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Aristotle
on Knowledge
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The Posterior Analytics

DAVID BRONSTEIN

OXFORD

Aristotle on Knowledge and Learning

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The Posterior Analytics

David Bronstein

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To Keren

קֶרֶן לְדָוִד
(Psalm 132)

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Abbreviations of Titles of Aristotle's Works

<i>APo</i>	<i>Posterior Analytics</i>
<i>APr</i>	<i>Prior Analytics</i>
<i>Cat</i>	<i>Categories</i>
<i>DA</i>	<i>De Anima</i>
<i>DC</i>	<i>De Caelo</i>
<i>De Mem</i>	<i>De Memoria et Reminiscentia</i>
<i>De Som</i>	<i>De Somno et Vigilia</i>
<i>EE</i>	<i>Eudemian Ethics</i>
<i>GA</i>	<i>Generation of Animals</i>
<i>HA</i>	<i>History of Animals</i>
<i>Met</i>	<i>Metaphysics</i>
<i>NE</i>	<i>Nicomachean Ethics</i>
<i>PA</i>	<i>Parts of Animals</i>
<i>Phys</i>	<i>Physics</i>
<i>Rhet</i>	<i>Rhetoric</i>
<i>SE</i>	<i>Sophistical Refutations</i>
<i>Top</i>	<i>Topics</i>

Introduction

General Introduction

The *Posterior Analytics* (henceforth *APo*) is one of the most important works in the history of western philosophy. It is the first work to attempt to explain systematically the nature and structure of a science and the methods of proof used to establish scientific truths. Yet it is also a difficult work full of cryptic passages the meaning and philosophical importance of which are often hard to discern. Aristotle wrote other difficult works of course, but with the *APo* it can sometimes seem doubtful whether the philosophical rewards of understanding the text justify the effort required to understand it. My aim in this book is to alleviate some of the difficulty—to reveal some of the *APo*'s virtues, even some of its charm—by arguing that the work is coherently and elegantly structured around two closely connected themes of enduring philosophical interest: knowledge and learning.

Aristotle announces his interest in these themes in the first sentence of the work:

- T1 All teaching and all intellectual learning come to be from pre-existing knowledge.^{1,2} (*APo* 1.1, 71a1–2)

This claim sets the argumentative trajectory of the rest of the work. In the *Metaphysics*, Aristotle identifies three types of learning:

- T2 All learning [comes to be] through things known beforehand,³ either [through] all [of them] or [through] some, both [learning] by demonstration and [learning] by definitions (for it is necessary that one know beforehand the

¹ Translations of Aristotle's texts are my own, unless otherwise noted. My translations of the *APo* draw from Barnes 1993. 'Rabbi Yehudah says: one who translates a verse literally, behold he is a falsifier, and one who makes additions, behold he is a blasphemer.' (Tosefta Megillah 3:21. Thanks to Laliv Clenman for the translation.) Like Barnes, I am more or less a falsifier. I signal my (blasphemous) additions to Aristotle's Greek with square '['']' brackets.

² Πᾶσα διδασκαλία καὶ πᾶσα μάθησις διανοητικὴ ἐκ προϋπαρχούσης γίνεται γνώσεως.

³ Aristotle says in T1 that 'all intellectual learning' requires prior knowledge and in T2 that 'all learning' does. However, it may be that in T2 by 'all learning' he means the three types of learning he goes on to identify, all of which are types of intellectual learning. For further discussion, see Chapter 1§4.

things from which the definition [is composed] and that they be familiar⁴); similarly too with [learning] by induction.⁵ (*Met* 1.9, 992b30–3)

To learn by demonstration is to acquire new scientific knowledge by grasping an explanatory syllogism the premises and (in some cases) the conclusion of which one already knows. To learn by definition—or better, by defining—is to acquire knowledge of the essence of an object by seeking and constructing its definition. To learn by induction is to advance from knowledge of particulars to knowledge of a universal proposition that identifies something they all share in common.

On my reading, the key to understanding the *APo* is to see, first, that it is organized around discussions of these three types of learning and, second, that there is a clear logic to Aristotle's order of presentation. He starts with a description of an expert scientist engaged in the practice of her science and he moves backwards from there, explaining the types of learning she needed to have undertaken in order to have become an expert scientist in the first place. He begins in Book 1 with learning by demonstration, which, I argue, expert scientists undertake. This requires prior knowledge of definitions, for these are the most important premises of demonstrations. Book 2 (especially 2.1–10 and 13) then takes up learning by definition, which requires prior knowledge of what I call 'preliminary accounts' of the objects to be defined. These are acquired by induction, which Aristotle discusses in the final chapter of the work, 2.19. The upshot is that the *APo* is an elegantly organized work that delves deeper and deeper, as it unfolds, into the epistemological foundations of scientific knowledge.

My discussion follows the plan of the *APo*. After an introductory chapter, in Part I (Chapters 2–4), I examine learning by demonstration; in Part II (Chapters 5–12), learning by definition; and in Part III (Chapter 13), learning by induction. I shall now provide a brief overview by highlighting three topics central to my account: Meno's Paradox, the order of inquiry, and *nous*. All three point to Plato's influence on the *APo*.⁶

1. Meno's Paradox

One important theme in this book is the influence of Meno's Paradox on Aristotle's thinking in the *APo*.⁷ The puzzle, which is from Plato's *Meno* (80d5–e5, T3) and

⁴ I usually translate *gnōrimon* as 'known', but I make an exception here to avoid redundancy with 'know' just above. I discuss Aristotle's use of *gnōrimon* in Chapter 1§5, n26.

⁵ καίτοι πάσα μάθησις διὰ προγινωσκομένων ἢ πάντων ἢ τινῶν ἐστὶ, καὶ ἡ δι' ἀποδείξεως <καὶ> ἡ δι' ὀρισμῶν (δεῖ γὰρ εἶναι ὅν ὁ ὀρισμὸς προειδέναι καὶ εἶναι γινώριμα). ὁμοίως δὲ καὶ ἡ δι' ἐπαγωγῆς. This is Ross's text. ἡ...<καὶ> ἡ at a31–2 is an emendation (proposed by Bonitz) of ἡ...ῆ, which is found in the manuscripts. Ross (1924 vol. 1: 210) notes that there is evidence for this emendation in Alexander's commentary in *Met* 130.18, 20.

⁶ This is explored in a different way by Ferejohn 2013. See also Bolton 2012 and Fine 2014: 179–225.

⁷ This is also discussed by Charles 2010b and Fine 2014: 179–225.

which I examine in Chapter 1§§1–3, states that inquiry and discovery are impossible. Discovery is impossible because if we do not already know the thing we wish to discover, then we would have no way of recognizing it should we happen to encounter it. Inquiry is impossible because if, prior to our search, we already know the thing we wish to seek, then we have no need to seek it, for we already know it. But if we do not already know it, then we have no way to seek it, for we do not know what to seek. The puzzle about inquiry takes the form of a dilemma, which Socrates presents (*Meno* 80e1–5):

- (S1) For any x , either one knows x or one does not know it.
- (S2) If one knows x , one cannot search for it.
- (S3) If one does not know x , one cannot search for it.
- (S4) Therefore, one cannot search for x .

Aristotle refers explicitly to Meno's Paradox just once, in *APo* 1.1 (71a29–30, T7), where he presents an instance of this dilemma. (Chapter 1§9) However, in my view, Aristotle's discussions of inquiry, discovery, and learning throughout the *APo* are profitably interpreted as responses to instances of this dilemma and other puzzles reminiscent of it. Some of these puzzles are explicit in the text.⁸ Others are not, although they can be seen to arise from (certain interpretations of) claims Aristotle explicitly makes. Aristotle's account would have solved the implicit puzzles, had he discussed them, and he may have had them in mind, although of course we cannot know. My claim is not that Aristotle worried that the conclusion of any of these puzzles might be true and felt that he needed to solve them. My claim is rather that they provide a useful framework in which to understand his account of learning. By reflecting on these puzzles and the assumptions behind them, we can better understand Aristotle's account of the nature of learning and the prior knowledge required for it.

One of the main assumptions Aristotle's account challenges is that knowledge is 'all or nothing' in an extreme way. This is the view that for any object of knowledge there are only two possibilities: either we completely know it or we are completely ignorant of it. In Chapter 1§2, I argue that S1 in the *Meno* should be understood in this way. Aristotle's puzzle in *APo* 1.1, on my reading, rests on the same view. His explicit solution in 1.1, and his explicit and implicit solutions elsewhere in the *APo*, consist in denying it: there are intermediate cognitive states from which we can inquire, discover, and learn. For example, an intermediate state that plays a prominent role in Aristotle's discussion of learning by definition is knowing a preliminary account. A preliminary account of x identifies a non-accidental feature of x and thereby allows us to inquire about it. (For example, a preliminary account of (lunar)

⁸ See *APo* 2.13, 97a6–11 (T47), Chapter 12§10; 2.19, 99b25–32 (T52), Chapter 13§4.

eclipse is that it is a certain loss of light from the moon; of human being, that it is a certain kind of animal.⁹)

2. The Order of Inquiry

In the *Meno* and other dialogues, Plato claims that before seeking anything else about a thing (e.g., whether virtue is teachable), we should first seek what it is, its essence.¹⁰ In Part II (especially Chapter 8), I argue that Aristotle's account of inquiry in the *APo* is significantly influenced by this claim. He is committed to what I call 'the Socratic Picture' of the order of inquiry.

Aristotle's theory of science is built around a fundamental ontological distinction between subjects (e.g., moon, human being, triangle)¹¹ and their attributes (e.g., being eclipsed, being two-footed, having interior angles equal to two right angles). (Chapter 3§1) The attributes studied within a science are either demonstrable (and thus explainable) or essential (and thus unexplainable). (Attributes that are neither demonstrable nor essential are accidental; these fall outside the purview of science.¹²) Aristotle's account of inquiry is 'Socratic', I argue, because he recommends that we seek a subject's essential attributes (i.e., the attributes that constitute the essence) before we seek its demonstrable ones. Inquiry, on this interpretation, divides into five stages:

- At Stage 1, we do not know whether a subject S exists and we seek whether it exists. (Chapter 11)
- At Stage 2, we know that S exists, and we seek what it is (its essence). (Chapter 12)
- At Stage 3, we know what S is, and we seek whether P belongs to it as one of its demonstrable attributes. (Chapters 7, 8, 10)
- At Stage 4, we know that P belongs to S as one of its demonstrable attributes and we seek why it belongs (the cause). (Chapter 10)
- At Stage 5, we know why P belongs to S.

To seek (at Stage 4) why P belongs to S is to seek the demonstration that proves that and shows why it belongs. Aristotle claims (in *APo* 2.2) that when we seek why P belongs to S, we are seeking what P is, its essence. Since a definition states

⁹ *APo* 2.8, 93a21–4 (in T32), Chapter 10§4.

¹⁰ See, e.g., *Laches* 190b7–c2, *Meno* 71a3–b8, 86d3–e3.

¹¹ Unless I note otherwise, whenever I use natural kind terms such as 'human being' and 'animal', I mean the natural kind signified by the term rather than the term itself or an individual member of that natural kind. Occasionally I italicize the term in order to emphasize this, but usually I do not.

