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Peitho 3, 31-50

2012

Artykuł został opracowany do udostępnienia w internecie przez Muzeum Historii Polski w ramach prac podejmowanych na rzecz zapewnienia otwartego, powszechnego i trwałego dostępu do polskiego dorobku naukowego i kulturalnego. Artykuł jest umieszczony w kolekcji cyfrowej bazhum.muzhp.pl, gromadzącej zawartość polskich czasopism humanistycznych i społecznych.

Tekst jest udostępniony do wykorzystania w ramach dozwolonego użytku.

Aristotle's Method of Understanding the First Principles of Natural Things in the *Physics* I.1

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1. The opening passage of Aristotle's *Physics* (184 a 10–16)

1. 1. The reconstruction of the syllogism

Aristotle begins the first book of his *Physics* with a chapter on method. In this chapter, Aristotle raises the question about the proper method of reaching the first principles of natural things. The proper method of reaching the first principles of natural things is evidently the proper method of natural science.

In his commentary, on the first book of Aristotle's *Physics*, Philoponus¹ remarks that it is Aristotle's custom to begin his works from certain common assumptions (ἀξιώματα).

¹ All references to Philoponus' Commentary on Aristotle's *Physics* I.1 are to the page and line of the Berlin Academy Edition (CAG XVI) and follow the translation of Osborne 2006. See Philoponus *in Phys.* 3.14–25.

Here too, in the opening chapter of the *Physics*, it is from a common assumption that Aristotle makes his beginning: “since knowledge (εἰδέναι) and understanding (ἐπίστασθαι) or knowledge (εἰδέναι) and scientific knowledge (ἐπίστασθαι) come about in all the disciplines that have principles or causes or elements from knowing these principles or causes or elements, for it is then that we think that we know each thing, when we have identified the primary causes and the first principles and as far as the elements, it is clear that also for natural science we should try to define firstly the matters concerning the principles”.

The reasoning, as it is reconstructed from Philoponus,² is the following: in natural science, there are principles and causes and elements. Every science in which there are principles and causes and elements becomes known when the principles and causes and elements have become known. Therefore, natural science also will become known when the principles and causes and elements have become known. Philoponus³ suggests that Aristotle for the sake of brevity sets down only the major premiss, the one that says that every discipline that has principles or causes or elements becomes known when the principles and causes and elements have become known, and omits the minor premiss that natural theory has principles and causes and elements. According to Philoponus, Aristotle also omits the conclusion, which would be “therefore natural theory also becomes known when its principles are known”; he gives the consequence of this, namely that since natural theory or natural science becomes known when its principles are known (which was the conclusion of the syllogism), we should try to define the principles of natural theory or natural science.

Simplicius⁴ also reconstructs the syllogism which is implicit in the introduction (προοίμιον) to the first chapter of Aristotle’s *Physics*. This syllogism according to Simplicius is the following: natural things have principles. Knowledge of the things that have principles comes about from knowing their principles. Therefore, knowledge of the natural things comes about from knowing their principles. Therefore, knowledge of the principles of natural things is necessary to anyone who wants to possess the natural science. Simplicius⁵ remarks that Aristotle omits the minor premiss of this syllogism and he stresses that this is a premiss which does not need to be proved, because it will be obvious from the whole theory that will be presented henceforward. According to Simplicius, this is the reason why Aristotle omitted this premiss. Regarding this syllogism, both Simplicius and Philoponus agree that Aristotle omits the minor premiss as well as the conclusion of the syllogism which is implicit in this introductory passage of chapter one of the first book of the *Physics*. It is worth noticing that in the conclusion of the syllogism the required object of knowledge for Aristotle is the principles of natural things,

² Philoponus *in Phys.* 3. 25–30.

³ Philoponus *in Phys.* 3.30–4.8

⁴ All references to Simplicius’ Commentary on Aristotle’s *Physics* I.1 are to the page and line of the Berlin Academy Edition (CAG IX). The translation is mine. Simplicius *in Phys.* 9.1–5.

⁵ Simplicius *in Phys.* 9.5–6.

whereas the object of knowledge for Simplicius is the natural things and for Philoponus the natural science.

According to the testimony of Simplicius and Philoponus, Theophrastus set out the whole syllogism at the beginning of his own treatise *On Nature*, thinking that an explanation or a demonstration was also required for the minor premiss of this syllogism, the one that says that natural things have principles.⁶ Theophrastus supports this premiss in the following way: “if natural things are either bodies or have their existence in a body, and these things are composite, then natural things are composite. But all composite things have elements and causes and principles; for simple things are the elements of composite things. Hence natural things have principles and causes and elements”⁷

Simplicius⁸ bears testimony to the view of Porphyry who believed that it is not the task of the natural scientist or the natural philosopher to search out if there are principles of natural things because the natural scientist or the natural philosopher always considers and treats these principles as given. Porphyry thinks that it is the first philosopher's task to search out if there are principles of natural things. Furthermore, Simplicius⁹ thinks that Porphyry should rather say that it is the first philosopher's task to search out which are the principles of natural things or he should rather say that it is the natural philosopher's task to explain or to demonstrate that natural things are composite and that they have principles and which are their principles. However, as it refers to the first principles considered as elements, Simplicius thinks it is the first philosopher's task to identify the capacity of each element of natural things, i.e. the capacity of matter and form, since these are the elements of which every natural thing is composed.

