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ARTICLE

Soul as Explanatory Cause of Life in Aristotle: Scientific Knowledge *simpliciter* (ἁπλῶς) through Coextensive Universal Demonstrations and Context Restriction as a Solution to a Core-Dependent Homonymy from *APo* 2.17 and *de An.* 2.1-4

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Abstract: The main purpose of this paper is to show, based on Aristotle's theory of scientific demonstration, how soul plays the role of explanatory cause of life in *De Anima* (henceforth *de An.*) 2.1-4. Firstly, I evaluate Aristotle's requirement, in *Posterior Analytics* (henceforth *APo*) 1.2 and 2.16, that universal demonstrations must satisfy a coextensional criterion between a given *explanandum* (A-term) and its most appropriate *explanans* (B-term). In addition, I argue that this criterion does not entail a causal symmetry between both those terms. Following Angioni (2014a) and Zuppolini (2018), I argue that, whenever one is before apparent multiple-causes scenario cases—in which there seems to be more than one possible cause to the same *explanandum*—, one shall still find a unified and fully appropriate explanation of that *explanandum*. In the second part of this paper, I examine an example from *de An.* 2.1-4 in view of *APo* 2.16-17. I argue that soul might be pointed out as the explanatory principle (B) that explains why life (A) belongs to a living body (C). Also, I argue that, although there is a core-dependent homonymy taking place between plants (γ_1), animals (γ_2) and the nutritive capacity (α_1), the nutritive soul (β_1) plays the role of an incidental factor (συμβεβηκός) in the context of a scientific demonstration that has by *explananda* whatsoever attributes (α_n) that belong to animals (γ_2) *qua* living beings endowed with a perceptive soul (β_1) that explains why attributes (α_n) belong to them.

Keywords: Aristotle, Scientific Demonstration, Soul, Homonymy.

Introduction

The aim of this paper is twofold. On the one hand, I intend to present and discuss how Aristotle examines possible recalcitrant cases of scientific demonstrations along *APo* 2.16-17.[1] At first place,

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I present and discuss how, in selected passages from *APo* 1.2-5 and 2.16, Aristotle requires that universal demonstrations satisfy a coextensional criterion between a given *explanandum* (A-term) and its most appropriate *explanans* (B-term). Also, I argue that this criterion does not entail a causal symmetry between those terms.[2] Starting from a key passage in *APo* 1.2, I shall show that there must be a hyperintensional asymmetry between the *explanandum* and its most appropriate *explanans*, so that the *explanans*, presented as a middle term which grasps the essence of the *explanandum*, explains in the fully appropriate sense why the *explanandum* is precisely what it is. Following Angioni (2014a) and Zuppolini (2018), I intend to argue that, whenever there seems to be more than one possible cause to the same *explanandum*—I henceforth call these cases "apparent multiple-causes scenario [MC-scenario] cases")—, one might still find a unified and fully appropriate explanation of that *explanandum*, either by *cashing out*[3] the attribute one wants to explain or by cashing out the subject (C) to which the attribute belongs. In order to address this point properly, I shall discuss how Aristotle examines ὡς ἐν γένει and homonymy cases in passages from *APo* 2.17.

On the other hand, I intend to discuss how Aristotle, in *de An.* 2.1-4, conceives of soul as principle of life for the many kinds of living beings. At this stage of my exposition, my purpose is to argue that the way by which he discusses soul and its capacities along those chapters is compatible with his scientific project such as presented in *APo*. I shall assume that causal relations have a triadic structure: an attribute (A) belongs to a subject (C) in virtue of an appropriate cause (B). In a very general level, soul might be pointed out as the explanatory principle (B) that explains why life (A) belongs to a living body (C). However, things are more complicated when the

[2] Along this text, 'A', 'B' and 'C' terms refer, respectively, to the major, middle and minor terms of a scientific syllogism. On the reason why Aristotle chose syllogisms as the most appropriate instrument of scientific demonstration, see Angioni (2014b, p. 69-71, 90).

[3] By "cashing out", I simply refer to a metaphor which helps to elucidate how an attribute or the subject (C) to which it is attributed must be more precisely specified.

explananda are whatsoever attributes (α_n) that belong to animals (γ_2) *qua* living beings endowed with a perceptive soul (β_1). I will show that, although there is a core-dependent homonymy concerning the nutritive capacity (α_1) as attributed to plants (γ_1) and to animals (γ_2), the nutritive soul (β_1) plays the role of an incidental factor (συμβεβηκός) if the *explananda* are those attributes (α_n) that belong to animals (γ_2) *qua* living beings endowed with a perceptive soul (β_1). Thus, my aim is to show that even core-dependent homonymies are not real multiple-causes scenario (MC-scenario) cases, nor do they present any threat to the methodological requirement of a one-to-one relation between the *explanans* and the *explanandum*.

APo 1.2, 1.4-5: The Definition of Scientific Knowledge and the Notion of Coextensive Universal (καθόλου)

It seems to be a yet disputed point whether the two books of the *APo* are interconnected or not. Some might (incorrectly, to my point of view) argue that, while Aristotle seems to be speaking of causes and demonstrable principles in the first book, the second one is devoted to definitions and its kinds, so that there would be a huge difference, not to say an incompatibility, between the topics at stake in each part of the treatise. On the other hand, some might argue—and I am among them— that those two parts compose a unified theory of scientific demonstration which might be perfectly understood and grasped in terms of the connection between the scientific explanation of an *explanandum* X and the definition of what it is to be X.[4] This point might be more easily accepted if one is