¹² Aristotle sometimes calls demonstrable attributes 'in itself accidents' (e.g., *APo* 1.7, 75b1 (in T38), 1.22, 83b19–20). See Chapter 3§3. These should not be confused with attributes that are merely accidental. Aristotle thinks that mere accidents cannot be known scientifically (*APo* 1.30; see also 1.8, 75b33–6), whereas in itself accidents can be. In Chapter 7§5, I argue that mere accidents are eliminated from the domain of science at Stage 3 of inquiry.

something's essence, there is a close connection, for Aristotle, between demonstration and definition: demonstration is the method he recommends (in *APo* 2.8) for seeking (at Stage 4) the essences of demonstrable attributes such as P. (Chapter 10) The resulting definition, he says in *APo* 2.10, is a kind of demonstration.¹³ (Chapters 7§§6–10 and 9§5)

The Socratic order of inquiry assumes that we have (at Stage 2) a way of seeking and discovering S's essence. In Chapter 12, I argue that this way of seeking is either division or induction: division, if S is what I call a 'subordinate subject-kind' (a species of a genus, e.g., human being); induction, if S is what I call a 'primary subject-kind' (a genus, e.g., animal). (Plato discusses and employs division in several dialogues (*Phaedrus*, *Sophist*, *Statesman*), so this is another Platonic influence on the *APo*.) This means that in *APo* 2 Aristotle recommends three methods by which to seek essences, corresponding to the three types of definable entity he recognizes: demonstration for demonstrable attributes, division for species, induction for genera. All three methods fall under the rubric of 'learning by definition'.

A striking feature of the account of inquiry in *APo* 2 is that the order of presentation is the reverse of the order of learning: Aristotle explains first (in 2.8) how we discover the essences of demonstrable attributes (Stage 4), then (in 2.13, 96a20–97b6, T42–6) the essences of indivisible species (Stage 2), then (later in 2.13, 97b7–15, T49) the essences of genera (Stage 2). (Aristotle thinks that we should seek the essence of a genus before we seek the essences of its species. (Chapter 12.1)) He concludes the work, in 2.19, by explaining how we acquire, by induction, the preliminary accounts we need for all three inquiries. (Chapter 13) We can see this sort of reversal over the *APo* as a whole: as I mentioned above, Aristotle moves from learning by demonstration (which experts undertake) to learning by definition (which is how one becomes an expert), and ends with learning by induction. His practice is to discuss the type of learning by which we acquire the knowledge we need for the type of learning previously discussed. Very roughly, the *APo* is Plato's allegory of the cave told in reverse.

3. *Nous*

This book is about knowledge in the *APo*: what it is and how it is acquired. 'Knowledge' (*gnōsis*), for Aristotle, covers a very broad range of cognitive states, from perception of sensible particulars to our highest intellectual grasp of necessary truths. (Chapter 1§5) The *APo* tells the story (in reverse order) of our ascent from perception to *epistēmē*, which I translate 'scientific knowledge'. *Epistēmē* is the knowledge an expert scientist possesses qua expert. The *APo*, on my reading, is about what scientific expertise consists in and how one becomes a scientific expert. In particular, I argue

¹³ 93b38–94a14. See also *APo* 1.8, 75b31–2.

that in defending the Socratic Picture Aristotle presents all the elements of a grand theory of inquiry, one that explains not only our acquisition of isolated bits of knowledge but also our acquisition of knowledge of a science as a whole, including knowledge of its first, indemonstrable principles, especially definitions. He calls our knowledge of first principles *nous*.¹⁴ In Part I, I defend an account of what *nous* is, and, in Part II, I defend an account of how we acquire it.

What nous is

In *APo* 1.2 (71b9–12, T9), Aristotle says that to have unqualified scientific knowledge (*epistēmē haplōs*) of *x* is to know that *y* is the cause of *x* and that *x* is necessary. In Chapter 4, I argue that two types of scientific knowledge fall under this definition. The first is demonstrative scientific knowledge, which consists in knowing (a) that *M* is the cause of the fact that an attribute *P* belongs to a subject *S* and (b) that *P* belongs to *S* by necessity. (For example, we have demonstrative scientific knowledge of the fact that the moon is eclipsed when we know that the moon's being screened from the sun by the earth is the cause of its being eclipsed and that it is eclipsed by necessity.) The second is non-demonstrative scientific knowledge, which consists in knowing (a) that *E*, which is the essence and thus the (formal) cause of *S*, is the cause because of which *S* is the very thing that it is and (b) that *S* is the very thing that it is by necessity. (For example, we have non-demonstrative scientific knowledge of the species *human being* when we know that being a two-footed tame animal, human being's essence (let's suppose), is the cause because of which human being is the very thing that it is and that human being is the very thing that it is by necessity.) Aristotle calls non-demonstrative scientific knowledge *nous*.¹⁵ To have demonstrative scientific knowledge is to know a demonstration: *P* belongs to *M*, *M* belongs to *S*, so *P* belongs to *S* (where *M* is the cause of *P*'s belonging to *S*). To have *nous* is to know an indemonstrable definition: *S* is_{def} *E* (where *E* is *S*'s essence). (Aristotle's distinction between demonstrative scientific knowledge and *nous* has precedence in Plato's distinction in *Republic* 6 (509d6–511e5) between *dianoia* and *noēsis*, which occupy the two highest segments of the divided line.)

How nous is acquired

In Chapter 3, I distinguish between two models of demonstration in the *APo*. These play an important role in Aristotle's explanation of our acquisition of *nous*. In

¹⁴ Various translated 'intellect', 'intuition', 'insight', 'intelligence', 'comprehension'. None of these translations, it seems to me, are adequate, so I use the transliterated form. Aristotle used the term *nous* in different ways in different works. For example, in *De Anima* it often signifies the mind or intellect. In the *APo* it signifies more specifically the acquired cognitive state in which we know the first principles of a science as such. (See 1.23, 85a1, 1.33, 88b35–6, 89a1, 89b8, 2.19, 100b8–15. These are all the occurrences of *nous* in the *APo*.) Some commentators think that *nous* in the is also the faculty by which we acquire this knowledge. (See, e.g., Bayer 1997, Irwin 1988: 134–7, 531–2, Kahn 1981: 397–414.) I argue against this interpretation in Chapter 13.

¹⁵ See *APo* 1.3, 72b18–25 and 1.33, 88b35–7, with my discussion in Chapter 4§1, n3.

a Model 1 demonstration, the middle term signifies the subject's (S's) essence. In a Model 2 demonstration, the middle term signifies the attribute's (P's) essence. I argue that if P belongs to S because of P's essence (Model 2), then P also belongs to S because of S's essence (Model 1). For if P belongs to S because of P's essence, then P's essence belongs to S because of S's essence. Now if P is a demonstrable attribute of S, then the proximate cause of P's belonging to S is either S's essence or P's essence. It follows that every demonstrable attribute of S belongs to it (ultimately) because of S's essence. Every Model 2 demonstration is explanatorily grounded in a Model 1 demonstration.

In Chapters 6, 8, and 12, I argue that to acquire noetic knowledge¹⁶ that E is S's essence, we must follow these explanatory links and explain S's demonstrable attributes from E. For we must see that E is the explanatorily basic feature of S, that which explains why S has the demonstrable attributes that it has and is not explained by any of them. As Aristotle says, 'the definition is the principle of everything'¹⁷ (*APo* 2.13, 96b22–3 (in T19), Chapters 8§4 and 12§1). This means that in the order of inquiry we first acquire non-noetic knowledge of the definition 'S is_{def} E' (at Stage 2, by division or induction, as I indicated in the previous section) and we then acquire noetic knowledge of it (at Stage 4) by finding the causes of S's demonstrable attributes. These causes include the attributes' essences (as in Model 2 demonstrations) and, ultimately, S's essence (as in Model 1). So by the time we reach Stage 5 we have scientific knowledge of S's essence, its demonstrable attributes, and their causes: we know the whole science of S. To be sure, Aristotle does not present an account of our acquisition of *nous* in just these terms. In fact, he says very little about this. My claim is not that Aristotle put all of the pieces together in exactly the way I describe. My claim is rather that all of the pieces are there to be put together in the way I describe.

We can find in the *APo* an account of what *nous* is and an account of how it is acquired. However, we must be careful not to let the second account mislead us about the first. To *acquire* noetic knowledge that E is the cause and essence of S we must learn that S's demonstrable attributes (P etc.) belong to it because of E. However, *having* noetic knowledge that E is the cause and essence of S does not consist in knowing that P belongs to S because of E. Rather, this is what having demonstrative scientific knowledge consists in. Having noetic (i.e., non-demonstrative scientific) knowledge, by contrast, consists in knowing that E is the cause because of which S is the very thing that it is—it consists in knowing that E is the cause of S's being not some other thing P, but just what it is. (Chapter 4) So even though *acquiring* noetic knowledge involves demonstration, *having* noetic knowledge is non-demonstrative. We should not confuse the means by which we acquire *nous* with what *nous*, once acquired, consists in.

¹⁶ By 'noetic knowledge' I mean the knowledge we have when we are in the cognitive state Aristotle calls *nous*.

¹⁷ τὸ ἀρχὴν εἶναι πάντων τὸν ὁρισμὸν.

In Part II, I argue that Aristotle's explanation of our acquisition of *nous* is contained implicitly in his account of learning by definition in *APo* 2.1–10 and 13. In Part III, I argue, against a common interpretation, that it is not contained, implicitly or explicitly, in his account of learning by induction in 2.19. That chapter has a more modest aim: to explain (as I have already mentioned) how we acquire by induction knowledge of the preliminary accounts required for learning definitions, and to defend the claim that our knowledge of definitions originates in perception.

1

Meno's Paradox and the Prior Knowledge Requirement

Aristotle never seriously doubts that we can acquire knowledge—that we can inquire, discover, and learn. Yet he thinks that by reflecting on puzzles that do cast doubt on whether we can acquire knowledge, we might better understand how we do so. Meno's Paradox is one such puzzle. In this chapter, I examine Plato's presentation of Meno's Paradox in the *Meno* and Aristotle's reference to it in *APo* 1.1. In addition, I discuss a crucial claim closely connected to the puzzle: the claim that learning requires prior knowledge (or cognition). I also introduce some key terms and concepts in Aristotle's theory of knowledge and learning.

1. Meno's Three Questions

In the first part of the *Meno*, Socrates and Meno try unsuccessfully to determine what virtue is (the essence). They reach a point of crisis when Meno, frustrated and embarrassed by Socrates's questioning, accuses him of being a stultifying torpedo fish and seems ready to give up.¹ Socrates urges him to continue searching with him for what virtue is. It is then that Meno introduces his puzzle:

T3 **MENO:** How are you going to search for this, Socrates, when you do not at all know what it is? For, what sort of thing among the things you do not know will you set up as the target for your search? And even if you do actually come across it, how will you know that this is the thing you did not know?

SOCRATES: I understand what you mean, Meno. Do you see what an eristic argument you are bringing down on us, how it is impossible for a person to search either for that which he knows or for that which he does not know? He could not search for that which he knows, for he knows it and no one in that condition needs to search; on the other hand he could not search for that which he does not know, for he does not know that for which he is to search.^{2,3} (*Meno*, 80d5–e5)

¹ *Meno*, 79e7–80b7.

² My translation draws from Day 1994: 47 and Fine 2014: 74–5.

³ {MEN.} Καὶ τίνα τρόπον ζητήσεις, ὦ Σώκρατες, τοῦτο ὃ μὴ οἶσθα τὸ παράπαν ὅτι ἐστίν; ποῖον γὰρ ὅν οὐκ οἶσθα προθέμενος ζητήσεις; ἢ εἰ καὶ ὅτι μάλιστα ἐντύχοις αὐτῷ, πῶς εἴσῃ ὅτι τοῦτό ἐστιν ὃ σὺ οὐκ

Meno asks three questions, the first of which sets the context for the remaining two. The first question worries about the possibility of searching for 'this' (*touto*)—namely, virtue.⁴ However, Meno is worried about searching not for virtue in general, but for what virtue is (the essence). For this is what Socrates in the immediately preceding lines (80d1–4) insists he and Meno should continue to seek. Meno's first question, then, worries about searching for what virtue is when one does 'not at all (*to parapan*) know what it is'. Meno's use of 'at all' is important, for it indicates that (in his view) he and Socrates lack knowledge in a very strong sense: they are in a state of complete ignorance, a cognitive blank about what virtue is.⁵ This certainly seems to be the condition Meno feels himself to be in, as his accusation just prior to T3 that Socrates is a stultifying torpedo fish makes clear.⁶

This interpretation also provides support for the two claims suggested by Meno's three questions. The first two questions suggest that we cannot search for what virtue is if we do not at all know what it is. This claim is true if not at all knowing what virtue is consists in being in a cognitive blank about what virtue is. For we cannot specify or describe something we are in a cognitive blank about and we cannot search for something we cannot specify or describe. Meno's third question suggests that if we do not know what virtue is, then if we were somehow to happen upon it, we could not know that *this* is what virtue is. That is, if we do not know what virtue is, we cannot discover it. This claim is true if, again, our lack of knowledge amounts to a cognitive blank. For we cannot match something we find to something about which we are completely ignorant. So although Meno omits the qualifier 'at all' in his second and third questions, we should interpret them as though it is there.