According to J. Fritsche,¹⁰ Simplicius' view is that the only task of natural science is to show or to prove that natural things are composed of matter and form, because in that way natural science identifies their principles, on condition that the First Philosophy or Metaphysics has already proved that the components of what is composed of matter and form are also its principles. In my opinion, J. Fritsche¹¹ is right when he points out that Simplicius' view represents a synthesis of the views of Theophrastus and Porphyry, since it combines the diverse tasks and aims of the natural science which have been reported by Theophrastus and Porphyry. Simplicius' synthetic point of view is that when Aristotle in his *Physics* explains which and how many principles of natural things there are in that way and at the same time, he also explains that there are principles of natural things.¹²

⁶ Simplicius *in Phys.* 9.7–10. Philoponus *in Phys.* 4.8–15.

⁷ Philoponus *in Phys.* 4.34–5.3.

⁸ Simplicius *in Phys.* 9.11–12.

⁹ Simplicius *in Phys.* 9.12–22.

¹⁰ Fritsche 1986: 171–172.

¹¹ Fritsche 1986: 24–27.

¹² Simplicius *in Phys.* 21.21–22 and 190.25–29.

1.2. The terminology

The terminology which Aristotle uses in the opening passage of the *Physics* (184 a 10–16) is applied very carefully in order to show that each term represents a different way of coming to know the principles, although these ways are complementary to one another and not incompatible. Simplicius¹³ points out that εἰδέναι and ἐπίστασθαι, i.e. knowledge and understanding (transl. C. Osborne)¹⁴ or knowledge and scientific knowledge (transl. R. Bolton)¹⁵ cannot be used in a parallel way to mean the same thing, because εἰδέναι has a wider meaning than ἐπίστασθαι, since we also use εἰδέναι with reference to what we grasp in perception and what we acquire by belief (δόξα) and with reference to the immediate and indemonstrable premisses which are the first principles of demonstration. Generally we use εἰδέναι with reference to what is not subject to demonstration, while normally we use ἐπίστασθαι with reference to scientific knowledge. According to Simplicius¹⁶ the relation between εἰδέναι and ἐπίστασθαι is analogous to the relation between genus and species. The fact that Aristotle uses εἰδέναι as prior to ἐπίστασθαι in this passage prepares the ground for the prominent role of perception in the empirical method of inquiry into the principles of natural things which will be presented shortly after.

Furthermore in the same passage Aristotle uses the verb γινώσκειν (184 a 12) to denote the procedure we follow in order to reach knowledge of natural things, whereas he uses the verb γνωρίζειν (184 a 12; γνωρίσωμεν 184 a 13) to denote the procedure we follow in order to reach knowledge of the principles of natural things. If natural things come to be known from their principles but knowledge of the principles of natural things ought to be gained from some previous knowledge, this would mean firstly that knowledge of the principles comes from knowledge of other principles and so on; and secondly that principles are not real principles, since they themselves have principles. In this case, a danger of a *regressus ad infinitum* would emerge. According to T.M. Horstschäfer,¹⁷ by using this slight terminological difference, which reflects a subsequent difference on a semantic level, Aristotle tries to avert the danger of a *regressus ad infinitum*.

We may also remark that in the opening passage of the *Physics* there are three different terms, “principles or causes or elements” (184 a 16), and there is a need for us to clear whether these three terms are used as synonyms or whether they have different meanings. Philoponus¹⁸ suggests that Aristotle is either using “principles” and “causes” in parallel to mean the same thing, so that he is saying that both the efficient and the final are principles and causes, but he calls the other two (the material and the formal) “elements”, or, alternatively, a) he predicates the first term, “principle”, of all in them in common, since

¹³ Simplicius in *Phys.* 12.14–20.

¹⁴ See Osborne 2006: 25, 28.

¹⁵ Bolton 1991: 2.

¹⁶ Simplicius in *Phys.* 12. 21–25.

¹⁷ See Horstschäfer 1998: 15.

¹⁸ Philoponus in *Phys.* 6.9–17.

he clearly calls each of them “principle” all over the place, and b) he predicates the second term, “causes”, of the efficient and the final, and “elements” of the other two, matter and form. In my opinion, even if Aristotle in this passage refers to all the causes calling them “principles”,¹⁹ he is trying to display the principles of natural things as elements of them, i.e. he intends to show those principles of natural things which inhere in them as elements of them. This is what we can infer from the method of inquiry that Aristotle proposes to us in the next passage. By the term “elements”, I mean matter and form, but by the term “principles”, I understand not only matter and form but also privation, which is also an adjunct accompanying one of the two elements of all natural things: matter. Privation is a principle of coming to be and passing away or a principle of change.

2. Two ways of acquiring scientific knowledge

Simplicius²⁰ refers to the doctrine that Aristotle expresses in the first sentence of the *Posterior Analytics*, in order to show that coming to know principles of natural things involves also a kind of pre-existent knowledge: “All teaching and all learning of an intellectual kind proceed from pre-existent knowledge” (*An. Post. A 1*, 71 a 1–2).²¹ Furthermore, Simplicius²² makes a distinction between what is self-evident and/or a principle of knowledge by general consent and what comes to be known from pre-existing or previous knowledge. What becomes known through syllogism and demonstration always comes to be known from pre-existing knowledge. As G. Bayer puts it “principles of science constitute the pre-existing knowledge that is needed to ground the intelligibility of what one learns or teaches in a science”.²³ As regards principles of natural things, knowledge of principles of natural things constitutes the necessary pre-existing knowledge or the prerequisite for knowledge of natural things. This pre-existing knowledge ensures for natural things their knowability and intelligibility.

But what is the pre-existent knowledge when it is the principles themselves that one is coming to know? Simplicius asserts that since the question about the principles of natural things has been answered in many different ways by natural philosophers, it is obvious that the principles of natural things are not self-evident.²⁴

Both Simplicius and Philoponus recognize that there are two ways of acquiring scientific knowledge. According to Philoponus,²⁵ these two ways are: a) the demonstrative

¹⁹ All causes are principles but not vice-versa; see Aristotle's *Metaphysics* IV, 1013 a 16–17. Privation is a principle of natural things in the sense that it is a principle of change, but is not reckoned among the causes.