[4] I mainly refer to definitions of the 'what it is' (τοῦ τί ἐστι). This kind of definition preserves the triadic structure of the causal relation between the attribute (οὗ αἴτιον, A-term), the *explanans* (αἴτιον, B-term) and the attribute's proper subject (ᾧ αἴτιον, C-term). Thus, to define X is to say: "X is (df.) A in C due to B" (see, e.g., 90a14-23, 90a31-34). However, there is an important restriction to make here. In *APo* 2.9, Aristotle restricts the threefold kind of definition to some kinds of objects or items, for there are certain entities in domain that are not subject to it, such as the "first

attentive not only to Aristotle's own examples along several passages of the treatise, but also to the way in which he characterizes scientific knowledge. Let's start by taking a look at how this notion is defined in *APo* 1.2 71b9-12:

> **[T1]** Ἐπίστασθαι δὲ οἰόμεθ' ἕκαστον ἁπλῶς, ἀλλὰ μὴ τὸν σοφιστικὸν τρόπον τὸν κατὰ συμβεβηκός, ὅταν τήν τ' αἰτίαν οἰώμεθα γινώσκειν δι' ἣν τὸ πρᾶγμά ἐστιν, ὅτι ἐκείνου αἰτία ἐστί, καὶ μὴ ἐνδέχεσθαι τοῦτ' ἄλλως ἔχειν.
>
> We think we have scientific knowledge of something *simpliciter*, and not in the sophistical way, incidentally, when we think we know, of the cause because of which the *explanandum* holds, that it is its cause, and also that it is not possible for it to be otherwise (*APo* 1.2 71b9-12; Barnes' translation, modified by Angioni, 2014a, and me).

This passage presents the reader with a key notion within Aristotle's theory of scientific demonstration, namely, the notion of scientific knowledge *simpliciter* (ἁπλῶς).[5] One achieves this kind of scientific knowledge, which is not based on an incidental factor (κατὰ συμβεβηκός), once one knows, about the cause because of which the *explanandum* holds, that that cause is the cause of that, and only of that, *explanandum*, so that a one-to-one relation between an *explanandum* and its *explanans* holds. Following Angioni (2014a, p. 101), I take the 'τοῦτο' pronoun to be referring back to the whole sentence "ὅτι ἐκείνου αἰτία ἐστί" ("that [the cause] is the cause of it"), so that the *definiens* account provides us two codependent criteria, namely, a) the causality criterion and b) the necessity criterion. The linkage between these criteria must be grasped as follows: to achieve scientific knowledge *simpliciter* (ἁπλῶς) of a given *explanandum* is to know a) that this is the cause (*explanans*) in virtue of which this *explanandum* holds, and that b) this relation

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entities". See, for further elucidation, Ackrill (1981), Charles (2000), and Bolton (1976).

[5] For discussion, see Barnes (1993, p. 89-93), Bronstein (2016, p. 31-42) Burnyeat (1981), Ferejohn (2013, p. 66-72). I am following Angioni (2016).

between the *explanandum* and its most appropriate *explanans* is a one-to-one explanatorily necessary relation.[6] Following Angioni (2020, p. 214), I consider that the necessity requirement introduced by b) is a mere specification of the a) condition, for the causality requirement establishes that there must be one, and only one, appropriate cause B that explains why A is what it is, so that there cannot be any other cause B that fully explains the same attribute A for the given subject C—and it is from this causal relation that emerges the necessity requirement as ranging over the explanatory connection between the A- and the B-term. For ease of expression, let us henceforth call this one-to-one relation as "A-B Uniqueness Requirement" (or, simply, "AB-UR").

The passage **[T1]** shows that Aristotle's point is not to account for a wide and generic kind of knowledge, but rather for a very specific one, the scientific knowledge *simpliciter* of a given *explanandum*.[7] In *APo* 1.2 71b16-9, Aristotle states that we acquire scientific knowledge through demonstrations, which are scientific syllogisms. In a scientific syllogism, the conclusion is necessarily deduced from the relation established between each of the extreme terms—that is to say, major and minor terms— and the middle term. In fact, this is the reason why Aristotle chooses syllogism as the best tool to express scientific knowledge, inasmuch as it is the appropriate one to apprehend the triadic structure of the causal relation AC-B ('A in C due to B'). Thus, in order to achieve scientific knowledge, one must be able to produce a scientific syllogism that explains, through its middle term (B), why a given attribute (A) belongs to its proper

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[6] This is explored by Angioni, 2016, p. 80. There is more than one sense in which one might take the terms 'necessity' or 'necessary'. There is no room here for a full discussion of this point. Suffice it to point out that I conceive of explanatory necessity in this sense: a principle is explanatorily necessary when it is the necessary one "for the fully appropriate explanation of a given *explanandum*" (see Angioni, 2014a, p. 90). For discussion, see Barnes (1993), who takes the necessity criterion as pointing to the necessity of a given *explanandum* being precisely what it is, and not to the causal relation between the *explanandum* and its most appropriate *explanans*.

[7] For discussion, see Angioni (2016), Burnyeat (1981), Ferejohn (2013).

subject (C). Once one produces the syllogism that turns out to be the most appropriate one to scientifically explain an *explanandum* through its most appropriate cause, respecting AB-UR requirement, one may say one has produced a scientific demonstration and, thus, achieved scientific knowledge *simpliciter* (ἁπλῶς).

There are several intermediate steps along *APo* 1.2, 1.4-5 about necessary and sufficient conditions to acquire scientific knowledge *simpliciter*. For my purposes, however, I take it to be sufficient to make a few remarks on the notion of coextensive or commensurate universal (καθόλου). In *APo* 1.4 73b32-39, Aristotle uses the notion of universal in a very strict sense: the universal attribute holds of a subject (C) for all its instances (κατὰ παντός) and in virtue of what it is in itself (καθ᾽ αὑτὸ και ᾗ αὐτό). In this strict sense, the universal attribute is commensurate or coextensive with the subject (C) it is predicated of. This stricter notion should not be confused with the notion of universal that appears in other passages and in other treatises.[8] This notion of universal taken in this stricter sense points to an intensional requirement too: the attribute (A) holds of the subject (C) in virtue of what the subject is in itself *qua* a subject that has the essential properties it has.