In sum, Meno's three questions suggest two claims:

- (M1) If one does not at all know what virtue is, one cannot search for what it is.
- (M2) If one does not at all know what virtue is, one cannot discover what it is.

In both cases, 'does not at all know' is synonymous with 'is completely ignorant of'.

ἡδησθα; {ΣΩ.} Μανθάνω οἶον βούλει λέγειν, ὦ Μένων. ὁρᾷς τοῦτον ὡς ἐριστικὸν λόγον κατὰγεις, ὡς οὐκ ἄρα ἔστιν ζητεῖν ἀνθρώπῳ οὔτε ὃ οἶδε οὔτε ὃ μὴ οἶδε; οὔτε γάρ ἂν ὃ γε οἶδεν ζητοῖ—οἶδεν γάρ, καὶ οὐδὲν δεῖ τῷ γε τοιούτῳ ζητήσεως—οὔτε ὃ μὴ οἶδεν—οὐδὲ γὰρ οἶδεν ὅτι ζητήσει.

⁴ See, e.g., Bluck 1961: 143, 271, Ebrey 2014: 1, Fine 2014: 74, and Sharples 2004: 143.

⁵ For a similar interpretation emphasizing 'at all', see McCabe 2009: 237–8, Nehamas 1994: 224–6, Scott 2006: 76. For a dissenting view, see Ebrey 2014: 2–4. Scott (2006: 76–7) and Fine (2014: 77, 82–3) argue that Meno is wrong to think that he and Socrates are in a cognitive blank about virtue, whereas Nehamas (1994: 226) argues that he's right.

⁶ See especially 80b4: 'but now I am not able to say at all what it [i.e., virtue] is' (νῦν δὲ οὐδ' ὅτι ἐστὶν τὸ παράπαν ἔχω εἰπεῖν).

2. Socrates's Dilemma

Socrates responds to Meno by ignoring his third question (and thus M2) and transforming the first two (and thus M1) into an argument in the form of a dilemma:⁷

- (S1) For any x , either one knows x or one does not know it.
- (S2) If one knows x , one cannot search for it.
- (S3) If one does not know x , one cannot search for it.
- (S4) Therefore, one cannot search for x .

(From now on I shall speak of 'Meno's puzzle' in reference to M1–M2 and 'Socrates's dilemma' in reference to S1–S4. I shall use 'Meno's Paradox' as a generic label covering both.⁸)

Socrates's dilemma, I now want to argue, rests on an 'all or nothing' conception of knowledge according to which either one completely knows x or one is completely ignorant of it. By 'completely knowing x ' I mean having recollected *epistēmē* of x . Socrates describes recollection as the process by which one recovers one's *epistēmē*.⁹ To have *epistēmē* of x , he says, is for one's true opinion of x to have been tied down by an explanatory account.¹⁰ If one has *unrecollected epistēmē* of x , one has knowledge (*epistēmē*) of x but not complete knowledge.

In T3, Socrates first says that one cannot search for x if one already knows it (S2) and he then explains why: 'for he knows it and no one in that condition needs to search' (80e4–5). The explanation provides the grounds on which the preceding claim (S2) is true. The explanation succeeds if knowing x means completely knowing it. For it seems true that no one in that condition needs to or indeed can search for x . So S2 should be understood as stating that if one completely knows x , one cannot search for it. (S2 adds a new worry to Meno's puzzle.) Socrates then says that one cannot search for x if one does not know it and he explains why: 'for he does not know that for which he is to search' (80e5). The explanation again provides the grounds on which the preceding claim (S3) is true. The explanation succeeds if not knowing x means being completely ignorant of it. For it seems true that a person who is completely ignorant of x cannot search for it. So S3 should be understood as stating that if one is completely ignorant of x —if one does not *at all* know it—one cannot search for it.¹¹ (S3 generalizes M1.) For the argument to be valid 'knows' and 'does not know' must have the same meaning in S1 as they do in S2 and S3, respectively.

⁷ For a detailed analysis of Socrates's dilemma, see Fine 2014: 87–104, 124–36. For a helpful overview of the similarities and differences between Meno's and Socrates's formulations in T3, see Ionescu 2007: 41–4. See also McCabe 2009.

⁸ Fine (2014: 1) uses 'Meno's Paradox' in the same way. She has a useful discussion of this and other labels for the puzzle in 2014: 25–7.

⁹ Meno 81c7–9, 85d3–e5, 98a3–6.

¹⁰ Meno 97e2–98a8.

¹¹ So although Socrates omits 'at all' (*to parapan*) in formulating S3, as does Meno in his second and third questions, we should interpret S3 as though it is there. For a different interpretation of Socrates's and Meno's uses and omissions of 'at all', see Fine 2014: 86–7.

Therefore, S1 states that there are only two possibilities: either one completely knows x or one does not at all know (is completely ignorant of) it.¹²

On this interpretation, S2 and S3 are true and S1 is false, so the solution lies in showing that the 'all or nothing' conception of knowledge is mistaken: there are intermediate cognitive states that allow us to search. This is what Socrates's subsequent proposal that learning is recollection seems to suggest.¹³ Since we possess latent innate knowledge of, say, what virtue is, we have knowledge of it that is incomplete and allows us to search. (The idea is that latent innate knowledge is incomplete because it has not been recollected.) Seeking and learning x are a matter of recollecting the latent knowledge of x one already possesses. Setting Plato's solution aside, I now want to examine more closely what Meno's puzzle and Socrates's dilemma imply about inquiry and discovery. I shall then turn to *APo* 1.1.

3. Meno's and Socrates's Prior Cognition Requirements

M1 imposes a constraint on inquiry. It implies (by the logical rule of transposition) that if we can search for what virtue is, then it is not the case that we do not at all know (are completely ignorant of) what it is. So a necessary condition for inquiry is that we have some prior cognition of the object of our search: if we are searching for x , then we have some cognition of x . Call this the Prior Cognition Requirement for Inquiry.¹⁴ M2 likewise implies that if we can discover what virtue is, then it is not the case that we do not at all know (are completely ignorant of) what it is. So a necessary condition for discovery is that we have some prior cognition of the object we discover. Call this the Prior Cognition Requirement for Discovery.¹⁵

In Socrates's dilemma, S2 and S3, read in the 'all or nothing' way I have proposed, also impose constraints on inquiry. S2 implies that if one can search for x , then it is not the case that one completely knows it. S3 implies that if one can search for x , then it is not the case that one is completely ignorant of it. Together they imply that a necessary condition for seeking x is that one is in an intermediate cognitive condition with respect

¹² See Matthews 1999: 54, Nehamas 1994: 227–8. For a different interpretation, see Fine 2014: 87–94, 124–36. For an interesting attempt to explain why Socrates reformulates Meno's puzzle in this 'all or nothing' way, see Charles 2010b. Charles's interpretation is discussed by Fine 2014: 99–103.

¹³ See White 1994. Some scholars disagree and downplay the extent to which recollection alone disarms Meno's Paradox. See Fine 1992, 2007, and 2014, and Scott 1995: 24–52 and 2006: 75–125.

¹⁴ 'Cognition' does not translate any particular term in Plato. I use it for whatever cognitive state we are in with respect to x whenever we are not in a condition of complete ignorance about x (i.e., whenever it is not the case that we 'do not at all know' x). I use 'cognition' rather than 'knowledge' in order to reserve 'knowledge' for *epistēmē* (as defined in *Meno* 97e2–98a8). (Schwab (2015), by contrast, argues that the appropriate translation of *epistēmē* in the *Meno* is 'understanding'.) In section 4, I use 'knowledge' in a broader way for what Aristotle calls *gnōsis* (and for *epistēmē* I use 'scientific knowledge'). I do not take a stand on what *gnōsis* in Plato is.

¹⁵ This might seem like too strong a condition for discovery. For we might think that we can discover (perhaps by chance) some new object or fact without any prior cognition of it (though not without any prior cognition *at all*). In that case, we might interpret this as a condition on the specific sort of discovery that is preceded by a deliberate search for the object we eventually find. For that sort of discovery does seem to require prior cognition of the object we discover.

to it—neither a state of complete knowledge nor of complete ignorance. So Socrates's dilemma implies the Prior Cognition Requirement for Inquiry.

Meno's puzzle and Socrates's dilemma together imply that inquiry and discovery require the absence of complete ignorance—that is, the presence of some cognition. They also implicitly agree on the specific form the requirement takes: to seek or discover x one must have some prior cognition of x itself.¹⁶ Again, to focus just on inquiry, since M1 and S3 state that one cannot search for x if one is completely ignorant of it, they imply that if one can search for x , one is not completely ignorant—one has some cognition—of it . Neither Meno's puzzle nor Socrates's dilemma implies that inquiry or discovery requires prior knowledge (*epistēmē*). What's required is the presence of some cognition—for example, true opinion. Still, knowledge satisfies the requirements. And so long as our knowledge is not complete (i.e., recollected), we avoid the objection that we cannot seek or discover what we already completely know. Indeed, this is the solution the theory of recollection seems to present: we can seek and discover (recollect) because we have prior knowledge, which is innate and latent and therefore incomplete, of the object we seek.

4. Aristotle on Learning: the Prior Knowledge Requirement

Aristotle also presents a prior cognition requirement. He does so in the first lines of the *APo*:

T1 All teaching and all intellectual learning come to be from pre-existing knowledge (*gnōseōs*). (71a1–2)

Let's consider this claim, which I shall call 'the Prior Knowledge Requirement', in detail.¹⁷

Elsewhere Aristotle defines teaching in terms of learning (but not vice versa): to teach is to cause someone to learn.¹⁸ He does not, however, define what learning (*mathēsis*) is, nor does he explain what intellectual learning (*mathēsis dianoētikē*) in particular is. A plausible view is that learning occurs if and only if one acquires knowledge (*gnōsis*),¹⁹ and intellectual learning in particular occurs if and only if one acquires knowledge of either a universal truth or a particular truth in light of a known universal truth. Now *dianoia* means 'thought', 'reason', or 'reasoning', and is sometimes used in contrast with perception (*aisthēsis*).²⁰ It seems likely, then, that in

¹⁶ For a different view, see Fine 2014: 77–8.

¹⁷ In Chapter 11, I discuss *APo* 1.1, 71a11–17 (T36), where Aristotle identifies two types of prior knowledge required for intellectual learning.

¹⁸ See *Phys* 3.3, 202b1–22. Aristotle thinks that if A teaches B, then B learns: teaching implies learning (on the part of the learner, not the teacher). This does not mean that teachers are always successful. Rather, it means that if they are not successful then they are not teaching. I argue below that there can be learning without teaching.

¹⁹ See Detel 1993 vol. 2: 9.

²⁰ In *De Anima*, Aristotle distinguishes between the *dianoētikōn* and the *aisthētikōn* parts of the soul. (See *DA* 2.2, 413b11–13, 2.3, 414a31–2.) In the ethical works he distinguishes between *dianoētikē* and

T1 Aristotle wishes to mark off the sort of learning that centrally involves thought from the sort that centrally involves perception and that he wishes to restrict the Prior Knowledge Requirement to learning of the first sort.²¹ When I perceive for the first time that this thing is white, I acquire new knowledge and learn, but my learning does not involve thought and so it does not require prior knowledge.²² In this way, Aristotle blocks the Prior Knowledge Requirement from regress (learning requires prior knowledge, which requires prior learning, ad infinitum). While some learning requires prior knowledge and all knowledge acquisition is learning, not all learning requires prior knowledge. We can acquire some knowledge without having or relying on any other. (For stylistic reasons, I shall often use 'learning' for 'intellectual learning', which is my main focus.)