²⁰ Simplicius *in Phys.* 15.1–4

²¹ Translation Barnes 1994.

²² Simplicius *in Phys.* 15.4–8.

²³ See Bayer 1997:112.

²⁴ Simplicius *in Phys.* 15.9–11.

²⁵ Philoponus *in Phys.* 9.11–14.

method and b) the didactic method. These two methods are in opposition to each other. As Philoponus explains, this opposition is due to the fact that the demonstrative method demonstrates secondary things from things that are first and more fundamental in nature, while the didactic method, although it is also a kind of demonstrative approach, demonstrates things that are prior from things that are posterior in nature, using inferior criteria or means of demonstration, or using a second rate type of demonstration.²⁶ Philoponus adds that the second way is also called “evidential” (τεκμηριώδης).

Simplicius²⁷ recognizes two types of the more knowable or more intelligible and correspondingly two types of apodeictic knowledge: the first is the demonstrative way of syllogism, which is properly speaking a demonstration and is based on the principles of demonstration or the principles of demonstrandum, and the second is the evidential (τεκμηριώδης) way of syllogism, which is not demonstrative, and which is based on the necessary consequences and results of the demonstrandum. Simplicius²⁸ points out that in this case although the consequences or the results of the demonstrandum are not principles of the demonstrandum they are principles of this sort of proof, since they are more knowable or intelligible than the demonstrandum itself. Philoponus²⁹ explains that we use this didactic or evidential method for certain things because we are unable to use the prior or demonstrative method, due to the fact that the nature of things is frequently in this condition, either through not possessing the more fundamental principles, or due to the fact that, though they do possess them, those principles are less clear and less knowable to us.

3. The dual meaning of *katholou*

3.1. The *Physics* I.1 and the *Posterior Analytics* I.2

In chapter one of the first book of his *Physics*, Aristotle says that since our present task is to get to know the principles of natural things it is necessarily by the second of these methods that we must get to know them. So, according to passage 184 a 16–26, “the natural course is to proceed from what is clearer and more knowable to us, to what is more knowable and clear by nature; for the two are not the same. Hence, we must start with things which are less clear by nature, but clearer to us, and move on to things which are by nature clearer and more knowable. The things which are in the first instance clear and plain to us are rather those which are compounded [= συγκεχυμένα transl. W. Charlton] or indiscriminate [transl. C. Osborne] or confused [transl. L. Angioni] or jumbled

²⁶ Philoponus in *Phys.* 9.14–17.

²⁷ Simplicius in *Phys.* 15.15–25.

²⁸ Simplicius in *Phys.* 15.25–29.

²⁹ Philoponus in *Phys.* 9.19–22.

up [transl. R. Bolton] or mixed together [transl. R. Waterfield]. It is only later through an analysis of these that we come to know the elements and principles. That is why we should proceed from the universal to the particular. It is the whole which is more knowable by perception, and the universal is a sort of whole: it embraces many things as parts”.³⁰

The main problem that emerges from this passage is that this use of the terms “more knowable and clear to us”, i.e., καθόλου (universal), and “more knowable and clear by nature”, i.e., καθ’ ἕκαστον (particular), contrasts with another passage, where the sense attributed to them is diametrically opposite; the other passage is *Posterior Analytics* I.2, 71 b 32–72 a 5: “Things are prior and more knowable in two ways; for it is not the same to be prior by nature and prior in relation to us, nor to be more knowable and more knowable to us. I call prior and more knowable in relation to us items which are nearer to perception, prior and more knowable *simpliciter* items which are further away. What is most universal is furthest away, and the particulars are nearest”.³¹

It is worth considering if what is said here, in the first book of the *Physics*, is in conflict with what is said in the first book of the *Posterior Analytics*. The *prima facie* inconsistency between the *Posterior Analytics* I. 2 and the *Physics* I. 1 is a first impression which upon careful examination cannot be verified. Most scholars believe that there is no incompatibility between these two different kinds of explanation, but a slight terminological discrepancy between the two texts.³² R. Bolton³³ admits that there is a contradiction “unless, as most commentators reasonably conclude, the use of the term καθόλου in the *Physics* I. 1 is peculiar and not the typical use displayed, for instance, in the passage at the beginning of the *Analytics*”.

Philoponus clarifies the use of the terms καθ’ ἕκαστον and καθόλου in the passage of the *Physics* and points out that the two passages are in agreement and not conflicting because the apparent contradiction is due to the dual meaning of καθόλου. According to Philoponus,³⁴ by “universal” (καθόλου) Aristotle means here the particular (μερικών), which is differentiated from the individual (καθ’ ἕκαστα) by virtue of the fact that the individual is definite, whereas the particular is indeterminate. So, the particular is nothing but an indeterminate individual capable of being applied to many things. Philoponus thinks that this very property of being indeterminate is the reason why Aristotle calls the particular also “indiscriminate” and “universal”; “universal” because of its capacity to apply to many things, while the individual applies to only one, and “indiscriminate” [συγκεχυμένον] because it applies in an indeterminate and inarticulate manner to the things it does apply to. Therefore, the “universal” here in the *Physics* means not the

³⁰ Mostly, I follow W. Charlton’s (1992) translation.

³¹ Translation Barnes 1994.

³² See Angioni 2001: 308.

³³ See Bolton 1991: 4.