However, although knowing the essence of the subject (C) might be relevant or even necessary for the scientific investigation, it is certainly not sufficient to provide a fully appropriate explanation of the *explanandum* at stake. Thus, I stress the importance of satisfying the AB-UR requirement. The 'ᾗ' operator in 73b27 suggests that Aristotle has in mind that a scientific demonstration in the strict sense is only attainable if both the subject (C) and the attribute (A) have been taken as what they are in themselves. But taking these terms as what they are in themselves implies cashing them out in more specific terms: it is only when this step has been achieved that the fully

[8] On the importance of commensurate universals, see Angioni (2007, p. 8-24; 2012, p. 22; 2016, p. 96-100; 2018, p. 182-184), Ferejohn (2013), Hasper (2006), Lennox (2001).

appropriate explanation of the *explanandum* might be attained.[9] Moreover, since there is only one *explanans* that appropriately and fully explains a given *explanandum*, we should call that intensional requirement a 'hyperintensional' one. In other words, we should say that there is a hyperintensional asymmetry between an *explanandum* and its most appropriate *explanans*, since the latter fully explains the former, but not the other way round, even though there is a coextensive relation between them. The hyperintensional asymmetry points out to the fact that the essence of a given X equals to the definition of X, for properly defining X is not only to apprehend the extensional symmetry between X and its *definiens*, but also to grasp the essence of X, i.e., that in virtue of which X is X in itself.

The notion of commensurate universal is applied not only to attributes or to sentences. Actually, Aristotle also applies it to demonstrations. An example of this might be found in 73b25ff, which refers to the scientific demonstration of the 2R attribute[10] of triangles. In these lines, Aristotle says that an isosceles triangle cannot be considered as the appropriate subject (C) to the demonstration of the 2R attribute, for the isosceles triangle (supposing a particular diagram which started from an isosceles triangle) must still be "cashed out", or specified, or "viewed", as triangle. For it is the triangle that plays the role of the fully appropriate subject (C) to which 2R is attributed—the triangle as such is explanatorily prior to isosceles triangles (see 73b38-9). Thus, if one shows that every isosceles, every scalene and every equilateral triangle have the 2R attribute, but one still fails to unify all these species of triangle under the relevant description, one will fall short of providing the fully appropriate explanation of the 2R attribute: one will only have produced an incidental (κατὰ συμβεβηκός) demonstration. But, once the proper subject (C) of the 2R attribute is correctly specified, the scientific

[9] For instance, if the scientist wants to appropriately explain what is thunder, she must, at first place, correctly specify to what kind of clouds (C) a specific kind of noise (A) occur (see 94a5ff).

[10] By '2R attribute', I mean 'the attribute of possessing the sum of the internal angles equal to two right angles'.

demonstration can proceed. When the demonstration is fully successful in attaining the fully appropriate explanation of why 2R is predicated of triangles *qua* triangles, the demonstration is universal of this first item (the triangle as triangle) and in virtue of what it is in itself (ἡ ἀπόδειξις καθ᾽ αὑτὸ τούτου καθόλου ἐστί) (see 74a1-2).[11] As a result of this, one will achieve scientific knowledge *simpliciter* (ἁπλῶς) such as defined in 71b9-12.

APo 2.16: Multiple-causes Scenario (MC-scenario) and Unified Explanation

In *APo* 2.16, Aristotle addresses two main questions, which lead to a third one, raised almost at the end of the chapter. The first two questions can be formulated as follows:

(Q1) When the attribute (τὸ αἰτιατόν) occurs (ὑπάρχει),[12] does the cause (τὸ αἴτιον) also occur? (ἆρα ὅτε ὑπάρχει τὸ αἰτιατόν, καὶ τὸ αἴτιον ὑπάρχει) (see 98a36ff);

(Q2) When the cause (τὸ αἴτιον) occurs (ὑπάρχει), does the attribute (τὸ αἰτιατόν) also occur? (εἴ τε τὸ αἴτιον ὑπάρχει, ἅμα καὶ τὸ αἰτιατόν) (see 98b2-3).

The whole chapter 16 is devoted to approach both these questions. Aristotle himself provides us an answer: if the cause (B) and the attribute (A) occur together, then one of them might be proved through the other and vice-versa (see 98b4-5). Thus, in order to make his point clearer, Aristotle exemplifies with two different syllogisms. For the first syllogism, let A_1 stand for "deciduousness", B_1 for "being a broad-leaved tree" and C for "vine". We shall, then, formulate the following *Barbara* syllogism **(S1)**:

(S1)

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[11] On universal demonstrations, see Angioni (2019), Fine (2010), Hasper (2006).

