

ARISTOTLE'S THEORY OF DEMONSTRATION AND ITS LOGICAL AND METAPHYSICAL ENTANGLEMENTS

This special issue of *Manuscripto* brings together articles around the notion of scientific demonstration as expounded by Aristotle in his *Posterior Analytics* (henceforth *APo*). Some articles (Morison and Goldin) have a broader scope in the sense that, being devoted to some topic, are not built around one or another specific passage of the text, while others (Bronstein, Zuppolini, Angioni, Karbowski, Castelli, Fait, Peramatzis, and Crager) specifically focus on one passage, or one chapter, or set of chapters that are usually taken together. Finally, some articles (Corcilius, Zillig, Hankinson, Falcon, and Hasper) deal with topics that, although rooted in (or at least connected to) Aristotle's theory of scientific demonstration, extend to other domains and other treatises, beyond the *APo*.

Benjamin Morison discusses the notion of theoretical *nous*. *Nous* is the scientist's non-demonstrative understanding of immediate premises, which are the foundations from which her demonstrative understanding derives. The author claims that *nous* is never defined in the *APo*, and proposes a definition that, according to him, captures what Aristotle had in mind. Exploring the idea that to have *nous* of a principle is to know it *as a principle*, Morison argues that one has *nous* of the proposition that *p* when (i) she knows that nothing explains why *p*, (ii) she knows that it is necessary that *p*, and (iii) she knows the ways in which the proposition that *p* integrates explanations in the science. Therefore, *nous* turns out to be as demanding as demonstrative understanding, something we could expect given that noetic and demonstrative understanding are the cognitive states that compose scientific expertise.

Owen Goldin's article contains a systematic approach to the distinction between scientific subjects and demonstra-

ble attributes. The author discusses a number of passages in which this distinction is employed. A special emphasis is given to *APo* II 8-10. These chapters, according to him, clarify the crucial feature that distinguishes derivative attributes from the subjects to which they belong. On the one hand, the basic subjects within science are entities that do not have a cause different from themselves. On the other hand, demonstrable attributes have ‘a different cause’ as their essence. The definition of an attribute—as opposed to the definition of a basic subject—is complex, which means that it can be displayed by a demonstrative syllogism which differs from it only ‘in arrangement’. The definition of an attribute, therefore, includes the minor term of the syllogism that reveals its essence, and therefore explicitly identifies the proper subject to which the attribute belongs. This picture allows Goldin not only to establish the sense in which a demonstrable attribute belongs to its subject ‘in itself’—that is, the second sense of ‘in itself’ defined in *APo* I 4—, but also to explain why, for Aristotle, subject and attribute must be coextensive.

The distinction between natural and unnatural predications is the object of David Bronstein’s article. According to *APo* I 19 and I 22, ‘natural’ predications—as secondary literature calls them—are categorical sentences in which the underlying subject is properly identified. According to the traditional interpretation of these chapters, only substances can be subjects in such predications. Bronstein offers a careful analysis of the relevant passages, and advances a new interpretation according to which nothing prevents non-substances from serving as subjects in natural predications. This reading has the remarkable advantage of accommodating some of Aristotle’s examples of demonstrative syllogism in the *APo*. These syllogisms would contain unnatural predications if the traditional interpretation were correct. In contrast, all of them become perfectly natural if we accept Bronstein’s alternative account.

The traditional interpretation of *APo* I 22 is also criticised by Breno Zuppolini in his contribution. Aristotle presents his view on natural predication as part of an argument meant to establish that demonstrations do not contain infinite predicative chains. This argument is part of a more complex proof in I 19-22 showing that Aristotle's model of demonstrative science is protected from the threat of infinite regress. According to the traditional interpretation of I 22, Aristotle relies on the fact that singular terms and summa genera have logical behaviours that prevent predicative chains from advancing *ad infinitum*. Zuppolini raises a number of objections against this reading, and proposes an alternative construal. The author identifies in the text premises from which a sound argument can be put together, one that does not involve including singular terms and summa genera in demonstrations. Additionally, Zuppolini explains how Aristotle's proof against infinite regress is connected to a defence of ultimate explanations in science—a connection that is far from clear if the traditional interpretation is accepted.