³⁴ Philoponus in *Phys.* 10.28–11.3.

universal proper [κυρίως καθόλου], but what is particular and indiscriminate because it applies to many things.³⁵

On the contrary, in the *Posterior Analytics* Aristotle refers to the *universal proper*. But since in the *Physics* “universal” means the particular, Aristotle does not invalidate the main thesis of the *Posterior Analytics*, for it is true that the individual is more knowable to perception. The difference is that in the *Posterior Analytics* the *universal proper* is related to the particular (proper) only just as the *prior by nature* and *more knowable simpliciter* is related to the *prior to us* and *more knowable to us*, while in the *Physics* in addition the universal is related to the particular as the whole is related to its parts.

So, what Aristotle says in this first chapter of the first book of the *Physics*, the chapter on method, is that perception initially grasps the individual as an indiscriminate and inarticulate whole, i.e. as an indeterminate particular which can apply to many things. Philoponus explains that “...since all nature proceeds from imperfection to perfection, for this reason it is in an indiscriminate and inarticulate manner that perception first hits upon the individual, given that it is not immediately capable of distinguishing the characteristic features of the individual from the rest. Hence, it was for this reason that Aristotle called such perceptual knowledge knowledge of the universal...”.³⁶

Both Simplicius and Philoponus explain this kind of perceptual knowledge with the same example. Simplicius says, “when something is coming toward us from a distance, we can more easily perceive that it is an animal rather than a man, and that it is a man rather than it is Socrates”.³⁷ Philoponus says, “when we see someone coming, we identify him first in accordance with the indiscriminate universals; For the first thing we think is simply that it is a body, then that it is an animal, then that it is a human, but not yet what sort of body or what sort of animal or what sort of human being”.³⁸

3.2. The *Physics* I.1 and the *Posterior Analytics* II.19

I believe that there is a strong connection between the method described in the first passage of the *Physics* and the passage of the *Posterior Analytics* II. 19, 100 a 15–b 5, as do other scholars. According to R. Bolton, “Aristotle uses the same unusual language in the two passages to say the same thing”³⁹. But R. Bolton,⁴⁰ speaking of a close correspondence between the two passages, mentions also the passage of the *Posterior Analytics* II. 19, 100 a 7–8, where Aristotle refers to “the one apart from the many, what is one and the same in all those things”, i.e., to the *universal proper* [κυρίως καθόλου] or the standard

³⁵ Cf. Philoponus in *Phys.* 17.25–26.

³⁶ Philoponus in *Phys.* 17.28–18.3.

³⁷ Simplicius in *Phys.* 16.18–20.

³⁸ Philoponus in *Phys.* 11.33–12.2.

³⁹ See Bolton 1991: 9.

⁴⁰ See Bolton 1991: 6.

universal or the strict universal. R. Bolton⁴¹ supports a unified interpretation of καθόλου in the *Posterior Analytics* II. 19, claiming that *katholou* here has a meaning that is closer to the concrete whole or “composite” notion. He also believes that in both chapters, the *Physics* I.1 and the *Posterior Analytics* II. 19, *katholou* has a single meaning. Although I believe that when in the *Posterior Analytics* II. 19 the universal or *katholou* is referred to as an object of perception it has the same meaning of the “whole” or of the “composite” as in the *Physics* I.1, I am inclined to recognize that in the *Posterior Analytics* II. 19 there is also place for the καθόλου as a usual or standard universal and that is the case when the καθόλου is referred to as “the one apart from the many, what is one and the same in all those things” (100 a 7–8), or as principle of art (τέχνη) and scientific knowledge (ἐπιστήμη) (100 a 8). But I also tend to believe and admit that in the *Physics* I.1, there is also a stage of the described method where the standard universal occurs and this is when the analysis or the division of the concrete wholes takes place.

G. Bayer gives a plausible explanation of the distinction between the two kinds of καθόλου, when he says that “the familiar universal, which for the moment we can call the ‘umbrella καθόλου’, is a single class umbrella with many particulars under it, e.g., ‘human’. The *Physics* I.1 καθόλου, ... the ‘composite καθόλου’, is a single composite with many attributes as parts, e.g., the cluster of attributes we pick out as ‘Callias’”.⁴² But I question G. Bayer’s⁴³ assertion concerning the relation between this special notion of καθόλου which occurs in the introduction to scientific investigation in the *Physics* I.1 and the more familiar universal which has the meaning of “one beside the many”. G. Bayer seems to identify the idea of “whole” with the idea of “one beside the many”, although he admits that both the “one” and the “many” are different in these two senses of the term “καθόλου”. I agree with him that we could describe the familiar universal as a single class umbrella with many particulars under it, and the *Physics* I.1 καθόλου as a single composite with many attributes as parts, but I argue that we ought to make the distinction between the “whole” and the “one beside the many”.

The Aristotelian “one beside the many” is the one and the same and common characteristic or attribute which appears and exists in all these many things, being something other than they are, which means that it is different from them, because in this case the one is a concept or a notion while the many are bodies, but the one does not have a separate existence beside the many. The “whole” is also the one beside its many parts because it is something different from its many parts, but it does not exist in each of its parts, neither is something common in all of its parts and whereas it cannot exist without its parts it has a separate existence beside its parts. In addition, the parts of a whole can have the same composition or structure as the whole, which means that the parts might be composite as well.

⁴¹ See Bolton 1991: 6–9.

⁴² See Bayer 1997: 129.

⁴³ See note 42.

Because of this distinction between the idea of “whole” and the more familiar universal, which normally is construed as the “one beside the many”, Simplicius casts doubt upon the adequacy of the parallel Aristotle tries to draw between the whole and the composite on the one side, and the universal on the other side. According to Simplicius,⁴⁴ the example or the notion of “whole” and “composite” is appropriate to the subject of this first chapter of the *Physics*, but the notion of “universal” (καθόλου) does not fit well with the subject. What Simplicius says in justification of his criticism of the Aristotelian examples is that the universal does not consist of the particulars as elements of it, whereas the parts of the whole or the parts of the composite are its elements; besides, in the case of the composite, the composite is not attributed to each of its parts, whereas the universal (καθόλου) is attributed to the particulars.