[12] I strongly suggest the reading of Angioni (2019, p. 154-157) on the uses of the verb 'ὑπάρχειν'. In the present context, the absolute occurrence of 'ὑπάρχειν' (without complement) has the force of 'exists', 'occurs', 'holds'.

$$\frac{\begin{array}{c}A_1aB_1\\ B_1aC\end{array}}{A_1aC}$$

According to this syllogism, if deciduousness (τὸ φυλλορροεῖν) (A_1) holds of all broad-leaved trees (τὸ πλατύφυλλον) (B_1) and if being a broad-leaved tree (B_1) holds of all vines (ἄμπελος) (C), then deciduousness holds of all vines. Thus, the middle term B_1, 'being a broad-leaved tree', is, in this case, appointed as the cause in virtue of which all vines are deciduous (αἴτιον δὲ τὸ Β τὸ μέσον) (see 98b5-10). However, it is also possible to prove through deciduousness (B_2) that vines (C) are broad-leaved trees (A_2) (ἀλλὰ καὶ ὅτι πλατύφυλλον ἡ ἄμπελος, ἔστι διὰ τοῦ φυλλορροεῖν ἀποδεῖξαι) (see 98b10-12). Syllogism **(S2)** shall be formulated as follows:

(S2)

$$\frac{\begin{array}{c}A_2aB_2\\ B_2aC\end{array}}{A_2aC}$$

According to this syllogism, if being a broad-leaved tree (A_2) holds of all deciduous trees (B_2) and if deciduousness (B_2) holds of all vines (C), then being a broad-leaved tree holds of all vines. In this case, the middle term B_2, 'deciduousness', is appointed as the cause in virtue of which all vines are broad-leaved trees (αἴτιον δὲ τὸ φυλλορροεῖν) (see 98b12-16).

Syllogisms **(S1)** and **(S2)** taken together show that the $A_{1\text{-}2}$ and $B_{1\text{-}2}$ terms are coextensive or commensurate. However, if we look attentively to syllogisms **(S1)** and **(S2)**, we will see that only one of them provides the most appropriate explanation of the fact that vines (C) are deciduous trees (A). Indeed, syllogism **(S1)** plays this role, for being a broad-leaved tree (B_1) is the factor in virtue of which all vines (C) are deciduous (A_1), and it is not in virtue of being a deciduous tree (B_2) that all vines (C) are broad-leaved trees—as **(S2)**

tries to show. Due to this reason, we will correctly say that **(S1)** provides the syllogism of 'the reason why' (διότι) the *explanandum* is what it is. On the other hand, **(S2)** only shows us 'that' (ὅτι) the *explanandum* is the case, but not the reason why it is what it is (see *APo* 1.13, 78a28ff).

In the last section of chapter 16, Aristotle explores two different scenarios, as Zuppolini (2018) stresses out. The first one is a multiple-cause scenario (MC-scenario) according to which "the same *explanandum* attribute belongs to distinct subjects (C), each of which relates to distinct *explanantia*" (see Zuppolini, 2018, p. 235). The second one is a one-cause scenario according to which there is one, and only one, *explanans* to each *explanandum* at stake. I will now discuss those scenarios in order to show how Aristotle concludes chapter 16 in favor of a unified explanation of a given *explanandum* that *prima facie* seemed to admit more than one cause as its appropriate *explanans*. Let, then, A_3 stand for an attribute, which is predicated of different subjects C_3 and C_4, for each of which there will be a middle term B_3 and B_4, respectively, that explains why A_3 is predicated of C_3 and C_4. Thus, we might formulate the following demonstrative syllogisms, which, for ease of expression, I shall name **(S3)** and **(S4)**, respectively:

(S3)	**(S4)**
A_3aB_3	A_3aB_4
B_3aC_3	B_4aC_4
A_3aC_3	A_3aC_4

The syllogisms **(S3)** and **(S4)** represent a case of a MC-scenario, for there is more than one *explanans*, namely, B_3 and B_4, to the same *explanandum* (i.e., the same attribute to be explained). Thus, if B_3 and B_4 are to be taken as equally appropriate explanations to the very same *explanandum*, then one would be forced to abandon the AB-UR requirement, which would not be satisfied.[13] But how is it possible

[13] This scenario might be exemplified with longevity (A) being attributed to birds and quadrupeds (*APo* 2.17, 99b5-7). I shall turn back to this example later.

for the same *explanandum* to have more than one appropriate *explanans* that fully explains why it is exactly what it is? In fact, if we admit this possibility, we will end up with this crossroad: **i)** either we really abandon the AB-UR requirement, or **ii)** we shall look for a unified explanation that proves that MC-scenario cases are to be discarded, for they are not real multiple-causes scenario cases, but only apparent ones.

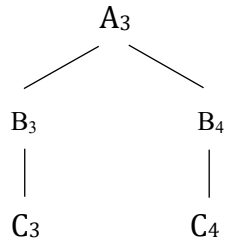
As to option **i)**, it is plain to the attentive reader that there is no textual evidence for it. In fact, Aristotle argues—since the very beginning of the treatise—in defense of a scientific demonstration theory in which the uniqueness relation requirement between the *explanandum* (A) and its most appropriate *explanans* (B) is a basic assumption (see 71b9-12). Thus, the least one should expect Aristotle to do is to try to provide a solution to those MC-scenario cases. And so he does, as the following passage shows:

> [T2] Ἢ ἐνδέχεται ἑνὸς πλείω αἴτια εἶναι; καὶ γὰρ εἰ ἔστι τὸ αὐτὸ πλειόνων πρώτων κατηγορεῖσθαι, ἔστω τὸ A3 τῷ B3 πρώτω ὑπάρχον, καὶ τῷ B4 ἄλλῳ πρώτω, καὶ ταῦτα τοῖς C3 C4. ὑπάρξει ἄρα τὸ A3 τοῖς C3 C4· αἴτιον δὲ τῷ μὲν C3 τὸ B3, τῷ δὲ C4 τὸ B4· ὥστε τοῦ μὲν αἰτίου ὑπάρχοντος ἀνάγκη τὸ πρᾶγμα ὑπάρχειν, τοῦ δὲ πράγματος ὑπάρχοντος οὐκ ἀνάγκη πᾶν ὅ ἄν αἴτιον, ἀλλ’ αἴτιον μέν, οὐ μέντοι πᾶν.
>
> Or is it possible for there to be several causes of one thing? If the same thing can be predicated of several items primitively, let A3 hold of B3 primitively and also of another term, B4, primitively, and let these hold of C3, C4. Therefore, A3 will hold of C3, C4; and B3 is explanatory cause for C3, and B4 for C4. Hence when the cause holds the object must hold; but when the object holds it is not necessary for everything that is a cause to hold—rather, some (but not every) cause must hold (APo, 2.16, 98b25-31; Barnes’ translation, with changes).