Aristotle says that all teaching and all intellectual learning come to be from prior knowledge. He mentions learning in addition to teaching because even though teaching implies learning, learning does not imply teaching, and he does not wish to restrict the requirement to learning brought about by teaching—that is, didactic learning. As we shall see in section 8, he also recognizes the existence of intellectual learning that occurs in the absence of a teacher and such non-didactic learning also requires prior knowledge. Non-didactic learning usually occurs as the result of a successful inquiry (*zētēsis*) and is for that reason identical to discovery (*heuresis*).²³ I shall call this 'zetetic learning'.²⁴ In Chapter 6§7, I argue that all inquiry, whether successful or not, requires prior knowledge.

5. Aristotle on Knowledge

Gnōsis ('knowledge' in my rendering; others opt for 'cognition'²⁵) is a difficult word to translate in Aristotle. As I remarked in the Introduction, it is an extremely broad

ēthikē aretē (virtue of thought and of character), where the latter is an excellent state of the part of the non-rational soul responsible for perception and desire. (See *NE* 1.13, 1102b28–1103a10, 2.1, 1103a14–18, 6.1, 1138b35–1139a1, *EE* 2.1, 1220a5.)

²¹ See Philoponus in *An Post* 4.29–5.4 and Barnes 1993: 81. For perceptual (as opposed to intellectual) learning see the opening lines of the *Metaphysics* (980a21–b25), where Aristotle says that sight above all the senses causes us to come to know (*gnōrizein*) (980a26) and where he speaks of non-human animals who have perception and memory but not thought and who learn (*manthanein*). See also *Phys* 7.3, 247b19.

²² See again Philoponus in *An Post* 4.29–5.4.

²³ I say 'usually' because, as Gail Fine has pointed out to me, one may discover (learn) something by chance. (See Plutarch Fragment 215e, with Fine 2014: 6. See also Matthews 1999: 58.) Learning and discovery are paired in *DA* 3.4, 429b9. For *zētēsis* and learning see *APo* 2.1–2 and 8, which I discuss in Chapters 6–10. Aristotle does not use the terms *mathēsis* or *manthanein* in these chapters. However, he often employs terms for searching (*zētoumen*, e.g., 89b24 (in T13), 90a1 (in T14), 93a17 (in T31)), discovering (*heurontes*, 89b27 (in T13); *heurōmen*, 93a35 (in T34)), and getting to know (*ginetai gnōrimon*, 93b15–16 (in T29); *gnōnai*, 93b18 (in T29)), the last two of which are synonymous with learning. Aristotle sometimes distinguishes between learning and discovery in a way that suggests that all learning is caused by teaching, all discovery by independent inquiry. See, e.g., *SE* 22, 178b34–5, 179a23–4. This is the view Philoponus attributes to Aristotle (see in *An Post* 12.5–13; see also 20.4–5). However, I do not think the relevant passages reflect Aristotle's considered view.

²⁴ I borrow this expression from Fine 2014: 109.

²⁵ Fine 2014, LaBarge 2006: 38.

term covering a wide range of cognitive states, from our perceptual awareness of sensible particulars to our intellectual grasp (i.e., *nous*) of the necessary and eternal first principles. Aristotle never defines it, but I submit that he regards all true cognition as *gnōsis* and all *gnōsis* as true cognition.²⁶ Examples in the *APo* of cognitive states that satisfy the Prior *Gnōsis* Requirement presented in T1 and are thus forms of *gnōsis* include: perceiving (*aisthanesthai*, 2.19, 99b38–9, in T54) (e.g., this white thing),²⁷ comprehending (*xunienai*, 1.1, 71a13, in T36) (e.g., what a term signifies),²⁸ assuming (*lambanein*, 1.1, 71a12, in T36) (e.g., that something is true),²⁹ grasping (*echein*, 2.8, 93a22, in T32) (e.g., part of the essence of an object), knowing scientifically (*epistasthai*, 1.1, 71a25–6, in T6) (e.g., that all triangles have interior

²⁶ It is, I think, uncontroversial to say that all true cognition, for Aristotle, is *gnōsis*. That all *gnōsis* is true cognition is disputed. Fine (2010: 148–52) argues that, for Aristotle, *gnōsis* can be false since (1) what is *gnōrimon hēmin* (usually translated 'known to us') can be false and (2) one has *gnōsis* of what is *gnōrimon* to one. (This is one of the reasons why she prefers 'cognition' as a translation of *gnōsis*.) In support of (1), Fine cites two pieces of evidence: (a) *Phys* 1.1, 184b12–14, where 'Aristotle apparently gives as an example of something that's *gnōrimon* to one, a child who calls all men "father"' (2010: 150), implying that the child has the false belief that all men are his father, that the content of this belief is *gnōrimon* to him, and thus that he has *gnōsis* of something false; and (b) the fact that '*endoxa* are among the things that are *gnōrima hēmin*. But not all *endoxa* are true.' (Fine 2010: 150–1) With regard to (a), a different (and, I think, better) reading is available: the child mistakenly uses the more specific term 'father' for the more general class signified by the term 'man'. (See Scott 1995: 122–3.) So the child does not have the false belief that all men are his father; he simply misuses the term. A fortiori the child does not have a false belief the content of which is something *gnōrimon* to him. With regard to (b), Aristotle may think that while in general *endoxa* are *gnōrima hēmin*, the false ones are not *gnōrima* at all. Alternatively, he may think that they are *gnōrima* but deny that we have *gnōsis* of them, thus attaching different meanings to the two terms, which we might capture in English by translating *gnōrimon* as 'familiar' (as Barnes (1993) does) rather than 'known'. I don't know of any other evidence to suggest that, for Aristotle, *gnōsis* can be false and, as I have argued here, I am not convinced by the evidence Fine cites. I conclude, then, that for Aristotle all *gnōsis* is true cognition. This is one of two reasons I cite in the main text below in support of 'knowledge' as a translation.

²⁷ In *DA* 3.3 (427b11–12), Aristotle says that 'the perception of the special sensibles is always true' (ἡ μὲν γὰρ αἰσθησις τῶν ἰδίων ἀεὶ ἀληθής). (By the 'special sensibles' he means colour, sound, etc.) He does not mean that every perception of a special sensible is propositional, for he immediately goes on to add: 'and belongs to all animals' (καὶ πᾶσιν ὑπάρχει τοῖς ζώοις, 427b12–13). So, for Aristotle, a cognitive state can be true (and thus count as *gnōsis*) without being propositional. For a different reading of Aristotle's claim, see Crivelli 2004: 108–9. Crivelli argues that if animal perceptions can be true, they must have propositional content. However, Crivelli also mentions a different interpretation, which I find captures better Aristotle's conception of animal perception, according to which Aristotle endorses the following principle: 'A perception of Fness is true just in case the object from which it is produced is F' (2004: 109 n39). On this interpretation, a dog's vision of, for example, whiteness is true even though it does not have propositional content.

²⁸ Note that Barnes (1993) translates *nous* 'comprehension'. This should not be confused with my use of 'comprehend' for *xunienai* (for which Barnes has 'grasp').

²⁹ Not every assumption is true, so not every case of assuming is a case of *gnōsis*. In Chapter 11§§4–6, I argue that when Aristotle presents cases of assuming as cases of *gnōsis*, he has in mind assumptions made in the context of teaching a science to a student. In this context, all the relevant assumptions are true, so all the relevant cases of assuming are cases of *gnōsis*. (See *APo* 1.1, 71a11–17 (T36), 1.10, 76a31–6 (T37), 76b3–22 (T39), 2.7, 92b12–16 (T41).) In the main text just below, I argue that 'knowledge' is the best translation of *gnōsis* in Aristotle. Therefore, I am committed to saying that the cases of assuming Aristotle mentions in these passages are cases of knowing. This is reasonable if I'm right that these cases of assuming are cases of true cognition and (as I say in the main text) 'true cognition' is among the meanings of 'knowledge' in ordinary English.

angles equal to two right angles), having *nous*³⁰ (e.g., of a definition)—in addition to knowing as Aristotle standardly calls it (*gignōskein*, *gnōrizein*, and *eidenai*).

I have opted to translate *gnōsis* as 'knowledge' rather than 'cognition' for two related reasons.³¹ First, I wish to highlight the fact that *gnōsis*, like knowledge, is always true. We can have false cognition, but not false *gnōsis*.³² *Gnōsis* is not just cognition but true cognition. Second, in the previous section I proposed that one learns if and only if one acquires *gnōsis*. If this is right, then the acquisition of *gnōsis* is sufficient for learning. But the acquisition of cognition is not sufficient for learning. For cognition can be false, and if one acquires false cognition one does not learn. If *gnōsis* is knowledge, by contrast, then it stands in the right relation to learning, for acquiring knowledge is sufficient for learning.

Still, it may be that there is no perfect match in English for *gnōsis* (as Aristotle uses it). 'Knowledge' may be too strong if there are forms of *gnōsis* we would not regard as knowledge.³³ 'Cognition' may be too weak if we can have false cognition but not false *gnōsis*. The textual evidence can be taken either way. If (as I have argued) *gnōsis* should be translated 'knowledge', then Aristotle has an expansive conception of knowledge. However, one might argue that since Aristotle's conception of *gnōsis* is so expansive, it should not be translated 'knowledge'. My claim is that 'true cognition' is among the meanings of 'knowledge' in ordinary English, and that this is what *gnōsis* in Aristotle is.³⁴

The *Apo* is about a particular type of knowledge: *epistēmē*, the type of knowledge characteristic of an expert scientist. Myles Burnyeat has argued powerfully that in the *Apo* *gignōskein* and *gnōrizein* (verbal cognates of *gnōsis*) should be translated 'to know' in contrast with *epistasthai* (verbal cognate of *epistēmē*), which should be translated 'to understand' in order to bring out the fact that *epistēmē* (unlike knowledge as we, according to Burnyeat, now conceive it) involves the grasp of a causal explanation.³⁵ Burnyeat is right to emphasize the connection between *epistēmē* and explanation. (See Chapters 2 and 4.) However, his translation and interpretation

³⁰ For *nous* as a type of *gnōsis* see, e.g., *Apo* 2.19, 99b17–18 (in T51) and b22. Aristotle first speaks of *gnōsis* of the first principles (99b17) and immediates (99b22) and later in the chapter he says that *nous* is of the first principles (100b12). It's clear that *nous* is the *gnōsis* he mentions at 99b17, so *nous* is a type of *gnōsis*.

³¹ Barnes 1993 has the same translation.

³² See n26.

³³ For example, Fine (2014: 189) says that perception (*aisthēsis*) as Aristotle conceives of it is not knowledge. For knowledge, Fine says, is 'a truth-entailing cognitive condition that implies but goes beyond mere true belief'. This is certainly how many people (especially philosophers) conceive of knowledge. But in ordinary English 'knowledge' has a considerably broader range. We say, for example, that the dog knows where the food is, that an infant knows its mother. We do not mean that the dog or the infant is in a truth-entailing cognitive condition that implies but goes beyond mere true belief. We mean that the dog and the infant have true cognition.

³⁴ For further discussion, see the useful account in Fine 2014: 187–95.

