*Aristotle on Knowledge and Learning: the* Posterior Analytics. By David Bronstein. Oxford: Oxford University Press, 2016. Pp. xiv + 274. £45.00 (hardcover). ISBN-13: 978-0198724902.

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The *Posterior Analytics* (hereafter *APo*) is one of the most difficult works in Aristotle. In this monograph David Bronstein aims 'to alleviate some of the difficulty—to reveal some of the *APo*'s virtues, even some of its charm' (3). As promised at the outset, his exposition throughout the book is clear and lucid, fully accessible to non-specialists as well. According to Bronstein, the *APo* is a systematic work which traces back the foundation of scientific knowledge by going through one's learning process in reverse order: demonstration, definition and induction. Following this order of Aristotle's presentation, the monograph examines those three types of learning one by one. But it is not intended to explain every detail of the work like a commentary, but rather to reveal its overall framework by focusing on methodological passages relevant to the process of learning.

The core of Bronstein's original interpretation lies in 'the Socratic Picture' of the order of inquiry. According to Bronstein, Aristotle's theory of science is based on a fundamental distinction between subjects (e.g. triangle) and their attributes (e.g. 2R = interior angles equal to two right angles). The distinction forms the basis for 'the Socratic Picture' of the order of inquiry in which seeking a subject's essential attributes precedes seeking its demonstrable attributes. First, on his view, the essence of a subject is sought by means of division or induction: division if a subject S is what he calls a 'subordinate subject-kind' (a species of a genus, e.g. triangle); induction, if S is what he calls a 'primary subject-kind' (a genus, e.g. line). What results in this subject-focused inquiry is knowledge of the definitions of the subject-kinds of a science, namely knowledge of its first principles. Next, the knowledge in question is established as *nous* by engaging in the attribute-focused inquiry in which one checks if the acquired definitions of the subject-kinds properly function as the ultimate grounds for demonstrating their demonstrable attributes.

In this review I shall first survey the contents of the book in more detail and then discuss some of its main points.

The book is divided into three parts, corresponding to the three types of learning. Following the introductory chapter, Part I (Chapters 2–4) is devoted to learning by demonstration, which Bronstein says is what the expert does. Chapter 2 critically examines

the prevailing view that it is impossible to learn by demonstration because in a demonstration one needs to have prior knowledge of both its premises and conclusion. Against this Bronstein argues that a demonstration is meant to discover the explanatory *connection* between its premises and conclusion, and that a demonstration can also reveal a new conclusion in the case where one discovers a particular instance or new sub-species of a universal truth. Chapter 3 is a short detour but makes an important point which I think is crucial to Bronstein's construal of the *APo* as a whole: that all of a subject's demonstrable attributes are ultimately grounded in its essence. Chapter 4 then argues that the essences of the subject-kinds of a science are therefore what one must know before learning by demonstration, but notices that the knowledge in question becomes *nous* only after demonstrating all or most of the demonstrable attributes of the science.

Part II (Chapters 5–12) discusses learning by definition, which Bronstein says is what the inquirer does. The first half (Chapters 5–9) paves the way for introducing 'the Socratic Picture' of the order of inquiry, on the basis of which the second half (Chapters 10–12) explains each stage of inquiry. Following a short introduction (Chapter 5), Chapters 6 and 7 respectively discuss *APo* 2.1 and 2.2, where Aristotle distinguishes between the process of inquiry from 'whether a property P belongs to a subject S' (Q1) to 'why P belongs to S' (Q2), and the process from 'whether S exists' (Q3) to 'what S is' (Q4), but treats those two processes in parallel by identifying Q2 with 'what P is'. Bronstein points out that here is a problem analogous to Meno's Paradox: how is it possible to answer Q1 before answering Q2, given that answering the former requires knowledge of what P is, likewise with Q3 and Q4? His answer (to be elaborated in Chapters 10 and 11) is that one can grasp a preliminary account of P or S before examining Q1 or Q3. Chapter 8 is a highlight of the book, arguing for 'the Socratic Picture' according to which the subject-focused inquiry (Q3 and Q4) comes before the attribute-focused inquiry (Q1 and Q2). In favour of this order of inquiry Bronstein critically examines two common views among scholars: 'the Intuitionist Picture' and 'the Explanationist Picture', neither of which supposes Q4 to come before Q1 because they think that Q1, taken as 'whether P belongs to S demonstrably or essentially', is heuristically important for answering Q4. Chapter 9, based on *APo* 2.8–9, supports the above distinction between the subject-focused and attribute-focused inquires by arguing that, while the cause of a property P is different from, or only part of, P's essence (causally complex or demonstrative), the cause of a subject S is the same as S's essence (causally simple or non-demonstrative).

Next, the second half of Part II elucidates each stage of inquiry in the reverse order of the actual learning. Chapter 10, by examining *APo* 2.8, explains how the attribute-focused (Q1 and Q2) inquiry proceeds. The point is that much of *APo* 2.8 is concerned not only with the question how one can use demonstrations to answer Q2 but with the question how one can tackle Q1 before Q2 by acquiring a preliminary account of a demonstrable attribute P. Chapters 11 and 12 explain how the subject-focused inquiry (Q3 and Q4) proceeds. Chapter 11 shows how one can answer Q3 before Q4 by grasping a preliminary account of a subject S. Chapter 12 then argues that in *APo* 2.13 Aristotle elaborates on how one can achieve the full essences of the subordinate subject-kinds of a science by the method of division, and of its primary subject-kinds by means of induction.