In this passage, Aristotle approaches a MC-scenario case that corresponds to the **(S3)** and **(S4)** syllogisms. Since A_3 is predicated both of C_3 and C_4 in virtue of B_3 and B_4, respectively, there seems to be more than one cause that explains why the same attribute A_3 is

predicated of distinct subjects C_3 and C_4. Now, given the fact that the attribute A_3 is predicated of C_3 and C_4 in virtue of B_3 and B_4's occurring, respectively, Aristotle concludes that, when the cause occurs, the *explanandum* necessarily occurs as well (see 98b29-30). This brief remark points to an affirmative answer to **(Q2)**, inasmuch as the occurrence of the cause entails the occurrence of the *explanandum* to which it provides an explanation. To make the point clearer, it will be helpful to consider Aristotle as showing us that, if we take **(S3)** separately and look at B_3, we will see that this middle term explains why A_3 is predicated of C_3. Once we have seen it this way, we might turn to **(S4)** in order to see that, now, B_4 plays the role of the middle term that explains why the very same attribute A_3 is predicated of C_4, but not of C_3. Consequently, we will see that, whenever the cause occurs, the *explanandum* to which it gives an explanation also occurs. On the other hand, since the very same attribute A_3 is predicated of distinct subjects C_3 and C_4, we shall say that, when the attribute occurs, it is not necessary that everything which is a cause occur: a cause must occur, but not every cause (see 98b30-1). To make the point clearer, let's consider the following scheme **(SC_1)**, which combines the previous syllogisms **(S3)** and **(S4)**:

(SC_1)



The **(SC_1)** scheme helps us to see how **(S3)** and **(S4)** syllogisms, as I have argued, bring to light a MC-scenario case. The point Aristotle is stressing in the last lines of **[T2]** is that, once one looks at A_3 and sees that its being predicated of C_3 and C_4 can be explained by B_3 and B_4, respectively, one must see that the occurrence of the *explanandum* does not entail the occurrence of everything that might play the role of an *explanans*, but only the occurrence of the fully

appropriate cause (ἀλλ' αἴτιον μέν, οὐ μέντοι πᾶν) (see 98b31). Here, I take the coordination between the Greek particles 'μέν' and 'μέντοι' to be emphasizing that Aristotle is implicitly retrieving an old friend of ours, namely, the AB-UR requirement: the occurrence of the *explanandum* entails the occurrence not of every cause, but only the occurrence of the fully appropriate one, the one on which scientific knowledge *simpliciter* (ἁπλῶς) depends and which is the only one capable of explaining why an attribute (A) is predicated of its proper subject (C). Thus, taken as stressing the importance of AB-UR requirement, the passage **[T2]** allows us not only to maintain the argumentative cohesion between the two books of the treatise, but also allows us to see that what comes next is strong evidence for option **ii)**.

At the end of *APo* 2.16, Aristotle presents us with a solution to the apparent MC-scenario cases (see 98b32-8). First, Aristotle's solution involves three notions: the conclusion of the demonstrative syllogism (πρόβλημά), the cause (τὸ αἴτιον) of the attribute and the attribute (οὗ αἴτιον). The question is formulated by Aristotle in these terms: is it the case that, if the conclusion is always universal, then the cause must be some whole, as well as the attribute must be universal? Suppose we have a scientific demonstration which is universal in the stricter sense, which I shall call **(D_1)**. Let, then, A be the attribute, B be the cause and Γ be the subject of which the attribute is predicated. Let our demonstration **(D_1)** be depicted by the following *Barbara* syllogism:

(D_1)

AaB
BaΓ
———
AaΓ

Let's take, as I have just proposed, the conclusion (πρόβλημά) 'AaΓ' to be universal in the strict sense. This means that the predication 'AaΓ' holds of every instance of A and Γ (κατὰ παντός) and in virtue of what they are in themselves (καθ' αὐτὸ και ᾗ αὐτό) (see *APo* 1.4 73b32ff). If this is so, the middle term B must not be

just any *explanans*; rather, it must be the primary cause, that is to say, the middle term B is to be taken as the only cause that can provide the fully appropriate explanation of A's being attributed to Γ.[14] If this were not so, how could the conclusion be universal in the strict sense—how could the conclusion hold in virtue of what the terms are in themselves (καθ᾽ αὐτὸ και ᾗ αὐτό)? In fact, B's being universal in the strict sense when predicated of Γ is also a necessary condition for A's being attributed to Γ universally in the strict sense, for B is the middle term that connects the extremes in the demonstrative syllogism. Consequently, if we take for granted that the conclusion of a scientific demonstration is universal in the strict sense, then we also must take for granted that the cause (B) is some whole (ὅλον τι), for it is a primary universal (πρῶτον καθόλου) (see 74a4ff; 99a33-35) that is explanatorily prior to what it is explanatory of (see 71b21). In addition, the cause explains all instances of the attribute which it is explanatory of, so that there is no other cause prior to B that would properly explain why A is predicated of Γ—at the end of the day, this is what being a "primary universal" means.[15]

In light of all this, the answer to Aristotle's question in 98b33-4 is plainly affirmative, and as a result of this the A and B terms are extensionally equal and, thus, counterpredicate with each other (see 98b35-6). This point gets clearer if we look at the example Aristotle advances to provide a solution to apparent MC-scenario cases (see 98b36-8). Let A_1 stand for 'deciduousness', B_5 for 'coagulation of sap' and C_5 for 'broad-leaved trees'. Consider the following syllogism **(S5)**:

(S5)

$$\frac{\begin{array}{c}A_1aB_5\\B_5aC_5\end{array}}{A_1aC_5}$$

[14] For more on this, see Angioni, 2014, p. 95-103.