³⁵ Burnyeat 1981 and 2011, both of which draw on Lyons 1963. See also Kosman 1973 and Tierney 2001. Barnes (1993) adopts the same translations, which he discusses (1993: 82), but he has since changed his mind (2014b: 73–94). Leshner (2001) argues that the best translation of *epistēmē* in Aristotle is 'expert knowledge' or 'disciplinary mastery'.

obscure the fact that *epistēmē* is a type of *gnōsis*.³⁶ It's true that in the *APo* Aristotle sometimes uses *gnōsis* (*gignōskein/gnōrizein*) to refer to a cognitive state different from and at a lower level than *epistēmē* (*epistasthai*).³⁷ However, this is a case where he uses a genus term also in a narrower way to refer to one of its species.³⁸ We need to distinguish carefully among several uses of *gnōsis* and *gignōskein/gnōrizein* in the *APo*:³⁹

- (i) *gignōskein* appears in the definition of *epistasthai*: to *epistasthai* *x* is to *gignōskein* that *y* is the cause of *x* and that *x* is necessary⁴⁰
- (ii) *gignōskein* stands in for *epistasthai*⁴¹
- (iii) *gignōskein* and *gnōrizein* signify a lower level of knowledge than *epistasthai*⁴²
- (iv) *gignōskein* and *gnōrizein* signify the acquisition of *gnōsis*⁴³
- (v) *gnōsis* (*gignōskein*) signifies the genus of which *epistēmē* (*epistasthai*) and all other forms of knowledge are species⁴⁴

Uses (i) and (v) are related: *gignōskein* appears in the definition of *epistasthai* because it is its genus. *Eidenai*, which I also translate 'to know', is the term for knowing that appears most often in the *APo*. Its range is similar to that of *gignōskein*: it is put to uses (i),⁴⁵ (ii) (its most common use),⁴⁶ and (iii),⁴⁷ but not as far as I can tell (iv). Since uses (i) and (v) are related, use (i) of *eidenai* implies use (v). Setting aside use (iv), the following schema

³⁶ As I noted above, *epistēmē* satisfies the Prior *Gnōsis* Requirement (T1, 71a1–2). Therefore, it is a type of *gnōsis*. (Salmieri (2010: 158) and (2014: 5) offers additional evidence.)

³⁷ See, e.g., *APo* 1.24, 85b38, 1.34, 89b13, 2.1, 89b34, 2.2 (in T13), 89b38–9 (in T14), 90a8 (in T17), 2.8, 93a18–19 (in T31), 2.13, 97a16 (in T48).

³⁸ Compare Aristotle's use of *aretē* in his ethical works both for the genus of which moral and intellectual virtue are species and for moral virtue specifically (genus: e.g., *NE* 6.1, 1138b35–1139a1, *EE* 2.1, 1220a5; species: e.g., *NE* 2.6, 1106b36).

³⁹ I do not claim that what follows applies to Aristotle's uses of *gnōsis* (etc.) outside the *APo*.

⁴⁰ See *APo* 1.2, 71b9–12 (T9), which I discuss in Chapters 2§3 and 4§1; see also *APo* 1.9, 76a4–5 and 1.31, 87b38–9, the second of which has *gnōrizein*.

⁴¹ This use of *gignōskein* is rare in the *APo*, but see 1.25, 86a36. See also 1.1, 71a17–29 (T5–6 below), where Aristotle uses *gnōrizein* and *gnōsis* (and *eidenai*) interchangeably with *epistasthai*. Aristotle also uses *gnōsis*, *gignōskein*, and *gnōrizein* for knowledge of first principles (e.g., 1.2, 72a28, 72a38–9, 1.3, 72b24–5, 2.19, 99b18 (in T51), b21–2, b27 (in T52)), including knowledge of definitions and essences (e.g., 1.22, 82b38). He eventually calls this knowledge *nous* (2.19, 100b12), which I argue in Chapter 4§1 is a form of *epistēmē* as defined in *APo* 1.2, 71b9–12 (T9). If this is right, then Aristotle's use of *gnōsis* (etc.) for our knowledge of first principles falls under use (ii).

⁴² See n37.

⁴³ For *gnōrizein* see, e.g., 1.1, 71a17–21 (T5), 2.5, 91b34, 2.19, 99b28–9 (in T52), 100b4 (in T58). For *gignōskein* see 2.8, 93b18 (in T29). As far as I can tell the only difference between *gnōrizein* and *gignōskein* in the *APo* is that *gnōrizein* more often than *gignōskein* signifies knowledge acquisition.

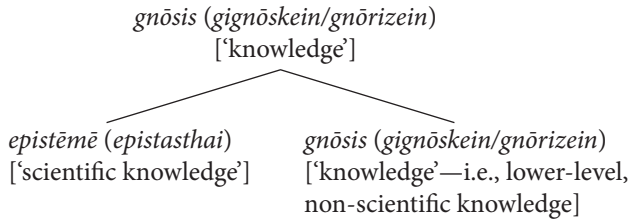
⁴⁴ For *gnōsis* as genus see 1.1, 71a1–2 (T1) and 2.19, 99b29 (in T52). For *gignōskein* see 1.1, 71a6 and 71a11 (in T36).

⁴⁵ See, e.g., 1.2, 71b30–1, 2.11, 94a20.

⁴⁶ See, e.g., 1.1, 71b4–7 (in T4), 1.2, 71b16–17 (in T11), 72a25, 72a31–2, 1.3, 72b5–13, b30, 1.5, 74a32–3, 1.9, 76a20, 76a27–8, 1.22, 83b32–84a6, 1.24, 85a23–4, 1.33, 89a11–15, 2.3, 90a2.

⁴⁷ See, e.g., 2.1, 89b28–34 (in T13), 2.2, 89b36–90a8 (in T14), 90a28–9, a31 (in T16), 2.8, 93a18–20 (in T31), 93b3 (in T35), 2.13, 97a5–10 (in T47), a16–17 (in T48). See also Ackrill 1981: 366 and Fine 2010: 131 n18.

represents the relations among the key epistemological terms in the *APo*, where *eidenai* has no independent use of its own but is used interchangeably with each verb here represented (in brackets):⁴⁸



Unlike Burnyeat (and others), I have decided to use ‘scientific knowledge’ for *epistēmē* (and ‘to know scientifically’ or ‘to have scientific knowledge’ for *epistasthai*).⁴⁹ For I want to emphasize that *epistēmē* is a type of knowledge (*gnōsis*), the type characteristically possessed by expert scientists, since it is scientists who characteristically meet the requirements for possessing *epistēmē* (which requirements I discuss in Chapters 2§3 and 4§§1–6).

For Aristotle, there are higher and lower levels of knowledge, with *nous* at the top of the scale and perception at the bottom. He expresses this by speaking of some states as ‘more knowing’ (*gnōstikōteron*) than others and some objects as ‘better known’ (*gnōrimōteron*) than others.⁵⁰ In a passage in the *Metaphysics* (7.3, 1029b1–12, T21), he says that learning proceeds from objects that are less known by nature to ones that are better known by nature. He also thinks that learning proceeds from less to more knowing states—ultimately, from perception to *nous*. For Aristotle, mental states are partly individuated by their objects, with which they share certain characteristics. Hence the most knowing state (*nous*) is so partly in virtue of the fact that its objects (first principles, especially definitions) are the best known by nature.⁵¹ I say

⁴⁸ I agree with some of Burnyeat’s recent conclusions about *eidenai* in Aristotle; see 2011: 14–24. I disagree, however, with his claim that *gignōskein* is not as generic as *eidenai* (2011: 21). Burnyeat takes *eidenai* to be the genus of which *epistasthai* and *gignōskein* are the main species. This overlooks the evidence I have cited that *gignōskein* is the genus of which *epistasthai* and *gignōskein* (in a different, narrower use) are the main species. Since *eidenai* is used interchangeably with each of these terms, I find it more helpful to think of it as standing outside this genus-species structure than as the genus term in it. In addition, the generic use of *eidenai* (use (v)) is only implied (i.e., by use (i)), whereas the generic use of *gignōskein* (etc.) is more explicit. See the passages cited in n44.

⁴⁹ Sometimes the appropriate translation of *epistēmē* in the *APo* is ‘science’: see, e.g., 1.10, 76a37–8, 1.11, 77a26, 1.13, 78a23. As Burnyeat (1981: 97) remarks: ‘like our word “knowledge,” [*epistēmē*] can refer either to the cognitive state of the knowing person or to a body of knowledge, a science’.

⁵⁰ For states that are ‘more knowing’, see *APo* 2.19, 100a12 (in T57); for objects that are ‘better known’, see 1.2, 71b33–72a5, *Top* 6.4, *Phys* 1.1, 184a16–26, and *Met* 7.3, 1029b3–12 (T21). In Chapter 8§5, I argue that what makes one object *x* better known by nature than another *y* is *x*’s position vis-à-vis *y* in the objective order of explanation. For example, if *x* is the cause of *y*, then *x* is better known by nature than *y*.

⁵¹ Definitions are the best known by nature because they occupy the highest position in the order of explanation: they explain other things and nothing else explains them.

'partly' because Aristotle thinks that two (or more) types of knowledge, one higher and more knowing than the other(s), can have the same object.⁵² In these cases, one type is more knowing because it apprehends its object as such, as it really is.⁵³ For example, noetic knowledge of a definition D is more knowing than non-noetic knowledge of D because it apprehends D as such (as a definition and first principle).⁵⁴ So what makes one state more knowing than another is both the nature of the object known and the manner in which it is known. In learning we usually proceed from less to more knowing states and from less to better known objects, but we sometimes proceed from less to more knowing states with respect to the same object. This is an important idea, one I shall return to several times.

6. Prior Knowledge of What?

Intellectual learning requires prior knowledge—but of what? The evidence in the *APo* suggests that there are two general possibilities. In some cases one learns x from (some sort of) prior knowledge of x itself; in other cases one learns x from prior knowledge of something else y , where x and y stand in some relevant relation.⁵⁵

An example of learning x from prior knowledge of x appears in *APo* 1.1 (71a17–29, T5–6 below). A geometer acquires 'unqualified knowledge' that a particular triangle C has interior angles equal to two right angles from prior 'universal knowledge' of the same fact. Another example appears in *APo* 2.8 (93a21–9, T32): an inquirer learns the essence of eclipse starting from prior knowledge of a preliminary account that identifies part of the essence. (See Chapter 10.) In the first example, as we shall see in sections 8–9, knowing x is necessary for learning it (in a certain way). In the second example, as we shall see in Chapter 10, knowing x is sufficient but not necessary for learning it. Aristotle's view is that in all cases of learning x from prior knowledge of x , one in a way knows x prior to learning it, but not in the same way one knows it as a result of learning it. As he says in *APo* 1.1:

T4 But nothing, I think, prevents us from in one way knowing and in another way being ignorant of that which we learn; for what's absurd is not that we know in some way that which we learn but that we know it in this way, in the way and manner in which we learn it.⁵⁶ (71b5–8)

⁵² See Chapter 2§§3–4 on scientific vs. non-scientific knowledge of explanatorily-connected facts, and Chapters 6§4, 8§§4–5, and 12§1 on noetic vs. non-noetic knowledge of definitions. See also *APo* 1.33, which I do not discuss, where Aristotle explains how there can be opinion (*doxa*) and scientific knowledge of the same thing.

⁵³ See Salmieri 2014: 6.

⁵⁴ I discuss what it means to have noetic knowledge of a definition as such in Chapter 4.

⁵⁵ For useful discussions of this distinction see Brown 2008: 469–70 and Fine 2014. Brown calls these the 'matching' and 'stepping-stone' versions of the requirement, respectively. Fine adopts the same terms.

⁵⁶ ἀλλ' οὐδέν (οἶμαι) κωλύει, ὃ μανθάνει, ἔστιν ὡς ἐπίστασθαι, ἔστι δ' ὡς ἀγνοεῖν. ἄτοπον γὰρ οὐκ εἰ οἶδέ πως ὃ μανθάνει, ἀλλ' εἰ ὁδὲ, οἷον ἢ μανθάνει καὶ ὡς.

APo 2.8 (93a37–b7, T35) also contains an example of learning x from prior knowledge of y , where x and y stand in some relevant relation.⁵⁷ An inquirer learns the essence of eclipse starting from prior knowledge of a preliminary account that identifies a feature of eclipse explanatorily connected to, but not part of, its essence: the full and unobstructed moon's inability to cast shadows on earth. The inquirer learns by reasoning from effect to cause: the absence of shadows is explained by the moon's loss of light, which in turn is explained by its being screened from the sun by the earth, which is eclipse's essence. She learns the essence starting from prior knowledge not of (part of) the essence itself, but of something relevantly connected to it. (See Chapter 10§12.)