Lastly, Part III or Chapter 13 discusses learning by induction. The point is that *APo* 2.19 is not concerned with the process or method by which one gains knowledge of first principles, but only with the incipient stage of inquiry in which one acquires a preliminary account of a subject-kind S by induction from perceptions.

Thus, Bronstein offers an admirably consistent account of one's learning process presented in the *APo*. As space is limited, my discussion below focuses only on his overall interpretation. First, Bronstein distinguishes between learning by demonstration (Part I) and by definition (Part II). But the distinction is not very clear because most cases of the latter type, causally complex essences, involve demonstrations. In anticipation of this objection, he briefly defends himself by saying that Part I is concerned with what the expert does and Part II with what the inquirer does (72–73). The difference between the expert and inquirer lies in whether or not they have acquired *nous*, which, according to Bronstein, can be acquired after demonstrating 'all or most' of the demonstrable attributes of a science (80). But this criterion strikes me as highly problematic: is it possible to demonstrate 'all or most' of them? For example, can a geometer demonstrate 'all or most' of the possible theorems in geometry, given that there are indefinitely many? If she cannot, all geometers will still be inquirers. Even if she can, it is still not clear exactly when her knowledge of the definitions of the subject-kinds is entitled to be *nous*. And what if she found her definitions to be explanatorily defective in the middle of the verification process? In this case, she would be forced to reformulate them based on the result of the attribute-focused inquiry, which contradicts 'the Socratic Picture' of the order of inquiry. In addition, it is not clear that demonstration is a way to *learn* the explanatory connection between a conclusion and its premises. Readers might sympathize with the anonymous reviewer who objects that it is rather *because* one knows the explanatory connection in advance that one can construct the demonstration, and not the other

way around (40–41). To this Bronstein only briefly responds that ‘demonstration’ could include the reasoning by which one grasps the cause. But the response requires more substantial justification, I believe, given that Aristotle sometimes distinguishes the inquiring process called ‘analysis’ from the demonstrating process called ‘synthesis’ at *NE* 3.3 1112b11–24 (cf. *SE* 175a26–28, *APo*. 78a6–13).

Second, Bronstein’s account of the structure of a science, especially his sharp distinction between subjects and their attributes, seems to imply an unwelcome consequence that a field of science is fractionalized. To put it more concretely, on his view, there seem to be as many independent sub-sciences within a science as its subordinate subject-kinds, such as the sub-science of the triangle, that of the quadrilateral, that of the pentagon and so on. For when Bronstein claims in Chapter 3 that all of a subject’s demonstrable attributes are ultimately grounded in its essence, by ‘a subject’ he means not only a primary but subordinate subject-kind of a science; and he draws a clear distinction between demonstrable attributes and subordinate subject-kinds (175–182), the latter of which he thinks are not demonstrable. It then follows that each of the subordinate subject-kinds also has its own deductive structure from its essence. It is true that Bronstein elsewhere notes that if a demonstrable attribute P belongs to a subject-kind S (e.g. straight line), it also belongs to any other subject-kind composed of S (e.g. triangle) because of the essence of the straight line, not of the triangle (190–194). But this does not mean that a demonstrable attribute (e.g. 2R) peculiar to a subject-kind (e.g. triangle) belongs to it because of the essence of any more basic subject-kind (e.g. straight line). Bronstein’s construal is therefore inconsistent with what Aristotle illustrates about the structure of a science. For example, Aristotle says that the quadrilateral has 4R because the triangle has 2R (*MM* 1187a36–b4, 1189b9–18, *EE* 1222b29–37), and that the triangle has 2R because of the essence of the straight line (*APo*. 66a11–15, *Ph*. 200a15–30, *de An*. 402b16–22, *Metaph*. 1051a24–26). Here 4R is a demonstrable attribute peculiar to the quadrilateral, and this attribute belongs to the quadrilateral ultimately because not of the quadrilateral’s essence but of the straight line’s essence, which seems to be one of the first principles in geometry. Likewise, 2R belongs to the triangle ultimately because of the straight line’s essence. The example indicates that a science is thus united and holistic because all that it demonstrates are ultimately deducible from its few first principles in some way. In contrast, Bronstein’s account apparently exhibits a sub-divided structure of a science.

Lastly, Bronstein notices that Aristotle’s methodology of inquiry comes very close to Plato’s. Bronstein says, ‘[t]he Platonist could follow Aristotle every step of the way, agreeing about the methods by which we learn definitional principles’ (230). I do not intend to criticize

this affinity but to point out that, although not explicitly discussed in the book, his understanding of the process of acquiring *nous* also has something in common with Plato's methodology: the method of hypothesis. According to Bronstein, as we saw above, the inquirer can achieve *nous* only after verifying the definitions of a science's subject-kinds she has acquired by means of division. The necessity for verification is what Plato also seems to say about a hypothesis at *Phaedo* 101d3–6 and about the unhypothetical first principle, the Form of the Good, at *Republic* 534b8–c5. We might therefore think that the definitions one formulates by means of division are hypotheses to be confirmed by making deductive inferences from them. Bronstein's interpretation thus hints at a unified view of the method of hypothesis and that of division, which may well interest Plato scholars as well, who often treat his two methods separately.

Bronstein offers many important and original observations of the *APo* underpinned by his meticulous reading of the text and fair criticism of the secondary literature. Among them 'the Socratic Picture' of the order of inquiry is particularly novel and well worth serious consideration. I am absolutely certain that it will be very fruitful and rewarding to engage with the book closely.[1]

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