of definition, which does not provide the cause yet – this is provided, rather, in the second sort of definition, which makes it manifest the cause (93b33-94a7) of things whose *aition* is different (93a6, 93b19) and whose essence, therefore, cannot be known without demonstration, as said in the corollary of II.8 93b18-19 (*out aneu apodeixeos esti gnonai to ti estin, hou estin aition allo*). So, the essence of things (e.g. eclipse) having a middle and a cause that is different from the subject (moon) can be only known through demonstration (without making the essence, though, into a demonstrable item) (II.9 93b25-28, I.3 72b18-32; *Met.* E.1 1025b10-18; *Ph.* II.1 193a1-9).<sup>26</sup>

Accounts like “privation of light” and “noise” are, as I said, only *preliminary* and *partial* for they have not conveyed a *full* scientific definition yet, which can play the role of a true explanatory principle – in fact, they do not convey the cause (interposition of the earth or

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<sup>24</sup> For the cognitive force of *echomen pros to ti estin*, see Bolton, 1987, 132 n 26. Bronstein, 2016; 156f stresses that, at that point, the inquirer knows only *part* of the essence. A combination of their interpretations is possible: the locution refers to the epistemological state in which the inquirer, being (non-accidentally) aware *that* this is an eclipse, knows it *initially as* a certain loss of light, which is only a *part* of what an eclipse is (the other one is the cause). While the initial account corresponds to the nominal definition, the explanatory definition contains the causal middle (*APo.* II.10 93b30-32 and 94a1-7).

<sup>25</sup> On the contrary, an accidental grasp would amount to dealing just with meanings (*APo.* II.7 92b5-8), yet without coming to know neither real facts nor what they are.

<sup>26</sup> Demonstrable attributes (e.g. thunder, eclipse, and the like) are in contrast to units, whose essence is immediate and a principle, and not explained by means of a cause that is different (93b22-25).

quenching of fire for eclipse and thunder respectively). Only when such an explanatory definition is elaborated (which is done by means of demonstrations and by looking for their first explanatory principles), the inquirer is finally in a position to sufficiently single out that sort of privation of light as an eclipse and that sort of noise as a thunder, as well as to distinguish them from, say, lunar phases or other noises in the clouds.<sup>27</sup> It comes to no surprise that, since the preliminary accounts convey the explained fact – but not immediately the explanatory principle –, Aristotle places them in the conclusion of a demonstration (II.10 94a8-9, a13-14).<sup>28</sup>

The role of *endoxa* within inquiry that is here suggested may be clarified by briefly considering Aristotle's statements on *what is more knowable to us* in *Physics* I.1. Aristotle claims that the discovery of principles starts from a complex that is more knowable to us (184a24-b11); this is a whole available to sense-perception, which comprehends many particulars referred to in an indiscriminate way. The *Physics* conveys a clear meaning to the complexity of this empirical origin and also makes it plain that the explanation is made

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<sup>27</sup> *APo.* II.8 93b15-20 summarizes the theory: the inquirer seeks the reason only when she already knows the fact – the same goes for grasping the (explanatory) essence (*homoios kai ti en einai ouk aneu tou hoti estin*, 93a19-20). But since any knowledge acquisition must start from a *prior* knowledge (I.1 71a1-2), establishing a fact can be only done by means of some prior grasp on what it is. Aristotle also makes room for demonstrations with more than two premises (II.8 93b12-14, II.17 99a26-29): when the middle term (*B*) (e.g. extinction of fire), which is the account of the major (*A*) (thunder or noise) (II.8 93b9-12, II.17 99a21-23), turns out to be a further explainable fact, another middle (in a finite series, I.19-22), say *D*, will explain *B* (II.18. 99b12-14, I.8 75a39-40) (this makes the proof logically compact and complete; see Lear 1980, 15ff). This results into a string of demonstrations ultimately leading to first principles (see *APo.* I.23). Detel (1993, I 302-6, II 829-88) is right in claiming that demonstration with further demonstrable premises conforms to the bottom-up procedure of explanatory analysis into first principles, whose intellection (*nous*) is acquired as a result of having exhaustively completed the analysis. See also Bronstein, 2016, 7-10, 225-47; and Bolton 1987, 137ff, 146-51, 154-55.