7. Prior Cognition and Prior Knowledge in Plato and Aristotle

Aristotle thinks that in some but not all cases learning x requires prior knowledge of x . In this way he differs from Plato, who as we saw in section 3 thinks that seeking and discovering x always requires prior cognition of x . They may agree, however, about the type and level of knowledge or cognition required for learning. For Plato, seeking and discovering x requires the absence of complete ignorance (of x)—that is, the presence of some cognition (of x).⁵⁸ If Plato thinks that what's required is *true* cognition, then he and Aristotle seem to agree: all (intellectual) learning requires prior true cognition. For, as I have been using 'cognition' in reference to Plato, true cognition in Plato seems to have the same range as *gnōsis* in Aristotle. However, Plato may think that in some cases false cognition about x is sufficient for seeking and discovering it. In that case, he and Aristotle disagree: they both think learning requires cognition, but Aristotle thinks it requires true cognition (*gnōsis*) and Plato does not.⁵⁹ Even here, however, they agree in denying that all learning requires high-level knowledge or cognition (e.g., *epistēmē*).⁶⁰ For Aristotle, (intellectual) learning requires prior *gnōsis*, which covers a broad range of cognitive states, from low- to high-level knowledge. For Plato, learning requires prior cognition, which arguably covers a similar range.

Plato, however, makes an additional move that Aristotle rejects. Plato thinks that latent innate *epistēmē* satisfies the prior cognition requirement. Although it is not necessary for inquiring and discovering, it is sufficient, and it is part of the

⁵⁷ Aristotle's general view of learning—namely, that it proceeds from what is better known to us to what is better known by nature (see again *Met* 7.3, 1029b3–12, T21)—lends support to the claim that one can learn x from prior knowledge of something other than x . For he gives no indication that the better known to us and by nature are always the same. Indeed, he is explicit that they can be different (see *APo* 1.2, 71b33–72a5).

⁵⁸ On my use of 'cognition' in reference to Plato, see n14.

⁵⁹ For this view, see Fine 2014: 195.

⁶⁰ Here I concur with Fine's claim that 'Aristotle agrees with Plato insofar as he doesn't require superior cognition for inquiry or learning.' (2014: 195) In other ways, my comparison of Plato and Aristotle differs from Fine's. See Fine 2014: 195–7.

explanation of how we in fact learn. This, I suggested in section 2, is part of his solution to Meno's Paradox. Aristotle rejects the existence of latent innate *epistēmē*,⁶¹ and so, as we shall see in Chapter 13§4, he rejects Plato's solution to the puzzle.

8. Simultaneous Learning in *APo* 1.1

I turn now to *APo* 1.1 where Aristotle introduces an example of a peculiar sort of learning, which illustrates his Prior Knowledge Requirement in an interesting way:⁶²

- T5 (a) It is possible to come to know (*gnōrizein*) by knowing (*gnōrisanta*) some things beforehand and acquiring knowledge (*gnōsin*) of other things at the same time [as one another], for example, whichever things happen to fall under a universal that one knows (*gnōsin*). (b) For he knew beforehand (*proē(i)dei*) that every triangle has two right angles. But he came to know (*eg nōrisen*) that this thing in the semi-circle is a triangle at the same time as he made the inference (*epagomenos*) [that it has two right angles].⁶³ (71a17–21)⁶⁴

In T5a, Aristotle states that it is possible to acquire simultaneously more than one item of knowledge starting from prior knowledge of other things. In the example in T5b, he presents a syllogism whose major premise is known beforehand and whose minor premise and conclusion are learned simultaneously:

All triangles have 2R⁶⁵

This thing in the semi-circle is a triangle

This thing in the semi-circle has 2R⁶⁶

Aristotle seems to have in mind an expert geometer who possesses what he elsewhere calls 'first actuality' knowledge⁶⁷ (i.e., acquired dispositional knowledge) of the universal truth that every triangle has 2R.⁶⁸ While working on a problem involving

⁶¹ See *APo* 2.19, 99b22–7.

⁶² Sections 8–9 summarize, and in a few places depart slightly from, Bronstein 2010, where I examine T5–7 in more detail than I am able to here.

⁶³ Ἦστι δὲ γνωρίζειν τὰ μὲν πρότερον γνωρίσαντα, τῶν δὲ καὶ ἅμα λαμβάνοντα τὴν γνώσιν, οἷον ὅσα τυγχάνει ὄντα ὑπὸ τὸ καθόλου οὐ ἔχει τὴν γνώσιν. ὅτι μὲν γὰρ πᾶν τρίγωνον ἔχει δυσὶν ὀρθαῖς ἴσας, προήδει· ὅτι δὲ τὸδε τὸ ἐν τῷ ἡμικυκλίῳ τρίγωνόν ἐστιν, ἅμα ἐπαγόμενος ἐγνώρισεν.

⁶⁴ There is a controversy about the meaning of *epagomenos* in this passage (and in *APr* 2.21, 67a23). My own view is that Aristotle uses it for the inference from a universal proposition to a particular one and not, as is usually the case, from knowledge of particulars to a universal. For further discussion, see Gifford 1999, LaBarge 2004, McKirahan 1983, and Ross 1949: 506. On *epagōgē* ('induction') in general see Engberg-Pedersen 1979, Hamlyn 1976, and Ross 1949: 481–5. I discuss learning by induction in Chapters 12§12 and 13.

⁶⁵ 2R = interior angles equal to two right angles.

⁶⁶ In Chapter 2§4, I argue that this example illustrates one way of learning by demonstration.

⁶⁷ See *DA* 2.1, 412a21–8 and 2.5, 417a21–b2.

⁶⁸ For a different view, see Fine 2014: 200–3.

a semi-circle,⁶⁹ the geometer realizes that the figure inscribed within it—call it 'C'—is a triangle; and at the very moment that he grasps this, he grasps the conclusion that C has 2R. Since the geometer learns this on his own without the aid of a teacher, this is an example of non-didactic learning. (See section 4.)

Immediately after T5, Aristotle identifies the prior knowledge the geometer must possess in order to learn in this way:

- T6** (a) Before making the inference or grasping the syllogism, perhaps we ought to say that in one way he knows (*epistasthai*),⁷⁰ but in another way he does not. (b) For, if he did not know without qualification (*ē(i)dei...haplōs*) whether [the triangle in the semi-circle] exists, how did he know without qualification (*ē(i)dei...haplōs*) that it has two right angles? (c) But it's clear that [before grasping the syllogism] he knows (*epistatai*) [that it has two right angles] in this way: he knows (*epistatai*) [this] universally (*katholou*), but not without qualification (*haplōs*).⁷¹ (71a24–9)

Aristotle distinguishes between two ways of knowing that C has 2R: universally and without qualification.⁷² T6 and *APr* 2.21 (67a16–21) suggest that these two ways of knowing are closely connected to knowledge (*epistēmē*) of the relevant universal proposition. If you know that every triangle has 2R, then (i) you know *without qualification* that the particular triangles whose existence you *are* aware of have 2R (provided you have brought them under the universal proposition) and (ii) you know *universally* that the particular triangles whose existence you are *not* aware of have 2R. In T6c, Aristotle claims that prior to learning the geometer knows universally, and not without qualification, that the particular triangle C has 2R and that the geometer knows this in virtue knowing the universal proposition 'every triangle has 2R'. For our purposes, the key idea is that in T6 knowing universally and without qualification are two ways of knowing the same thing: that C has 2R. We know this universally in virtue of knowing that every triangle has 2R. We know it without qualification in virtue of knowing both that every triangle has 2R and that C is a triangle.

⁶⁹ See Heath 1949: 37–9.

⁷⁰ Starting in the next chapter I translate *epistasthai* as 'to know scientifically' or 'to have scientific knowledge' (and *epistēmē* as 'scientific knowledge'). In the rest of this chapter, by contrast, I use 'to know' and 'to have knowledge'. My reasons are purely stylistic: some of Aristotle's locutions (e.g., 'knows universally', *katholou epistatai*, T6c) are awkward in English if we have an additional modifier ('scientifically' or 'scientific').

⁷¹ *πρὶν δ' ἐπαχθῆναι ἢ λαβεῖν συλλογισμόν τρόπον μὲν τινα ἴσως φατέον ἐπίστασθαι, τρόπον δ' ἄλλον οὐ. ὁ γὰρ μὴ ᾗδει εἰ ἔσται ἀπλῶς, τοῦτο πῶς ᾗδει ὅτι δύο ὀρθὰς ἔχει ἀπλῶς; ἀλλὰ δῆλον ὡς ὥδι μὲν ἐπίσταται, ὅτι καθόλου ἐπίσταται, ἀπλῶς δ' οὐκ ἐπίσταται.*

⁷² See also *APo* 1.1, 71b5–8 (T4) and *APr* 2.21, 67a16–21. For knowing universally, see also *APo* 1.24, 86a22–30. For an illuminating discussion of the distinction between these two ways of knowing, see Morison 2012.

9. Meno's Paradox in *APo* 1.1

In the lines immediately following T6, Aristotle introduces Meno's Paradox:

T7 But if not, the problem in the *Meno* will come about; for one will learn either (\bar{e}) nothing or (\bar{e}) that which one [already] knows (*oiden*).⁷³ (71a29–30)

The phrase 'one will learn either nothing or that which one [already] knows' ($\bar{e} \dots \text{ouden} \dots \bar{e} \text{ ha oiden}$) is reminiscent of Socrates's statement that 'it is impossible for a person to search either for that which he knows or for that which he does not know' (*oute ho oide oute ho mē oide*).⁷⁴ The occurrence of 'either ... or' constructions in both texts and Aristotle's reference to 'the problem in the *Meno*' suggest that he sees himself as introducing either the same dilemma as Socrates's or an instance of it.⁷⁵ Now Socrates's dilemma applies to any object we can intelligibly be said to inquire about,⁷⁶ whereas Aristotle's applies to a specific kind of object (a particular truth that falls under a universal one). In addition, Aristotle only mentions learning and Socrates only mentions inquiry. By 'inquiry' Socrates seems to mean something quite general: as Gail Fine puts it, 'improving one's cognitive condition'.⁷⁷ Learning is one way of improving one's cognitive condition. So what interests Aristotle (non-didactic learning) is an instance of what interests Socrates (inquiry, broadly construed). If this is right, then the puzzle Aristotle introduces is an instance of Socrates's dilemma.⁷⁸

The first horn of Aristotle's dilemma is easy enough to understand. T7 begins with a conditional statement whose antecedent denies what Aristotle has said in the previous passage, T6—namely, that there is a difference between knowing universally and without qualification. If there is no such difference, then one possibility is that before learning the geometer already knows without qualification that C has 2R. But in that case he learns what he knows without qualification, and so he does not learn at all. As Aristotle says in T4, it is absurd to think that prior to learning one knows something in the very way one goes on to learn it.

The second horn is harder to work out, but I think it can become clear once we remind ourselves of the context of the passage and introduce two implicit assumptions. Aristotle is discussing, by way of illustration, his Prior Knowledge Requirement for intellectual learning. Let's say (as the antecedent of the conditional

⁷³ $\epsilon\iota\ \delta\acute{\epsilon}\ \mu\acute{\eta},\ \tau\acute{o}\ \acute{\epsilon}\nu\ \tau\acute{\omega}\ \acute{\alpha}\pi\acute{o}\rho\eta\mu\alpha\ \sigma\upsilon\mu\beta\acute{\eta}\sigma\epsilon\tau\alpha\iota\ \eta\ \gamma\grave{\alpha}\rho\ \text{o}\acute{\upsilon}\delta\delta\acute{\epsilon}\nu\ \mu\alpha\theta\acute{\eta}\sigma\epsilon\tau\alpha\iota\ \eta\ \acute{\alpha}\ \text{o}\iota\delta\epsilon\nu.$

⁷⁴ *Meno* 80e2–3, in T3.