Furthermore G. Bayer claims that “what seems to be the case in (the *Posterior Analytics*) II. 19 is that the first stage of coming to know is being described as καθόλου in *both* senses. Callias is the πρώτον ἐν τῇ ψυχῇ καθόλου in two senses: we see him as a composite καθόλου, a cluster of attributes including both essential human attributes as well as incidentals like 'bearded', 'shod', 'wearing a robe', etc. But we also take this composite to be an umbrella καθόλου, in that we assume it to be typical, repeatable, 'universal'. Seeing Callias, one sees such a universal, 'human being'...With more experience of different humans ... we refine this confused πρώτον... καθόλου, 'first item taken as universal', shedding the incidentals until only essential attributes remain. This is the properly determined universal human, which was immanent in the first confused cluster of attributes we saw in Callias”,⁴⁵

I think that the last sentence of the above excerpt from G. Bayer’s article confirms that in fact the first stage of coming to know includes καθόλου in both senses, but not in the way G. Bayer suggests it. Especially, when we see Callias coming, we grasp him initially as a confused cluster of attributes, as an indiscriminate whole, but we do not also take this composite to be an umbrella καθόλου, because “human being” is at first only one attribute immanent in this confused cluster of attributes. The attribute “human being” is only a part of this confused whole we initially grasp. If we already have an idea of this καθόλου in our soul and we have defined it, we recognize it as καθόλου and we assume it to be typical, repeatable, immutable. However, we do not identify the confused whole with this καθόλου, which is only one attribute among the others-essential and incidental attributes. Nor do we grasp the confused whole as being the ordinary or familiar καθόλου, i.e., we do not see Callias coming just as human being and we do not identify the whole which represents Callias as being one specific καθόλου, even if this καθόλου, 'human being', is the one which defines the substance of Callias. So, in my opinion G. Bayer is not quite right when he says, “Seeing Callias, one sees such a universal, 'human being’”. Seeing Callias coming one sees a cluster of attributes, one of which is 'human being'.

⁴⁴ Simplicius in *Phys.* 17.33–37.

⁴⁵ Bayer 1997: 129–130.

It is vital to pay attention to Philoponus' explanation regarding the *Physics* I.1 καθόλου, in order for us to conceive the way in which καθόλου is construed more as an indeterminate whole or an indeterminate individual rather than a usual or typical καθόλου: "... when we identify the one coming as animal, we do not identify it as a genus (for we know it is one thing), but as an indeterminate individual; and that is the particular... For the genus is not indiscriminate; whenever I say 'animal' I have defined the substance and whether it is said of thousands or of one, the substance of the animal will not be any the more or less known; but whenever I say 'an animal', since the meaning conveys not only the notion of animal but also of the existence of some differentia belonging to it and separating it from the others, but does not yet add what the differentia is — for that belongs exclusively to the individual — for this reason it is indiscriminate and inarticulate".⁴⁶ So, when we say that we identify something we perceive as indiscriminate or indeterminate [συγκεχυμένον], this means that we do not identify it as a genus or a species, because genus and species are not indiscriminate.

At this point, it is worthwhile to consider the explanation of Philoponus and Eustratius regarding the passage of the *Posterior Analytics* II. 19, 100 a 15–b 5 in order to examine how this explanation can contribute to the clarification of the *Physics* I.1 καθόλου: Philoponus⁴⁷ states that when someone sees Callias or Socrates perception grasps not only some incidental, but also some essential features, i.e. some common characteristics which are universal, e.g., that they are animals or that they are reasonable. From this first perception, of the universal, which is retained as a phantasm, there arises within the soul some first but uncertain knowledge of the universal. One comes to know the universal through the accumulation of similar sense data. Certain and secure knowledge of the universal arises out of many similar perceptions and of the retention of such perceptions as phantasms. As D. Modrak points out: "because Callias is a member of all the classes involved, an exemplification of all the universals under consideration, the perception of Callias and the retained phantasma of Callias can serve as the basis for the apprehension of these universals".⁴⁸

But while these explanations shed light on the Aristotelian description of the articulation of the universal in *Posterior Analytics* II. 19, I think that if we want to elucidate the way perception grasps the universal within the particular in the first chapter of the *Physics*, we have to pay attention to what Eustratius says about the relevant passage of the *Posterior Analytics*. Eustratius points out that when we see Socrates, perception, apart from Socrates, grasps also the man, without abstracting the universal from the particular, without abstracting the man from Socrates; our perception grasps the universal in a confused or jumbled way within the particular.⁴⁹ Eustratius' explanation offers us a hint at the difference between the universal considered as something general, in the

⁴⁶ Philoponus in *Phys.* 13.1–12.

⁴⁷ Philoponus in *Analyt. Post.* 437.21–31.

⁴⁸ See Modrak 1987:169.

⁴⁹ Eustratius in *Analyt. Post.* 266.10–16.

sense of a class, and the universal considered as an indeterminate, undifferentiated and compounded whole.

Eustratius' explanation also reminds us of the way W. Wieland construes the καθόλου in the first chapter of the *Physics*. According to W. Wieland "Katholou here, of course, does not designate anything general in the sense of a class, but something general in the sense of *indeterminate*, something not yet differentiated into its factors... We may call this method of coming to know first principles an inductive method — so long as we remain aware that induction does not have to signify merely the accumulation of particular facts and the consequent abstraction from them. Induction can start with a particular example, from which it reads off a general characterization. After all, the distinction between general and particular is itself a product of reflection"⁵⁰.