<sup>28</sup> Detel (1993, I 327, II 651f) remarks that preliminary accounts figure in the conclusion of demonstrations. So, such accounts cannot be confused with demonstrative principles – these are expressed, rather, in the explanatory middle syllogistic term.

by means of the causal analysis of jumbled up facts (184a18-24). Now, this allows us to place the Aristotelian concept of experience we have seen working in *APr.* I.30 47a18-19 at the bottom of the natural way to principles: experience conveys a complex and undifferentiated (in terms of causal analysis) generality (*katholou* in 184a23-24, 25) – this is certainly not a standard universal, but rather something comprehensive, which corresponds to the pre-scientific understanding that helps to fix the reference to facts by singling them out through preliminary accounts (within the *Posterior Analytics* picture). In *Physics* I.1, the inquirer starts by knowing names, and then she proceeds to analyze them in terms of definitions, which, in turn, stand for the elements and principles of the referred facts. Here, names convey anything but thin contents: their epistemological role is that of referring to a still undifferentiated whole (*holon gar ti kai adioristos semainei*) (184b11-12; see *APo.* II.19 100a16-17: *adiaphoron henos [...] katholou, [...] aisthesis tou katholou*), from which the inquirer starts investigating. In comparison with a definition, the epistemological value of a name is what is *more knowable to us* – an argument which can be fulfilled by other similar items, such as perception (*holon kata ten aisthesin gnorimoteron*, 184a24-25; *APo.* I.2 72a1-5, II.19 100a11) and *endoxa*.

## **5. Last remarks on dialectic, definition, and inquiry in *Physics* IV.1-5**

In this final section, I would like to hold the threads of my argumentation together by spelling out how the dialectical examination of *endoxa* can make a contribution by conceptually framing our perceptual experience and providing the required preliminary account of place. Let me begin by saying in which sense I do think that *Physics* IV.1-5 may be deemed akin to *Nichomachean Ethics* VII.1 1145b2-7 (usually claimed by dialecticists to present the so-called method of *endoxa*).<sup>29</sup> The *Nichomachean Ethics* passage

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<sup>29</sup> Owen, <sup>2</sup>1980, 92-103; Nussbaum, 1982, 267ff; the opposite view in Bolton, 1987, 128-30, 165f, who stills sees *EN* VII as dialectical.

describes the job to be done as consisting in setting the phenomena and proving the *endoxa* in the best possible way after having examined the difficulties (*diaporesantas*) and solved them (*luetai ta duschere*). The outcome of this is to leave the true *endoxa* standing (*kataleipetai ta endoxa*). In parallel, *Physics* IV.4 211a7-11 enumerates six main features of place, which were collected and examined in the previous chapters, where Aristotle has already absolved the task of going through the difficulties. Also here, the true *endoxa* will be left standing (*ta dokounta hyparchein toi topoi hyparchonta estai*, 211a9) by using a way of proving that follows a well-known dialectical pattern: rejecting competing beliefs that are contradictory or inconsistent with the most reputable opinions. However, neither in the *Physics* nor in the *Nichomachean Ethics* Aristotle endorses that the explanatory principles are justified by means of showing their coherence with the *endoxa*. In my reading of the *Nichomachean Ethics* passage, this is just intended to establish facts (*tithentas ta phainoma*) by means of examining *endoxa* in view of discovering principles (i.e. definitions) (Berti 1995, 273ff.; for other views, see Bolton 1999, 95f; and Bolton 1991, 17-9, 21). One may argue that the way of proving considered in these two parallel passages matches with diaporematic: it examines reputable opinions in terms of their coherence with others that are most firmly anchored in our belief system, as described in *Topics* VIII.5 (for the most reputable opinions, see 159b8-9, 13-14: *SE* 33 182b38; they are the starting point of dialectical argument, see *APo.* I.19 81b18-19). It is also described in I.2 101a35-36 in terms that more readily discern the true and the false in any subject. Being that so, the force of the sufficient proof (*dedeigmenon hikanos*) of the *Nichomachean Ethics* cannot be overrated: it amounts to grasping what is true after having gone through the difficulties; but in no way does Aristotle here suggest that we face a justification of principles by reference to *endoxa* and following a coherentist pattern of justification (as claimed by dialecticists). On the contrary, Aristotle makes it clear (for natural science in *Cael.* III.7 306a12-17; *GA* III.10 760b28-32) that any scientific theory is justified in reference to what follows from the premises (*ek ton apobainonton*), and mainly by means of its goal