Lucas Angioni addresses the contrast between *episteme* and *doxa* in *APo* I 33. He argues that Aristotle is far from aiming at an overarching characterisation of *doxa* as a cognitive state in general. The previous chapters of the *APo* have characterised *episteme* in terms of grasping explanatory connections in a very demanding way—and the key notions of *universal* and *necessary* have contributed to Aristotle's characterisation of that demanding way: 'universal' has been employed to mark the distinctive feature of demonstrations that appropriately explain their *explananda*, whereas 'necessary' has been employed as ranging over the explanatory relation between *explanans* and *explanandum*. Chapter I 33 is taking advantage of this picture built in the previous chapters. Aristotle assumes that some explanatory attempts are only in the level of *doxa*, and tries to characterise them as such: they express *doxa* because they fail to grasp the uni-

versal connections and the necessary principles on which scientific demonstrations depend.

Joseph Karbowski examines Aristotle's claim in *APo* II that syllogisms can be used to establish existence. The author rejects a common interpretation of this claim, according to which determining the existence of a kind is just a matter of checking whether it has at least one actual instance. This traditional reading neglects the fact that in *APo* II Aristotle is primarily concerned with kinds that are properly scientific, i.e. kinds that are genuine in the sense of having an essence. What it is for a scientific kind to exist is something more than being instantiated. Determining the existence of a genuine kind is the same as establishing that there is a middle term for it. Hence, Karbowski argues that the existence of such a kind amounts to the existence of a single, unified cause underwriting its non-accidental features. This 'causal' or 'structural' existence, as the author calls it, is established by tracing correlations between the kind in question and its *propria*, i.e. the attributes possessed by that kind, and only that kind, which are ultimately grounded in the kind's essence.

The *aporiai* about definition and demonstration developed by Aristotle in *APo* II 3-7 are the topic of Laura Castelli's article. These *aporiai* have been overlooked in the literature as being of less philosophical importance. Castelli takes them seriously in the sense of finding good reasons why Aristotle has chosen this way to develop his positive views about definition and demonstration in the following chapters of *APo* II. She discusses carefully how the procedures of defining and demonstrating are entangled in a way that justifies (and gives full signification to) the aporetic treatment of the subject. Thus, the procedure of defining something can involve the grasp of the object of a demonstration (the conclusion) without collapsing into demonstrating it, and the procedure of demonstrating something can involve the grasp of the object of a definition without

collapsing into defining it. There is no need to take one of these procedures as reducible to the other.

Three articles are dedicated to *APo* II 11, a chapter that has attracted special attention since the ancient commentators. Aristotle argues that every explanatory factor or cause can be expressed by a middle term in a syllogism, but his claim is far from being clear. Doubts have been raised both about its exact meaning and about the success of the arguments in which Aristotle is supposed to illustrate the syllogistic expression of each kind of cause. One might wonder whether Aristotle is prescribing syllogistic expression as a norm (or as a regimentation) or is only stressing that syllogistic expression can be useful to highlight some important features of explanatory relations.

Paolo Fait dwells on 94a24-36, the part of the chapter dedicated to a fourth kind of cause that would normally be identified with the material cause—although there is no explicit expression pointing or alluding to Aristotle's notion of matter, a fact that has led many scholars to believe that Aristotle's object is not matter, but a different type of cause. Fait addresses the issue of whether and how material necessity can be cast into syllogistic expression. He also examines a possible reason for Aristotle's use of a geometrical example to illustrate what is traditionally understood as an expression for material causality.

Michail Peramatzis analyses 94b8-26, the passage traditionally understood as concerned with final causality and its syllogistic expression. He tackles a series of important issues concerning how this passage coheres with the theory found in the *APo*. Is Aristotle defending the explanatory priority of the final causes over the efficient causes? Is Aristotle assuming that his examples display all the requirements about universal and *per se* predications? How is Aristotle's discussion related to the practical syllogism and to the explanation-based definitions discussed previously in

the chapter? All these issues are carefully tackled in a step-by-step examination of the passage.

Klaus Corcilus starts with an examination of the same passage discussed by Peramatzis (*APo* 94b8-26), but is basically concerned with issues that extend beyond the limits of the *APo*. He argues that the passage at II 11 on final causality expounds a model for the causal structure involved in the teleology of *praxis* in general, the same model which is further explored in *de Motu Animalium* as an account of the highest goals of animal (including human) self-motion. The most important feature of the model is that these goals are contingently related to what realizes them in each situation.