[15] On primary-universal demonstrations, see Ferejohn (2013), Hasper (2006), Lennox (2001), Zuppolini (2018, p. 238-9).

According to syllogism **(S5)**, if deciduousness (A_1) holds of coagulation of sap (πῆξις τοῦ ὑγροῦ) (B_5) and if coagulation of sap (B_5) holds of all broad-leaved trees (C_5), then deciduousness (A_1) holds of all broad-leaved trees (C_5). In this example, the middle term 'coagulation of sap' (B_5) is the one that provides the fully appropriate explanation of deciduousness (A_1) being attributed to all broad-leaved trees (C_5). Now, given that B_5 is the primary universal cause that explains why all broad-leaved trees (C_5) are deciduous (A_1), we shall say that **(S5)** presents a universal demonstration of the *explanandum* through its fully appropriate *explanans*. It is important to note that, since **(S5)** is the only scientific demonstration that is able to primarily (in the explanatory sense) cover all instances of A's being attributed to C, **(S5)** must be taken as a unified explanation that successfully explains why all instances of broad-leaved trees are deciduous.

Yet, there is a point I must, once again, insist on: this unified explanation achieved by a universal demonstration can only take place when one has properly cashed out or specified the A- and C-terms. This is plain from *APo* 1.4-5 (see, for instance, 2R predicated of triangles, as I have mentioned), but it is also plain from *APo* 2.16: the case of deciduousness attributed to vines, for instance, shows that, although one might explain this *explanandum* through the middle term 'being a broad-leaved tree', this middle term extends further than vines, so that one still must cash out the subject (C) of the scientific demonstration in order to attain the proper subject deciduousness is predicated of.

In light of all this, we are now allowed to provide a satisfactory answer to question **(Q1)**: an affirmative answer to **(Q1)** is true if, and only if, one is before a universal scientific demonstration in the strict sense, for only such a demonstration is able to assure that, once the attribute is present, its most appropriate cause (A) is present too, and, alternatively, once the most appropriate cause (B) of a given *explanandum* is present, then the attribute (A) must necessarily be present too (see 98b36-8). From all this, it is plain that MC-scenario cases are just apparent cases of multiple-causes for the same

explanandum. Therefore, once again, the AB-UR requirement remains untouched, and option **ii)** emerges as the best reading.

APo 2.17: Explanation of ὡς ἐν γένει and Homonymy Cases in Defense of AB-UR Requirement

At the beginning of *APo* 2.17 (see 99a1-2), Aristotle reintroduces what has been object of examination since the previous chapter, namely, whether it is possible or not for the very same *explanandum* to be explained by multiple *explanantia*. In chapter 17, Aristotle explores this issue in detail, and the answer presented in 99a2-4 is in the same line as his argument in *APo* 2.16: if the scientific demonstration is conducted καθ᾽αὐτὸ, and not κατὰ σημεῖον or κατὰ συμβεβηκός, then the cause cannot be different for any instance of the *explanandum*. Otherwise, one can find different *explanantia* to the same *explanandum*. The reason why a demonstration conducted καθ᾽ αὐτὸ assures that the AB-UR requirement is preserved is also presented to the reader: the middle term is the definition of the major term (ὁ γὰρ λόγος τοῦ ἄκρου τὸ μέσον ἐστίν) (see 99a3-4).

Here, it is important to note that my translation of the lines 99a3-4 favors what Zuppolini (2018, p. 243) called "A-Model of scientific explanation". The distinction between a "S-Model" and an "A-Model" of scientific explanation refers back to Ferejohn (2013) and relies on distinct interpretations as to whether the term 'ἄκρος' refers back to the major term (A) or to the minor term (C). According to the A-Model, the middle term of a scientific syllogism supplies a definition of the major term, the attribute (A) of the conclusion of the scientific syllogism. On the other hand, the S-Model proposes that the middle term of a scientific syllogism supplies a definition of the minor term, the subject (C) of the conclusion of the scientific syllogism. In my view, the A-Model seems the most appropriate to provide a fully appropriate explanation of a given *explanandum*, for the aim of a scientific demonstration is to explain why the *explanandum* is exactly what it is, but the *explanandum* itself is a

predicative tie, in which the attribute (A) is more decisive to determine what the *explanandum* consists in. After all, it is "by being essential (not to C, but to the *explanandum* as such) that property B explains why its subject C has property A" (see Angioni, 2014a, p. 106).[16]

In the next passage, Aristotle says that it is possible to investigate incidentally (κατὰ συμβεβηκός) both the attribute (A) and the subject (C), but such things do not count as problems (see 99a4-6). Otherwise, advances Aristotle, the middle term will behave similarly; if the items (in the *explananda*) are homonymous, then the middle terms will be homonymous; and if they are "as in a kind", the middle terms will behave similarly (see 99a6-8). Aristotle is here providing a plain contrast between investigating (σκοπεῖν) something incidentally (κατὰ συμβεβηκός) and investigating something καθ᾽ αὐτὸ. This contrast is strongly suggested by the expression 'εἰ δὲ μή': if the scientific demonstration is conducted καθ᾽αὐτὸ, and not on the basis of an incidental factor (κατὰ συμβεβηκός), then the scientist will be able to achieve a unified explanation that preserves the AB-UR requirement. Yet, Aristotle argues that, if the items are homonymous, the middle terms will be so too; similarly, if the items are as in a kind (ὡς ἐν γένει), the middle terms will be so too.