(*ek telous*), which is to provide a causal explanation of the relevant perceptual phenomena (*phainomena kata ten aisthesin*). In this regard, perceptions generally have authority over reputable opinions in both discovering and justifying the principles. To Aristotle, then, a theory can be justified when the initial facts, from which the inquirer starts (bottom-up) inferring the principles by induction, are turned into reasoned facts in a top-down demonstrative procedure. In conclusion, the *endoxa* about affections and, similarly, the features about place collected by different means<sup>30</sup> will make up the hybrid experience that can provide the principles, as said in *Prior Analytics* I.30 46a17-18.<sup>31</sup> And as it is made explicit when Aristotle finally enumerates the problems about place that turn out to be solved in *Physics* IV.5, what can be really assigned to solve the difficulties is rather the explanatory definition of place:

It is manifest from these considerations that all the problems, too, will be solved by this account of place. (212b22-23) (trans. Hussey 1983).

Following the set of guidelines of the *Analytics*, the definition of place stands here for the essence that can explain why some (demonstrable) attributes do belong (*per se*) to some other thing. So, the *aporiai* are due to the precarious epistemological position in which the inquirer is at the outset, when she still lacks a full explanatory account. Take, for instance, one of these problems. By clarifying what it means for place to be a limit of the surrounding body (211b14), the difficulty about whether place is somewhere or not – which, on the assumption that a place is in a place (210a5-9), can generate an endless regress – can be finally solved: a place will be somewhere, though not in the sense of being in a place, but rather,

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<sup>30</sup> Assumptions (*hypolambanousin*) about place are the dominant source (see 208a29) for searching whether there is place and what it is; but an inductive consideration on the basis of observations (*epaktikos skopousin [...] horomen*), which are consistent with what is plain by reasoning (*toi logoi*) (210b8-9), play the same role.

<sup>31</sup> The *exetastike* of *endoxa* must be located together with the inquirer's collecting facts (*historia*, *APr.* I.30 46a24).

as the account explains, “as the limit is in what is limited” (212b27-28).

Things considered to be true about place are taken into account by the natural scientist in *Physics* IV.4 in order to elaborate a full explanatory definition. This is explicitly the target in 210b32 (*ti de pote estin ho topos*), which resumes the inquiry launched in 208a27-29 in terms of the stages of *Posterior Analytics* II.1: “whether it [*scil.* place] is or not, and in what way it is, and what it is” (for a general discussion on place, see Morison, 2002). So, from 208b1 on, Aristotle focuses on the determination of whether there is place (*hoti men oun esti ho topos*), which is made possible by means of the features that are then collected in the six attributes in IV.4 (Vigo, 1995, 191). In 208a27, *pos esti* may stand just for the attributes described as things that belong to the subject (place) or, alternatively, may refer to facts about place (both are possible translations of *hyparchonta* in 208a34). For instance, replacement is taken into account in order to claim that place is something different from all the things that come to be in and move about it (208b1-8). This first feature is further elaborated in three of the six attributes enumerated in 210b34-211a6. It seems clear that Aristotle takes these attributes to be explanatorily dependent on another more basic feature. We can take them to be *explananda* (or attributes that truly belong *per se* to place: *alethos kath’ hauto hyparchein autoi*, 210b33-34, i.e. demonstrable attributes), which are heuristically helpful in finding their *explanantia*, as shown in the following passage:

[...] place should be (1) the first thing surrounding that of which it is the place; and (2) not anything pertaining to the object [...] (4) it should be left behind by each object and be separable <from it>. (210b34ff)

In 211a6-7, Aristotle claims that by starting from these points, which we take to be true, the rest of the inquiry must proceed. This is likely to be understood as singling out the features that make up the essence and play an explanatory role with regard to other dependent attributes. Distinguishing which of these attributes are merely accidental and which of them, on the contrary, belong to place *per se*

proves to be crucial for singling out *what* place is. Much in the way of “privation of light” in relation to eclipse, the assumptions about place, which help to grasp what it is, are those that convey a non-accidental initial grasp (210b33-34):

What place is, should become manifest in the following way. Let us assume about it all the things that are thought truly to belong to it in respect of itself (*kath' hauto hyparchein autoi*) (210b32-34).