Adam Cramer addresses the difficult text of *APo* II 19 100a6 and contends that the expression ‘*ē ek pantas*’ can reasonably be taken as an erroneous interpolation. He brings in new philological evidence: the β-family of manuscripts (ignored or neglected by most modern editors), Abū Bishr’s Arabic translation and the Anonymous Commentary on the *APo* do not have the three words. He suggests that, all things considered, there is good reason to take these three words as an erroneous reproduction of the word ‘*erēmē Santos*’ (in the same line), later interpolated into the text. Without the interpolation, Aristotle’s sentence reads smoothly as introducing a necessary condition for the transition from experience to *nous*.

The notion of *phainomenon* and its several roles in Aristotle’s methodology is explored from an interesting and original standpoint by Raphael Zillig. What is it for us to know something as a phainomenon? Every phainomenon (*qua* object of cognition) is characterized by being accessible, but epistemologically limited. However, instead of restricting phainomena to some extensionally pre-fixed class of things—such as the observed facts, or the singular facts grasped by perception etc., as is normally found in the literature—, the author claims that accessibility and epistemological limitation are always relative to a given context.

Thus, a given item is grasped as a phenomenon in comparison to some other item, which is less accessible and less epistemologically limited. This approach helps us explain why ‘phenomenon’ (and cognates) is employed in several passages to introduce something much more elaborate than merely brute facts—e.g., explanatory attempts.

R. J. Hankinson tackles the issue of whether and how a science of psychology—of pure soul—can be developed according to the requirements laid down in the *APo*, which amounts to tackling how much the *APo* cohere with the *de Anima*. Hankinson’s answer is positive. Aristotle’s drive to a maximum generality in his account of the soul seems to conflict with the requirement of maximum specificity in the identification of explanatory principles. However, the author argues, Aristotle’s project in the *de Anima* consists in identifying a web of causal relations in the general level of the soul itself, i.e., in the level of the basic soul functions that are common to living beings, without considering the strict correlation with a specific enmatterment or the strict teleological relations between bodily parts that depend on specific modes of living.

Andrea Falcon provides a detailed account of how Aristotle’s explanation of sleep and waking in the treatise *de Somno et Vigilia* follows some of the methodological guidelines advanced in the *APo*. We know from the latter work that scientific inquiry advances in stages. A pre-explanatory stage (ὄτι-stage) in which the relevant facts are established precedes and prepares an explanatory stage (διότι-stage) in which the scientist displays the appropriate causes of those facts. Aristotle’s approach to sleep and waking follows this procedure. In addition, Falcon argues that the explanatory stage of this approach is itself developed in multiple steps. First, Aristotle attempts to identify the primary subject of the process under investigation, i.e. the bodily part that is primarily affected by sleep and waking: the heart (or the primary sense organ analogous to the heart). Only after the

proper subject of change is identified, Aristotle can move on to investigate the cause of sleep, its final cause being the functional role it plays in animal life in general, while its moving cause is a set of complex physiological processes called *ἀντιπερίστασις*, which results in a temporary paralysis of the primary sense organ.

In his article, Pieter Sjoerd Hasper analyses an argument in *Metaphysics* M 2 against the existence of Platonic Forms. The author identifies the premises and underlying assumptions involved, and argues that the argument turns out to be effective against Platonism. Aristotle relies on universal mathematics to provide a counterexample to the view that Forms must exist in order to be the objects of scientific knowledge. The theorems of universal mathematics are not about the universal *quantity*, or more specific universals such as *number*, *point*, or *magnitude*. The universal in question, Hasper argues, is *quantity-of-type-x*, which does not qualify as a Platonic Form insofar as it depends on the types of quantity over which the variable ‘x’ ranges. The object of scientific knowledge of the proposition that ‘all Fs are G’ is that F in virtue of which G holds, and both Plato and Aristotle share this assumption—although, of course, they disagree about the ontological status of that F. Since the F in question cannot be a Form when it comes to universal mathematics, we have reasons to reject the Platonic contention that, for each theorem in a demonstrative science, there must be a Form that can serve as the object of that theorem.

We would like to finish this Editorial Note by expressing our deep gratitude to the editorial team of *Manuscripto*. Special thanks are due to its editor Marco Ruffino, who is originally responsible for the idea of a volume devoted to Aristotle.

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