In my opinion, it is reasonable to assert that perception of the καθόλου in the *Physics* I.1 has an affinity with this meaning of ἐπαγωγή (induction) which confines this cognitive procedure to an inductive insight into some universal point as a consequence of attending one particular case. Thus, from a single action of perception the cognitive subject could yield knowledge of the universal. G. Bayer correctly stresses that "it is by ἐπαγωγή from a single perception of a particular thing that we can surmise that this thing 'falls under a universal'".⁵¹ He also points out that we cannot sustain the claim that perception alone is responsible for this initial grasp of the universal. In my view, it seems that the initial grasp of the universal is an exclusive task of perception. At least this is what we can infer from passage 100 a 16–b 1 of the *Posterior Analytics* II. 19 and 184 a 16–26 of the *Physics* I.1.⁵² But I agree with G. Bayer⁵³ that perception is only the first step in the process that culminates in the possession of the universal.

This initial grasp of the universal by perception is not sufficient for the possession of the universal, and after all is not sufficient for acquiring knowledge of the principles of natural things. The universal in the first chapter of the *Physics*, considered as indiscriminate and undifferentiated whole grasped by perception, neither can serve as an explanatory cause nor can function as a principle of natural science, as H. Wagner⁵⁴ correctly puts it, since it does not have a determinate articulated content. Natural philosopher or natural scientist has to analyze or divide this sense-perceptible whole into its constituents in order to yield knowledge of the principles of natural things.

⁵⁰ See Wieland 1975: 131.

⁵¹ Bayer 1997: 123.

⁵² Pietsch (1992) points out that knowledge begins at the perception of the natural, composite thing, which is an individual, but he stresses the fact that what perception grasps is already a universal, since perception receives the immaterial forms, because one perceives "red", and not this red; cf. *De anima* 424 a 17–19. According to Pietsch what is grasped by sense-perception is already a universal which should be described as an internal object of perception. He sets out the view that in Aristotle there is not absolutely unmediated knowledge of any extramental, i.e., natural, composite, thing. See Pietsch 1992: 64–65. In addition to what C. Pietsch argues, we have to keep our mind on the explanation of the ancient commentators, according to which perception grasps essential features of the particular, i.e., of the undifferentiated whole, and these features are universal.

⁵³ See note 51.

⁵⁴ See Wagner 1967: 395.

4. The transition from μέθοδος to ὁδός: the task of scientific research and the real limitations of human knowledge

Thus, we have to make the necessary distinction between the καθόλου of the *Posterior Analytics* I.2, a principle of science, and the καθόλου of the *Physics* I.1, a starting point for the inquiry into the principles of natural things, which are also principles of natural science. The principles of science in the *Posterior Analytics* I.2 have only an epistemological content or value, whereas the principles of natural science in the *Physics* I.1 have also an ontological value since they are also principles of natural things. In the *Posterior Analytics* I.2, the discussion concerns science, or the knowledge of universals, but here in the *Physics* I.1, the καθόλου or universals are things more immediately cognizable to us by sense-perception, whereas the καθ' ἕκαστα or particulars are the primary elements of natural things. This distinction between these two meanings of καθόλου is also reflected in the terminological difference which occurs in passage 184 a 10–23. Aristotle on the one hand employs the word μέθοδος (method) for scientific knowledge and scientific reasoning which is applied to various disciplines and is grounded on explanatory causes and principles and elements, and on the other hand employs the word ὁδός (route) to describe the procedure which a human intelligence follows in order to gain knowledge of the principles of natural things.⁵⁵

G. E. L. Owen asserts that “there seems to be a sharp discrepancy between the methods of scientific reasoning recommended in the *Analytiks* and those actually followed in the *Physics*... The discrepancy between the two works lies rather in the fact that, whereas the *Analytiks* tries (though not without confusion and inconsistency) to distinguish the two processes of finding and then applying the principles, the *Physics* takes no pains to hold them apart”.⁵⁶

I think that the Aristotelian distinction between μέθοδος (method) and ὁδός (route) in the first chapter of the *Physics* disproves Owens' assertion. Aristotle seems to recognize that perceptual phenomena or perceptual appearances are the sources which provide the principles of natural things with their knowability and intelligibility. Given that the end or goal of natural science is what in each case appears authoritatively (κυρίως) in accordance with perception, this accordance is the criterion by which we must ultimately test the adequacy of the principles of natural things in physics⁵⁷.

The transition from μέθοδος to ὁδός reflects the distance between what is determined as the formal task of scientific research (the route from the causes and principles to

⁵⁵ See Horstschäfer 1998:17.

⁵⁶ Owen 1986: 239. But Barnes finds no traces of these two different processes reported by G.E.L. Owen in the *Analytiks*. Barnes suggests that “... the *Posterior Analytics* was never intended to provide the theoretical substructure for Aristotle's scientific research... the theory of demonstrative science was never meant to guide or formalize scientific research: it is concerned exclusively with the teaching of facts already won; it does not describe how scientists do, or ought to, acquire knowledge: it offers a formal model of how teachers should present and impart knowledge”. See J. Barnes 1975: 77.

⁵⁷ See *De caelo* III, 306a16–17. See Owen 1986: 243; Irwin 1988: 34.

the things these causes and principles explain), and the real limitations of human knowledge or the nature of human knowledge⁵⁸. The words πέφυκε and ὁδός echo the deviation of the naturally proper route to knowledge of the principles from the procedural methodology which is supposed to guide or formalize scientific research.