Now, the existence of place is made evident in 208b6-7 by means of an argument that proves that air can replace water when water goes out from a vessel; the place is rightly compared with a vessel (209b28-30, 210a24, 212a29), and this helps to clarify two things: first, that, for remaining the same, the place must be different and separable from the bodies that occupy it; and second, that place is, in a sense, moveable (see 211a35-b1, and the opposite view in 212a18) and not anything pertaining to the thing. In turn, *to be different from* bodies proves to be explanatory with regard to their replacement (which is a demonstrable attribute). Aristotle suggests here that (ii) the solution to the problems (see also (iv)) depends on knowing (i) *what* place is (see also 208a32-33.) He further claims in (v) that the best way of proving concerns (iii) the demonstration that the attributes belong to the subject. Notably, these attributes are introduced by means of beliefs (*ta dokounta*, 211a9), suggesting that the endoxical source of similar accounts is subordinated to the specific method and logic of science: the goal is to prove that such beliefs convey attributes of place (*ta dokounta huparchein toi topoi huparchonta estai*, 211a9). Also, the inquirer’s task is to mine for the essence in such attributes – the same as when she mines the cause of eclipse from “privation of light” – as well as to single out those attributes that can be demonstrated by means of the essence. The moral is that the knowledge of facts that is reached with the help of a preliminary account co-involves the knowledge of their essences; and

thus it makes the inquiry easier (*rhaon*, *APo.* II.8 93a28; see also *De An.* I.1 402b21-22), as Aristotle has it in 209b18.<sup>32</sup>

As already said, by speaking about difficulties and solutions Aristotle refers to scientific problems and proofs – so, this cannot be taken to conform to a dialectical way of proving. In fact, the passage in 209a2-30 and chapter 2 are devoted to circumvent difficulties derived from several misleading characterizations of place (e.g. as a body, as something in which the surfaces of a body are, as a corporeal or incorporeal element, as a form, as an extension and matter etc.). One of these difficulties is whether we must think of place as being a body; in that case, there will be two bodies in the same thing (209a6-7). In the end, this brings about a difficulty as to whether there is place and what it is (209a29-30). Now, defining place as the thing where a body is helps to definitely avoid this difficulty. Bearing this in mind, two main features of inquiry are crucial to better understand Aristotle's method in *Physics* IV. First, solving problems depends on the *hoti* and the *ti esti* questions (210a11-13; solving the difficulties is the purpose indicated in 211a10-11 and then in chapter 5). And, second, similarly to what happens with the definitions of motion and soul in *Physics* III.1-3 and in *De Anima* II, determining the essence of place is reached by gradually specifying the preliminary account through relevant precisifications, by means of which the explanatory gaps are fulfilled until we have a workable complete definition (211b5-6).<sup>33</sup> From this, and after having examined several features

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<sup>32</sup> On the contrary, wrongly thinking (a variant of knowing something just accidentally) about place in terms of form and matter (the distinction between place and form will be established only later, in *Ph.* IV.4 211b5ff) makes it difficult (*chalepon*) to recognize what place is (or which genus it belongs to, which comes first in the inquirer's grasping on more basic explanatory features, see 209b4).

<sup>33</sup> One of these precisifications may be that the proper place is the first thing in which a body is (the first thing surrounding each body, 209b1-2); this feature picks up what is said in 209a33 and helps to clarify, later on in 211a25ff, how a body that is divided, but still in contact with the extreme part of its surrounding place, moves not *in* that place, but *with* it (211a35) – in contrast to things that are not divided but are parts in a whole.

about place in 211a12-b5 (mainly related to locative change),<sup>34</sup> Aristotle draws the fullest definition in two steps, namely in 212a6 and in 212a20-21:

<Place is> the limit of the surrounding body, at which it is in contact with that which is surrounded. (212a6)<sup>35</sup>

Also, this definition admits of relevant refinements by means of further explanatory features, like being the limit of a body (and not an independent magnitude and a void extension) as well as being something surrounding and unmovable (and not a moving vessel):<sup>36</sup>