⁷⁵ Thus I disagree with LaBarge (2004) who argues that T7 does not present a genuine dilemma. For further discussion, see Bronstein 2010.

⁷⁶ Examples in the *Meno* include: whether virtue is teachable; what virtue is; who Meno is; whether Meno is handsome, rich, or well born; what a bee is; what colour is; what shape is; and the length of the line of the area of the square twice the area of the four-foot square.

⁷⁷ Fine 2014: 109, 182. More precisely, Fine states that successful inquiry consists in improving one's cognitive condition and that successful inquiry is what interests Socrates.

⁷⁸ See Fine 2014: 205–6.

in T7 says) that there is no distinction between knowing universally and without qualification, and let's say (as T6 says) that the geometer lacks unqualified knowledge that C has 2R. In that case, learning will be possible only if the geometer has some other type of knowledge. Now suppose that in order to learn, the geometer's prior knowledge must consist in (some sort of) knowledge that C has 2R—that is, the very fact he is meant to learn.⁷⁹ And suppose in addition that one can have no other knowledge (*gnōsis*) of that fact apart from unqualified *epistēmē*. In that case, either one has unqualified *epistēmē* or (we now assume) one has no knowledge (*gnōsis*) at all. This gives us the dilemma's second horn: learning will now be impossible. Prior to learning the geometer will have no *gnōsis* at all that C has 2R—he will be in a cognitive blank with respect to it.⁸⁰ For he lacks unqualified *epistēmē* of that fact, and (the puzzle assumes) there is no other knowledge of that fact available to him. Since learning (in our example) requires prior *gnōsis* that C has 2R, and since *ex hypothesi* the geometer has none, he learns nothing. I suggest that this second assumption—that unqualified ignorance is the only alternative to unqualified *epistēmē*, that knowledge is 'all or nothing' in this way—is the key to understanding Aristotle's puzzle, just as it was the key to understanding Socrates's dilemma. Aristotle's reference to Meno's Paradox is intended to call attention to—and warn against—this extreme 'all or nothing' view.

Here, then, is the puzzle:

- (A1) Either the geometer knows without qualification that C has 2R or he is completely ignorant of that fact.
- (A2) If the geometer knows without qualification that C has 2R, he cannot learn it.
- (A3) If the geometer is completely ignorant of that fact, he cannot learn it.
- (A4) Therefore, the geometer cannot learn that C has 2R—'he will learn either nothing or what he [already] knows.'

Aristotle's solution is that prior to learning the geometer knows universally and not without qualification that C has 2R. This means that he accepts A2 and A3 but denies A1 (just as Plato accepts S2 and S3 but denies S1, as I interpreted them): there is an intermediate cognitive state that satisfies the Prior Knowledge Requirement and makes learning possible.⁸¹ The intermediate state (universal knowledge) and the knowledge we have as a result of learning (unqualified knowledge) have the same object: the fact that C has 2R. So this is a case in which learning consists in moving from a less to a more knowing state with respect to the same object.

At this point one might object that A3, unlike S3, is false. A3 implies that learning that C has 2R requires some sort of prior knowledge that C has 2R, but that seems wrong. Why couldn't the geometer rely on knowledge of other facts in order to learn

⁷⁹ I defend the cogency of this assumption in Bronstein 2010.

⁸⁰ It is legitimate to infer 'cognitive blank' from 'no *gnōsis* at all' because *gnōsis*, as I discussed above, covers such a broad range of cognitive states, from the very lowest (perception) to the very highest (*nous*).

⁸¹ For a different interpretation of the puzzle and solution, see Fine 2014: 205–8.

this one? Why, for example, couldn't he just measure the angles in the figure and conclude that they add up to two right angles?

Aristotle could defend A3 in the following way. If the geometer is completely ignorant of the particular fact that C has 2R, then he does not have *epistēmē* of the universal fact that all triangles have 2R. For a necessary condition for having *epistēmē* of the universal fact is that one knows universally particular facts of this sort.⁸² Now if the geometer does not have *epistēmē* of the universal fact, Aristotle thinks that he cannot acquire unqualified *epistēmē* of the particular fact (although he may acquire some other type of knowledge of it).⁸³ For having unqualified *epistēmē* of the particular fact requires knowing not only *that* the triangle has 2R but also *why*, and this in turn requires *epistēmē* of the universal, which, the puzzle assumes, the geometer does not have. In other words, the learning that consists in acquiring unqualified *epistēmē* that C has 2R requires knowing universally that C has 2R, but the learning that consists in acquiring some other type of *gnōsis* that C has 2R may not. So it's true that the geometer could just add up C's angles, but he wouldn't thereby acquire unqualified *epistēmē*. When Aristotle says that the geometer will learn nothing (A3), he means that he will not acquire any unqualified *epistēmē*.⁸⁴ His puzzle targets the acquisition of unqualified *epistēmē* of particular facts.

Conclusion

In the *Meno*, Meno worries about seeking and discovering something specific: what virtue is. Socrates then introduces his dilemma, which applies to any object we can intelligibly be said to inquire about. In *APo* 1.1, Aristotle introduces an instance of Socrates's dilemma, one that targets a specific kind of learning (the acquisition of unqualified *epistēmē*) about a specific kind of object (a particular truth that falls under a universal one). Plato's solution to Meno's Paradox involves the theory of recollection, according to which we have latent innate knowledge of the objects we seek. Aristotle's solution in *APo* 1.1 (the distinction between knowing universally and without qualification) does not appeal to latent innate knowledge, and later in the *APo* he rejects its existence (2.19, 99b22–7). However, Aristotle in 1.1 does not present his solution as a rival to Plato's. Indeed, Plato could agree that this is the correct way to solve this instance of the puzzle and still favour his own way of solving the more general dilemma. In Chapter 13, I shall discuss Aristotle's response to Plato's solution, as it appears in *APo* 2.19. Before then, we shall encounter in the *APo* other instances of Meno's Paradox that apply to other types and objects of inquiry and learning and that admit of other solutions.

⁸² As I noted in the previous section, if one knows that all triangles have 2R, then one knows universally that any particular triangle whose existence one is not aware of has 2R.

⁸³ For this claim, see *APo* 1.5, 74a25–32.

⁸⁴ In Aristotle, the result of learning is always *gnōsis* and sometimes but not always *epistēmē*.

PART I

Learning by Demonstration

2

Learning by Demonstration

In *APo* 1, Aristotle presents his theory of demonstration (*apodeixis*). In doing so he explains the relationship between demonstration and scientific knowledge (*epistēmē*). He says that to have scientific knowledge of x is to know that y is the cause of x and that x is necessary.¹ A demonstration is a special type of syllogism in which a fact is proven to be necessary and its cause is revealed. If we grasp a demonstration, therefore, we have scientific knowledge, and demonstration is one of the means by which a scientist expresses what she knows scientifically. Demonstrations are also the means by which the body of facts that make up a science is organized. A science is made up of chains of demonstrations in which the highest demonstrations have as their premises the first principles of the science (mainly definitions) and the lower ones include among their premises conclusions of demonstrations higher up. In short, Aristotle's theory of demonstration in *APo* 1 contains an account of the structure of science and the nature of scientific knowledge.

Jonathan Barnes has argued influentially that there is more and less to Aristotle's theory of demonstration than has often been thought.² There is more to it because in addition to describing the structure of science and the nature of scientific knowledge, the theory also 'offers a formal account of how an achieved body of knowledge should be presented and taught.'³ There is less to the theory because demonstration is not a tool for discovery or research: 'the theory of demonstrative science was never meant to guide or formalise scientific research... it does not describe how scientists do, or ought to, *acquire* knowledge'.⁴ Barnes presents two theses, one positive and one negative.⁵ His positive thesis is that demonstration is a pedagogical tool instructors use to teach their students the knowledge they have acquired.⁶ The negative thesis is that demonstration is not a means by which scientists acquire the knowledge they go on to teach. Barnes's positive thesis has been criticized and has not gained wide acceptance.⁷ The negative thesis, however, is widely accepted,⁸ and for good reason: it

¹ *APo* 1.2, 71b9–12 (T9). See section 3 and Chapter 4§1.

² Barnes 1975 (originally published in 1969); reprinted in Barnes 2014a.

³ Barnes 1975: 85. ⁴ Barnes 1975: 77; emphasis in original. ⁵ See Barnes 1993: viii–ix.

⁶ For discussion of this thesis, see Burnyeat 1981: 119–20, Kapp 1975, Weil 1975: 98.

⁷ See Burnyeat 1981: 115–20, Ferejohn 1991: 141 n4, Wians 1989. Barnes himself offers a partial retraction in 1993: xviii–ix.

⁸ See Burnyeat 1981: 116, McKirahan 1992: 233, Mendell 1998: 197, Sorabji 1980: 194, Wians 1989.

seems to rescue the theory of demonstration from at least one powerful objection leveled against it by the *APo*'s many detractors. The idea that from her prior knowledge that (1) all Bs are A and (2) all Cs are B, a scientist discovers, if (1) and (2) meet a strict set of requirements, that and why (3) all Cs are A is a silly scholastic fantasy, which should be discarded along with the Aristotelian theory from which it derived—or so the objection goes. Therefore, according to the prevailing view, which rejects Barnes's positive or 'teaching' thesis and accepts his negative or 'research' thesis, neither students nor their expert teachers learn by demonstration. Assuming that these are the only candidates for learning by demonstration, the prevailing view is that no learning is done in this way.

I shall argue, against the prevailing view, that there is such a thing as learning by demonstration and that both students and expert scientists engage in it (albeit in different ways). On my reading, then, Barnes was right where others have taken him to be wrong and wrong where he has been taken to be right. In Chapter 11§§4–6, I argue that some version of Barnes's positive thesis is correct: students of a science are taught and therefore learn by demonstration (although Barnes may have exaggerated the importance of demonstration in their studies). In the present chapter and in Chapter 4, I argue that Barnes's negative thesis is false: expert scientists make some of their discoveries by demonstration; demonstration is a source of new scientific knowledge for experts. In section 1, I examine in more detail what drives the prevailing view. In section 2, I present textual evidence in support of my unorthodox claim. In section 3, I examine the relationship between scientific knowledge and demonstration. Finally, in section 4, I defend the claim that scientists can learn by demonstration and I explain what their learning consists in.

1. The Prevailing View

The following argument against the possibility of learning by demonstration captures the prevailing view.⁹ We begin with the question, who learns by demonstration? There are two candidates: the expert scientist and the student.¹⁰ Two considerations together seem to show that experts do not learn by demonstration. First, Aristotle says that one knows by means of a demonstration only if one has prior knowledge of its premises, including the first principles (*archai*) of a science.¹¹ The expert possesses this knowledge, for this is the mark of scientific expertise. Second, Aristotle

⁹ See Barnes 1975, Burnyeat 1981, Ferejohn 1991: 141 n4, Kapp 1975, McKirahan 1992: 233–4, Mendell 1998: 196–9, Wians 1989.

¹⁰ For the time being I set aside the inquirer—the person seeking to discover, without the aid of a teacher, either for the first time or an existing science she does not already know. In Chapter 10, I argue that demonstration is the means by which the inquirer discovers the essences of demonstrable attributes. However, I do not think that this is what Aristotle means by 'learning by demonstration', which is my topic in this chapter. For the distinction between the expert (of *APo* 1) and the inquirer (of *APo* 2), see Chapter 5. For an interesting discussion of demonstration as a tool used in scientific inquiry, see Chiba 2012.

¹¹ *APo* 1.2, 71b17–72a14.

says that in the order of inquiry we know the facts to be explained before we know their explanations; indeed, prior knowledge of the *explanandum* (*to hoti*) is a necessary condition for seeking the *explanans* (*to dioti*).¹² Since the conclusion of a demonstration signifies an *explanandum* and its premises signify the *explanans*, it follows that by the time the expert is set to demonstrate she already knows both the fact that the demonstration proves (as its conclusion) and the explanatory premises that prove it. And since it is commonly (and crucially) assumed that learning by demonstration would be, if it were possible, a method for coming to know new conclusions from known premises,¹³ it follows that the expert cannot learn by demonstration, for she already knows the very thing she is meant to learn.