According to W. Wieland's view "... Aristotle is not in the least concerned with the distinction between a subjective and an objective sphere, or between an order of being and an order of knowledge. He is concerned merely with different *forms of knowledge* (i.e., with ways in which a thing is known), not with an opposition between knowing and thing known, or with an ontological dualism...the path from what is better known to us to what is better known by nature, which Aristotle indicates is the path to knowledge, is emphatically not a path from not knowing to knowing, but a movement from one form of knowing to another".⁵⁹ W. Wieland correctly stresses that Aristotle's method of natural science in the *Physics* I.1 is not concerned with an ontological dualism. Nevertheless, I think that each form of knowledge corresponds to a different ontological level, since what is better known to us is the particular (in this case the indeterminate composite particular, the compound), whereas what is better known by nature is the universal (in this case the principles of natural things).

5. The principles of natural things as *principia realia*

Normally, the universals in Aristotle do not have any ontological content, since they are mere conceptions and means of classification, but the principles of natural things are not only *rationes cognoscendi* but also *principia realia*. As T. Irwin puts it "Aristotle also regards things – non-linguistic, non-psychological, non-propositional entities – as first principles... Actually existing things are first principles because they explain other things and our knowledge of the world requires us to know the explanatory relations in it... What is prior and better known by nature is both the propositional principle about, e.g., atoms, and the real principle mentioned in the proposition – the atoms themselves. We grasp both sorts of principles at the same time and in the same way".⁶⁰

In fact, there is an interconnection between the ontological and the cognitive value of a principle. This interconnection is echoed through the concise definition which Aristotle formulates at the end of chapter Δ 1 of the *Metaphysics*: "it is therefore common to every origin to be the first point from which a thing is, or comes to be, or from which one gets acquainted with it" (1013 a 17–19)⁶¹. The method Aristotle suggests to the natural philosopher or the natural scientist in the opening chapter of his *Physics* is a philosophical method which proceeds to the active discovery of the principles of natural things

⁵⁸ Cf. Horstschäfer 1998:18–19.

⁵⁹ See Wieland 1975: 129.

⁶⁰ See Irwin 1988: 4.

⁶¹ Translation Kirwan 1993.

by employing empirical inquiry⁶². Empirical inquiry, as Irwin puts it “begins from the particulars grasped in perception and proceeds to the universal grasped by reason”⁶³. Since we begin with what is confused and look for a clear and thorough grasp of each perceptual form, the progress from what is confused to what is clear is the most prominent feature of this procedure.

6. The three stages of Aristotle's method

This method of understanding the first principles is presented by Aristotle as the only *ὁδός* or as the naturally proper route one has to follow in order to find out the first principles of natural things. Aristotle's method includes or consists of three stages. Each of these stages represents a specific method but there is no need to talk about three different methods, because they are all included in one and single general method. We may call the first stage an inductive method or an inductive stage, so long as we remain aware that induction can start with a single perception, with a particular example, from which one can yield some essential features, some general or universal characteristics.⁶⁴

The second stage is *διαίρεσις* or *ἀνάλυσις*. *Διαίρεσις* as T. M. Horstschäfer⁶⁵ correctly points out, is the method by which we can proceed from what is clearer and more knowable to us to what is clear and more knowable by nature. *Diairesis* involves an analysis of compound indeterminate wholes in their parts or in their constituents which ultimately constitute the elements and principles of natural things. Therefore, *διαίρεσις* presupposes reason's involvement, since “the distinction between general and particular is itself a product of reflection”.⁶⁶

The procedure of *διαίρεσις* involves an analysis of a whole to its parts. Aristotle illustrates this procedure well by means of the two examples that he refers to at the end of this first chapter of the *Physics*. A name signifies a certain whole in an indefinite way. On the other hand, the definition is a specification which signifies explicitly each of the essential properties that belong to the thing which bears this name and divides the thing as a whole into its proper essential and logical parts. Children at first call all men father and all women mother; later they distinguish each of them. According to Philoponus' explanation this example means that “children start off by having an indiscriminate knowledge of fathers and know them as human beings, not as fathers; hence they think all male human beings are fathers. But later when they can eventually attend to the properties of their father, then they get hold of an articulated knowledge of him and so distin-

⁶² Cf. Horstschäfer 1998:7.

⁶³ See Irwin 1988: 43.

⁶⁴ As Seidl (1995) puts it, sense-perceptible things already have at the level of sense-perception a non sense-perceptible aspect, an aspect which is grasped by intellect. See Seidl 1995: 32.

⁶⁵ Horstschäfer 1998: 20.

⁶⁶ See Wieland 1975: 131.

guish him from other human beings”.⁶⁷ Philoponus explains that a child identifies every human being as father, because he does not have yet an idea of the καθόλου nor does he understand or possess the characteristics of the individual particular: “Even if the child identifies every human being as father, yet he does not have an idea of the universal, but of the particular, the indeterminate particular; he does not have the characteristics of the individual articulated, so that he applies to everyone those characteristics of the human being that he picked up at the start”.⁶⁸

Philoponus’ explanation explicitly shows that the reason why children call all men father and all women mother is not that they can recognize their father or mother, but they wrongly assign the name because they cannot link the name to the right person. The reason is not that children grasp the difference between their parents and the other people, but that they cannot express it at the level of language.⁶⁹ The point seems to me rather that the child’s parents are parts of a collective universal,⁷⁰ i.e., of a perceptible indiscriminate whole, and that the child is not yet in a position to recognize its own parents among the other persons.⁷¹ W.D. Ross is right when he points out that dividing the whole into its καθ’ἕκαστα means rather the analysis of a genus into its species, which is the business of logical division, not of definition. But definition, as Ross remarks, also analyzes a whole into its logical constituents, genus and differentia.⁷² It seems plausible to me that Aristotle would choose both of these procedures, the transition from name to definition on the one hand and logical division on the other, as illustrations of the second stage of the actual method of physics, that is of the analysis of the confused data of experience into their elements.