So that is what place is: the first unchangeable limit of that which surrounds. (212a20-21)

The following central passage presents the method and the program of this inquiry:

We must try to make inquiry in such a way that (i) the ‘what-it-it’ is provided; and so that (ii) the problems are solved; (iii) the things that are thought to be present in place are in fact present; (iv) finally, the reason for the difficulty and for the problems about it is manifest; (v) this is the best way of demonstrating anything. (IV.4 211a7-11)<sup>37</sup>

Granted, the scientific practice in *Physics* IV.1-5 does not develop a strictly formal demonstration. In this regard, and beyond any concern with recasting Aristotle’s non-formal arguments as

<sup>34</sup> In 211b6-10, only one from four similar features is finally accepted (namely, that the place is the extreme, inasmuch as there is no extension apart from the magnitude of the body that is in a place).

<sup>35</sup> On textual problems, see Ross, 1950 *ad loc.*

<sup>36</sup> Still other explanatory features may be relevant (the place is together with the object, in that the limits are together with the limited, 212a29-30; the surrounding must be different from the surrounded body, 212a31, b15-16).

<sup>37</sup> *Ph.* IV.3 applies a dialectical tool (*Top.* I.13) by distinguishing different meanings of “one thing is in another” (210a14-15); the main difficulty (whether something can be in itself or nothing can) (210a25) has been gone through (*dieporemena*, 210b31) and addressed by that tool (“in itself” is said in two ways, 210a26-27).

sylogistic proofs,<sup>38</sup> one should note that his rather sketchy presentation has another focus: it spots the first stages of inquiry, where, starting from *endoxa* and perceptions, the inquirer searches for a workable explanatory account of the subject-kind, on whose basis she can then solve the difficulties. This may indicate what Aristotle really envisages when it comes to fully working out demonstrations, namely to establish the true explanatory definitions as their principles and to prove the attributes that the examination of reputable opinions brought to light earlier.

Let me close by briefly highlighting some main points I have argued in this paper. At the beginning, I tried to show that the dialectical reasoning cannot be taken as the logic required by demonstration; rather, a more robust syllogistic (than the logical entailment of the *Topics*) seems to be required to do justice to the strictures of an explanatory syllogism (in the *Posterior Analytics*). But then the connected problem to be addressed by the interpreter is what the scientific use of dialectic really amounts to and in which manner the dialectical reasoning can be still of some help in holding inquiry. My suggestion was that the dialectical examination of reputable opinions can make a substantive contribution (i.e. not restricted to just removing contradictory views) to find the preliminary accounts within the initial stage of inquiry, which is previous to doing demonstrations properly. According to the modest spirit of the proposal here presented, we have to distinguish between what is provided by dialectic and what is offered by demonstrations in terms of a distinction between just preliminary accounts, on the one hand, and full explanatory definitions (first principles), on the other. This can be also made clear in Aristotle's discussion on place. This interpretation seems to be advisable in several respects: it avoids any conflation of dialectic and science as to their respective logic and affordances; but at the same time, it justifies that the dialectical reasoning is a way to the principles, which results in a contribution

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<sup>38</sup> I generally agree with Lennox, 1987, 118f; and Gotthelf, 1987, 194-97 on seeing the formal structuring by means of the syllogistic as a testing of the logical properties of explanations presented in natural (logically informal) language.

that is both more useful (to further elaborate explanatory definitions) and more modest (for the *endoxa* based accounts are just preliminary and their scientific usefulness does not depend on the proof by refutation of the highest principles) than usually acknowledged.<sup>39</sup>

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<sup>39</sup> I would like to especially thank my colleagues of the "Grupo Aristóteles UNL" (working online during the Pandemic year 2020) for having tirelessly read and discussed the second book of the Posterior Analytics in our weekly virtual meetings, which have been a constant source of friendly philosophical exchange and have also preserved us from so many dark thoughts during these uncertain times. Research for this work at its initial stage has been sponsored by the German Alexander von Humboldt-Stiftung at the LMU-Munich -- I am very grateful to my host in Munich, Prof. Dr. Christof Rapp for his generous support -- and the Argentinian ANPCyT (PICT 2016-2128).

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Submitted in 15/12/2021 and accepted for publication 15/03/2022



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