As to what Aristotle means by the 'ὡς ἐν γένει' expression, we have a good example from the previous section. For the sake of clarity, we will talk about vines again: suppose one is willing to explain why 'deciduousness' (A) is predicated of vines (Γ_1) and fig-trees (Γ_2). Suppose, in addition, that there are two middle terms, say B_1 and B_2, both of which seem to provide appropriate explanations to A being attributed to Γ_1 and Γ_2, respectively. Thus, one could formulate two syllogisms such as the syllogisms **(S3)** and **(S4)** I have presented earlier. Instead of repeating this construal, I propose the following scheme **(SC_2)**:

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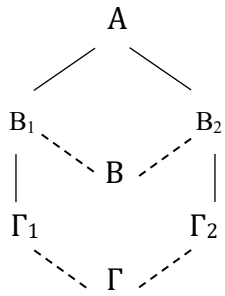
[16] I recommend Angioni (2014a, p. 103-10) for a complete understanding of my point.

(SC$_2$)

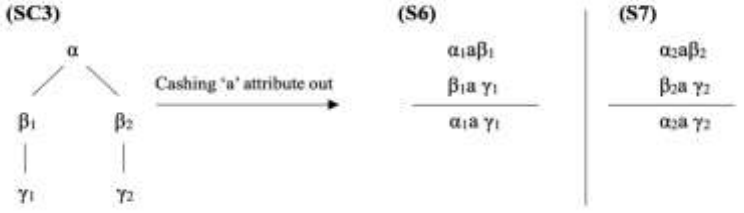


In the previous section, I have argued that the demonstration of 'deciduousness' (A) attributed to vines (Γ_1) is not a universal scientific demonstration in the strict sense, inasmuch as vines are located in a kind (ὡς ἐν γένει) of things 'deciduousness' is predicated of, namely, broad-leaved trees (see 99a26ff). The same applies to fig-trees (Γ_2): since fig-trees, as well as vines, must still be cashed out in terms of broad-leaved trees—for vines and fig-trees are as in a kind (ὡς ἐν γένει), i.e., vines and fig-trees are subspecies of broad-leaved trees—, the demonstration of 'deciduousness' (A) predicated of fig-trees (Γ_2) is not universal in the strict sense either. However, once the scientist cashes out both subjects ('vines' and 'fig-trees') in terms of broad-leaved trees (Γ), she will be able to find a unified *explanans* B that explains in the fully appropriate sense why broad-leaved trees are deciduous: the explanatory factor that makes this demonstration universal in the strict sense is the coagulation of sap at the junction of the seed (B).[17] Therefore, AB-UR requirement remains preserved.

Something similar to ὡς ἐν γένει cases happen when the attribute to be explained is not appropriately specified yet: there also seems to emerge a MC-scenario case, but, at the end of the day, the AB-UR requirement rests unviolated. Speaking more clearly, I am referring to homonymy cases. These take place when the very same 'α' attribute seems to be predicated of distinct subjects γ_1 and γ_2. In fact, this produces an appearance of a MC-scenario case, for there would

[17] On ὡς ἐν γένει cases, see Hasper (2019) and Zuppolini (2018, p. 251-3). Those cases seem to refer to the mathematical cases alluded to in *APo* 1.5 and 1.24.

be β_1 and β_2 terms to explain, respectively, why the 'α' attribute holds of γ_1 and γ_2. However, this is only a false appearance of a MC-scenario case: although the 'α' attribute indeed holds both of γ_1 and γ_2, the 'α' attribute receives different definitions according to what subject it is attributed to, γ_1 or γ_2. In other words, there is a homonymy relation between γ_1 and γ_2, such that, inasmuch as α holds of γ_1 and γ_2, α receives distinct definitions in each case, which makes 'α' an ambiguous term. For instance, 'similar' (τὸ ὅμοιον) is a homonymous term in relation to 'figure' (σχῆμα) and 'color' (χρῶμα), for 'similar' holds both of figures and colors, but 'similar' has distinct definitions when applied to each of them (see 99a10-6). Consequently, 'similar' is an ambiguous term. If one wanted to achieve a universal demonstration of the 'similar' attribute predicated of figures and colors, one should specify 'similar' in terms of what it is to be similar for figures and what it is to be similar for colors. In this case, one will end up with two completely different scenarios, in which there are two irreducibly different kinds of similarity. However, a different result emerges concerning the longevity example Aristotle provides at the end of chapter (see 99b4-7). Let α stand for 'longevity', γ_1 for 'birds' and γ_2 for 'quadrupeds'. The following **(SC3)** scheme presents this homonymy case and its solution:



18

In this scheme, the longevity attribute is predicated both of birds and quadrupeds, so that the scientist might think, at first glance, that she is before a MC-scenario case, for α's being attributed to γ_1 and γ_2 should be explained both by β_1 and β_2, respectively. However, at the

[18] My scheme of cashing the attribute out.

beginning of the scientific investigation, what the scientist does not know yet is that the longevity attribute is not the same for birds and for quadrupeds. Indeed, 'longevity' is a homonymous term in relation to birds and quadrupeds, for the term is ambiguous: it displays distinct definitions when applied to birds and to quadrupeds. For birds (γ_1), the longevity attribute is explained by the middle term 'being dry' (β_1), whereas the middle term 'absence of bile' (β_2) is the explanatory factor of longevity's being attributed to quadrupeds (γ_2) (see 99b4-7). Thus, once the scientist cashes the α-attribute out, she will see that there are two different syllogisms, **(S6)** and **(S7)**, that constitute the fully appropriate explanation of longevity's being attributed to birds and to quadrupeds, respectively. Therefore, the AB-UR requirement remains preserved in these homonymy cases as well.