The third stage of Aristotle’s method of natural science is induction in its usual meaning, i.e., induction considered as an advance from particulars to universals. The natural scientist has to attend to many particular cases and discover which are the first principles of each particular under examination. The consequence of this scientific process is to acquire insight into some universal point, and in this case to acquire knowledge of the first principles of all natural things. It is worthwhile to mention Philoponus’ explanation⁷³ according to which when we have learned that one of the principles is matter, another form, another privation, we have moved on to something more articulated, but still inarticulate and indiscriminate as regards the peculiar principles of each thing, since we have learned a theory that is general and indiscriminate. For instance, when we learn about

⁶⁷ Philoponus in *Phys.* 11.19–23.

⁶⁸ Philoponus in *Phys.* 12.29–13.1.

⁶⁹ This is Horstschäfer’s interpretation (1998: 29–30).

⁷⁰ Wieland distinguishes between two meanings of *katholou*, regarding this example: the universal as a structural whole and the universal as a collective whole. Wieland believes that the example of children does not immediately reflect the specific structure of the knowledge of principles, because it refers to the discrimination within a collective and not within a structural whole; see Wieland 1992⁵[1962]: 93.

⁷¹ Ross 1936: 457.

⁷² See note 71.

⁷³ Philoponus in *Phys.* 15, 26–16.1.

matter, it is about matter that can be predicated of every sort of matter, it is about matter under its more general description.

7. Conclusion: Nature and the nature of human knowledge

So, neither knowledge of each natural thing nor knowledge of its first principles is unmediated, but each one becomes known through knowledge of the other as T. M. Horstschäfer⁷⁴ correctly puts it. Regarding this cognitive process (which when it starts from the natural thing ends up in its first principles and when it starts from the first principles ends up in natural thing), Horstschäfer mentions the words of W. Kullmann⁷⁵ who speaks of an ascending as well as a descending Dialectic.

Furthermore, an interesting and at the same time thorny question emerges from this reflection: is there a similar Dialectic or a similar interaction or a similar interconnection between nature and the nature of human knowledge? We have noticed that the word $\pi\acute{\epsilon}\varphi\upsilon\kappa\epsilon$ in passage 184 a 16 refers to the nature of human knowledge. Can we say that the structure of the natural world to which we belong determines the structure and the form of our knowledge — or at least the way in which we understand — since we are parts of nature and at the same time observers of nature and cognitive subjects?

I think that the answer might be affirmative, if we consider that in the extramental world forms inhere in matter and the natural world consists of composite things, i.e., of bodies. Matter and form are not just parts, they are *elements* of the composite things, i.e., of natural things. Philoponus makes the distinction between an *element* and a *part* considered in its normal sense or a *part* properly said when he states, “Only in composite things are there elements, which is the same as to say only in natural things. For an element is that which is immanent in the thing and becomes a part of the composite, but not a part like the parts <of the body> in the normal sense, i.e. the uniform and organic parts: these have their own circumscribed location and activity, and each of them is allotted a certain part of the composite; but the elements, by contrast, penetrate through and through each other and through the composite, so that there is not a jot of the composite that does not share in the elements”⁷⁶. Therefore, we can reach the conclusion that any composite thing, i.e., natural thing, is a confused whole regarding every certain part or aspect of its structure. The natural thing, as a composite thing, is a confused whole not only in the sense that its elements in their entirety penetrate through and through the composite, but also in the sense that in every jot of it matter and form are mixed together, because they penetrate through and through each other.

Aristotle's method of inquiry into the principles of natural things in the *Physics* I.1 seems to imply that since every natural thing is composite, i.e., has existence in reality

⁷⁴ Horstschäfer 1998: 16.

⁷⁵ Kullmann 1975: 302.

⁷⁶ Philoponus in *Phys.* 7.25–32.

and subsists as a composite, it can be initially grasped as a composite. The crucial point of Aristotle's theory of method in the *Physics* I.1 is that perception, the only faculty of human being that can have access to the composite natural thing, naturally grasps it as an indiscriminate, inarticulate and confused whole.

Simplicius⁷⁷ offers a reasonable explanation of this procedure in his commentary: composite things or compounds are more knowable to us than their constituents which are simple, because on the one hand we come to know composite things by perception, a faculty shared by all humans, and perceptual knowledge (knowledge derived from perception) is more accessible and familiar to us than any other form of knowledge, and, on the other hand, it is natural to reach knowledge of simple things, i.e., of principles, starting our inquiry with the composites.

⁷⁷ Simplicius in *Phys.* 16.8–12.

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Aristotle's Method of Understanding the First Principles of Natural Things in the *Physics* I.1

This paper presents Aristotle's method of understanding the first principles of natural things in the *Physics* I.1 and analyzes the three stages

of which this method consists. In the *Physics* I.1, Aristotle suggests that the natural proper route which one has to follow in order to find out the first principles of natural things is to proceed from what is clearer and more knowable to us to what is more knowable and clear by nature. In the *Physics* I.1, the terms καθόλου (universal) and καθ' ἕκαστα (particular) are not used in their usual meaning (e.g., the meaning which the same terms have in the *Posterior Analytics* I. 2). This paper examines the *Physics* I.1 in comparison with the *Posterior Analytics* II. 19 in order to elucidate the meaning of καθόλου in the first chapter of Aristotle's *Physics*. Furthermore, it reaches the conclusion that the structure of the natural world to which we belong determines the structure and the form of our knowledge. On the one hand, natural things are composite and, on the other hand, perception is involved in the initial grasping of natural things as composites. Thus, since perceptual knowledge is more accessible to us than any other kind of knowledge it is natural to reach knowledge of simple things, i.e., of the principles, starting our inquiry with the composites.

KEY WORDS

Aristotle, method, natural things, principles, universal, particular, *epagōgē*, analysis