Now that I have presented two examples of homonymy cases, I turn my attention to a subspecies of homonymy that is sometimes called 'core-dependent homonymy'.[19] The **(SC3)** scheme shows a typical case of homonymous relation as it is described in *Categoriae* 1 1a1-2: things are said to be homonymous when they share a name, but the definition of this name is different for different beings it is attributed to. When this kind of homonymous relation takes place, the scientist must find the most appropriate specification of the attribute, so that she might find the fully appropriate *explanans* that explains why each *explanandum* is exactly what it is. Now, what would happen if she saw herself before a scenario in which, after a preliminary specification of the original attribute into two different attributes, one of these overlapped the other? In other words, if the scientist has already adequately specified the attribute, but still faces a case in which the already specified attribute seems to extend further than its expected domain, shall she abandon the task of searching for the fully appropriate explanation of the *explanandum* according to the AB-UR requirement?

[19] See Shields (1999, ch. 4) for this terminology.

In order to illustrate this issue, I address an example from Aristotle's *de An.* 2.1-4. Here, my modest purpose is to show that the way by which he characterizes soul as a principle that explains why life is attributed to living bodies (ἔστι δὲ ἡ ψυχὴ τοῦ ζῶντος σώματος αἰτία καὶ ἀρχή) (see 415b8) is perfectly compatible with his scientific demonstration theory such as depicted in the *APo*, especially regarding the triadic structure (ABC) of the causal relation between terms. Regarding my point about core-dependent homonymies, let's consider the following **(SC4)** scheme, where α stands for 'living', α_1 for 'nutritive life', α_2 for 'perceptive life', β for 'soul', β_1 for 'nutritive soul', β_2 for 'perceptive soul', γ_1 for 'plants' and, finally, γ_2 for 'animals':

(SC4)

[20]

The **(SC4)** scheme presented above describes a scenario that, according to my view, might be read from Aristotle's account of soul in *de An.* 2.1-4. In fact, along these chapters, Aristotle presents a characterization of soul, as well as of its parts and its capacities. At the beginning of the investigation, a scientist (in Aristotelian terms) who intends to produce a universal demonstration, in the strict sense, of the reason why life (A) belongs to a living body (C) still needs to appropriately specify the (A) attribute. However, in this case, cashing the attribute out, at least in terms of what we have achieved in **(SC4)** scheme, might not be sufficient to prepare a fully appropriate explanation of the *explanandum*, for Aristotle recognizes that the nutritive life (α_1) extends further than plants (γ_1): in fact, in the domain of mortals, the nutritive capacity of the soul (α_1) is pointed

[20] My scheme of cashing the attribute out.

out as separable from the other parts of the soul, whereas these other parts of the soul are not separable from the nutritive one (see 431a31–b2). Thus, following (**SC4)** scheme, we must say that, since there is an overlap between α_1 and α_2, there is a core-dependent homonymy taking place regarding the nutritive capacity (α_1) applied to plants (γ_1) and to animals (γ_2). Nonetheless, even though the scientist understands she is before a core-dependent homonymy and, thus, a possible MC-scenario case, she must not abandon the task of searching for the fully appropriate explanation of the *explanandum* according to the AB-UR requirement. The reason why this is the case is that the nutritive soul (β_1) plays the role of an incidental factor (συμβεβηκός) in any demonstration attempting to explain whatsoever attributes (α_2) belong to animals (γ_2) *qua* living beings endowed with a perceptive soul (β_2), whereas perceptive soul (β_2) explains why the (α_2)-attributes belong to animals. After all, sometimes an *explanans* (B), even being essential to the minor term (C), might not be explanatorily determinant to provide the fully appropriate explanation of a given *explanandum* (A) in a given context. Having a nutritive soul is surely part of the essence of animals, but it does not appropriately explain attributes that depend on the perceptive life animals have. Therefore, according to this solution to core-dependent homonymies, the MC-scenario vanishes once again, while AB-UR requirement stands.

Conclusion

In the first part of this paper, I have shown that to achieve scientific knowledge *simpliciter* (ἁπλῶς) of a given *explanandum* is to know a) the cause (*explanans*) in virtue of which this *explanandum* holds, and that b) this relation between the *explanandum* and its most appropriate *explanans* is a one-to-one *explanatorily* necessary relation (which preserves AB-UR). I have also argued that scientific knowledge *simpliciter* (ἁπλῶς) is achieved only if one is able to produce a scientific demonstration καθόλου in the strict sense. In addition, I have shown that, whenever one is before apparent multiple-causes scenario (MC-scenario) cases, one might still find a

unified and fully appropriate explanation of that *explanandum*. At this point, I have discussed selected passages from *APo* 2.17 which deal with ὡς ἐν γένει and homonymy cases.

Also, I have discussed how this applies to Aristotle's conception of soul as principle of life in *de An.* 2.1-4. I have argued that, although there is a core-dependent homonymy regarding the nutritive capacity (α_1) applied to plants (γ_1) and to animals (γ_2), the nutritive soul (β_1) plays the role of an incidental factor (συμβεβηκός) in any demonstration attempting to explain whatsoever attributes (α_2) belong to animals (γ_2) *qua* living beings endowed with a perceptive soul (β_2). Consequently, I have shown that even core-dependent homonymies are not real multiple-causes scenario (MC-scenario) cases, nor do they present any threat to the AB-UR requirement. Therefore, I concluded that an *explanans*'s being essential to the minor term (C) of a demonstration might not always count as explanatorily determinant to provide the fully appropriate explanation of a given *explanandum* (A) in a given context.

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