What about the student of a science? Demonstration requires prior knowledge of first principles, but this is precisely what the student lacks and is trying to acquire. A method of learning that requires the very knowledge the learner hopes to acquire by its means is no method at all.¹⁴ Proper pedagogy requires that teachers guide students from conclusions to principles, from *explananda* to *explanantia*, not the other way around. So students—like experts, but for different reasons—are not capable of learning by demonstration.¹⁵

According to the prevailing view, then, learning by demonstration, if it were possible, would proceed from known premises to new conclusions. But Aristotelian learning (whether by experts or by students) proceeds from known conclusions to new premises. Therefore, learning by demonstration is not Aristotelian learning.

2. Textual Evidence

The first piece of evidence in support of my claim that expert scientists can learn by demonstration is Aristotle's use of the phrase 'learning by demonstration', which appears twice in the remaining corpus (*APo* 1.18, 81a39–40, *Met* 1.9, 992b30–3, T2). As we saw in the Introduction, in *Metaphysics* 1.9 he distinguishes learning by demonstration from learning by definition and by induction. In *APo* 1.18, he says that learning by demonstration requires prior knowledge of 'universals' (81a40–81b1),

¹² See, e.g., *APr* 1.30, 46a17–27 (T20), *APo* 2.1–2, 2.8, 93a21–9 (T32), *DA* 1.1, 402a13–15, 402b16–403a2 (T18), *HA* 1.6, 491a7–14 with Lennox 1987. I discuss Aristotle's account of the order of inquiry in Part II.

¹³ This is the second of the two possibilities Barnes considers for how demonstration might be a tool for scientific research (Barnes 1975: 84–5; see also Burnyeat 1981: 116–17, Wians 1989: 48–9). The first possibility is different: one arrives at scientific knowledge of some previously known fact by seeking and discovering its cause, which can then be set out as the middle term in a demonstration whose conclusion states the previously known fact. Everyone agrees that it is possible to learn in this way. However, no commentator that I am aware of thinks that this is what Aristotle calls 'learning by demonstration'. (See Barnes 1975: 84.) I agree with this. (See section 4.) In this chapter, I offer a different account of what learning by demonstration is. In Part II, I discuss the inquirer, who makes discoveries of the sort I just outlined.

¹⁴ See Burnyeat 1981: 116–17 and Wians 1989: 48–9.

¹⁵ For a clear expression of this view, see McKirahan 1992: 233–4.

which we can plausibly take to be first principles (*archai*). Since it is scientists who know first principles, 1.18 suggests that they can learn by demonstration.

The second piece of evidence is from *APo* 2.19. For Aristotle, all intellectual learning requires prior knowledge (71a1–2, T1). In *APo* 2.19 he says:

T8 But if we acquire [the first principles] without possessing [them] earlier, how would we acquire knowledge and learn from no pre-existing knowledge? For this is impossible, as I also said in connection with demonstration.¹⁶ (99b28–30)

Aristotle claims that we cannot learn first principles without prior knowledge. When he connects this thought with demonstration in the second sentence, he means that we cannot learn by demonstration without prior knowledge. So demonstration is a way of learning and subject to the Prior Knowledge Requirement.¹⁷ The most obvious candidate for the prior knowledge required for learning by demonstration is the one Aristotle discusses in *APo* 1.2 (71b17–72a14): knowledge of first principles. In fact, Aristotle reminds us of this just a few lines above T8: ‘It was stated earlier that it is impossible to have scientific knowledge through demonstration without knowing the primary immediate principles’ (99b20–2, in T52).¹⁸ So demonstration is a way of learning that requires prior knowledge of first principles. It follows that expert scientists can learn by demonstration, for it is experts who have this knowledge.¹⁹

The third piece of evidence comes from *APo* 1.2, 71b17–25 (T10), a passage I discuss in the next section. Aristotle says that we have scientific knowledge if we grasp a demonstration. He also says that demonstration produces or causes (*poiēsei*) scientific knowledge (71b25). Commentators who deny that scientists learn (i.e., acquire scientific knowledge) by demonstration must take Aristotle to be saying that demonstration is the means by which a scientist expresses or actualizes a piece of knowledge she already possesses and previously acquired by non-demonstrative means. However, a more natural reading is that demonstration is a way of acquiring scientific knowledge in the first place. To be sure, demonstration is also a means by which a scientist expresses knowledge she already has (e.g., by exhibiting syllogisms to colleagues or students or even herself). However, if demonstration were not also a way of acquiring new scientific knowledge, then Aristotle should not have said that it

¹⁶ εἰ δὲ λαμβάνομεν μὴ ἔχοντες πρότερον, πῶς ἂν γνωρίζοιμεν καὶ μαθαίνοιμεν ἐκ μὴ προϋπαρχούσης γνώσεως; ἀδύνατον γάρ, ὥσπερ καὶ ἐπὶ τῆς ἀποδείξεως ἐλέγομεν.

¹⁷ See Ross (1949: 674, 676) who takes the back-reference of *elegomen* at b30 to be 71a1–2 (T1).

¹⁸ Ὅτι μὲν οὖν οὐκ ἐνδέχεται ἐπίστασθαι δι’ ἀποδείξεως μὴ γινώσκοντι τὰς πρώτας ἀρχὰς τὰς ἀμέσους, εἴρηται πρότερον.

¹⁹ In Chapter 11§§4–6, I argue that students learn by demonstration and that they do so from prior knowledge of certain propositions that have the same content as first principles (especially definitions). So students do in a way have knowledge of first principles. However, they do not have the same knowledge as experts. For experts have non-demonstrative scientific knowledge (*nous*) of first principles. This is the knowledge Aristotle has in mind in the *APo* 1.2 and 2.19 passages I cite. Since experts and students learn by demonstration from different types of prior knowledge, the outcome of their learning is different: experts acquire new demonstrative scientific knowledge; students acquire new knowledge that falls short of scientific knowledge.

‘produces’ it. Recall too that Aristotle speaks of ‘learning by demonstration’. It is natural to think that learning by demonstration is the process in which demonstration produces new scientific knowledge.

Barnes might respond that when Aristotle speaks of demonstration as productive of scientific knowledge he does have learning by demonstration in mind, except that the learning is accomplished by a student of a science, not an expert. That is, Barnes might claim that demonstration is expressive of old scientific knowledge in scientists and productive of new scientific knowledge in students.

However, Aristotle’s claim that demonstration produces scientific knowledge should not be taken in this way. In *APo* 1.2, he says that a requirement for (demonstrative) scientific knowledge is that one finds the premises (principles) of one’s demonstration more convincing than its conclusion.²⁰ In fact, one must find the principles most convincing of all (72a37–b4). So the person in whom demonstration produces new scientific knowledge must already be thoroughly convinced of the principles. However, this describes the cognitive state of the scientist, not the student, for it is the scientist who has made what is better known and more convincing by nature (the principles) better known and more convincing to herself and it is the student who is on her way to this condition.²¹ So when Aristotle says that demonstration produces scientific knowledge, he means that it produces new scientific knowledge in experts. Scientists learn by demonstration.²²

3. Scientific Knowledge and Demonstration: *APo* 1.2

When an expert scientist learns by demonstration, she acquires demonstrative scientific knowledge. In this section, I examine Aristotle’s account of scientific knowledge and demonstration, paying close attention to their connection.

In *APo* 1.2, Aristotle defines scientific knowledge as follows:

- T9** We think that we have scientific knowledge (*epistasthai*) of each thing without qualification (*haplōs*), and not in the sophistic sense accidentally, whenever we think that we know (*ginōskein*) the cause (*aitian*)²³ because of

²⁰ 72a25–37. See also *NE* 6.3, 1139b33–5.

²¹ *Met* 7.3, 1029b3–8 (in T21), *Top* 6.4, 142a9–11.

²² I believe this argument also shows that the inquirer described above in n10 and n13 does not learn by demonstration. When the inquirer discovers that *y* is the cause of *x*, she knows *y* for the first time. Therefore, she is not yet fully convinced of *y*. However, the person who learns by demonstration, as Aristotle describes it in *APo* 1.2, must already be fully convinced of *y*, prior to learning that it is the cause of *x*.

²³ *Aitia* and *aition* may also be translated ‘explanation’, which we should hear as shorthand for ‘causal explanation’: the explanation that is the real cause. Aristotle recognizes four types of cause (formal, final, efficient, material; see *Phys* 2.3, *APo* 2.11). In the *APo* he focuses on the formal cause, although in some of his examples, especially in Book 2, the formal cause is also the efficient cause. (See Chapter 7§§6–7.) Throughout this book I switch freely between ‘cause’ and ‘explanation’, which I use synonymously for *aitia* and *aition*. (Leunissen (2007: 150–2), by contrast, argues that there is a semantic distinction in the *APo*

which the object is (*to pragma estin*),²⁴ that it is the cause of that [object], and that²⁵ this [object] cannot be otherwise.²⁶ (71b9–12)

I return to this passage in Chapter 4§1, where I argue that two types of unqualified scientific knowledge fall under Aristotle's definition: demonstrative and non-demonstrative, which he also calls *nous*. In this chapter, I focus on demonstrative scientific knowledge.

To have unqualified scientific knowledge of x ²⁷ is to know that y , the cause (explanation) of x , is the cause of x and that x is necessary.²⁸ Aristotle does not mean this to define knowledge (*gnōsis*) in general but a specific kind of knowledge: scientific knowledge (*epistēmē*)—the kind of knowledge expert scientists characteristically possess. For one thing, the objects of scientific knowledge are necessary, whereas the objects of other types of knowledge (e.g., perception) are contingent.²⁹ For another, scientific knowledge requires knowledge of a cause, whereas other types of knowledge do not.

Focusing on the first part of the definition, we can say that to have scientific knowledge of x is to know x 's cause *as* its cause, or—what amounts to the same thing—to know x *as* caused by that which causes it. Aristotle's claim that scientific knowledge is knowledge of the cause *as* the cause entails at least two different ways in which one can fail to have scientific knowledge of x : first, when one thinks that x 's cause is something other than it is; second, when one knows what is in fact x 's cause without knowing it *as* its cause.³⁰ That the second failure is possible is clear from Aristotle's

between the two terms: the *aition* is the cause picked out by the middle term in a demonstration; the *aitia* is the explanation presented in the demonstration as a whole.)

²⁴ I discuss the phrase *to pragma estin*, including the meaning of *pragma*, in Chapter 4§1.

²⁵ As Barnes (1993: 90) notes, the clause 'that this cannot be otherwise' depends on either (a) 'we think' or (b) 'we know'. On both readings, if we have scientific knowledge of x , then x is necessary. On reading (b) but not on reading (a), if we have scientific knowledge of x , then we know that x is necessary. Like Barnes, I have opted for reading (b), for which *APo* 1.6, 75a14–15 is evidence.

²⁶ *Ἐπίστασθαι δὲ οἴομεθ' ἕκαστον ἀπλῶς, ἀλλὰ μὴ τὸν σοφιστικὸν τρόπον τὸν κατὰ συμβεβηκός, ὅταν τήν τ' αἰτίαν οἴωμεθα γινώσκειν δι' ἣν τὸ πρᾶγμα ἐστίν, ὅτι ἐκείνου αἰτία ἐστί, καὶ μὴ ἐνδέχεσθαι τοῦτ' ἄλλως ἔχειν.*

²⁷ I take Aristotle to be defining occurrent unqualified scientific knowledge (consciously knowing x in a certain way). I use the expression 'have unqualified scientific knowledge of x ' in place of the more awkward 'know scientifically without qualification x '.

²⁸ *APo* 1.6, 75a14 may indicate that to have unqualified scientific knowledge of x one must know not only that but also why x is necessary. (See Burnyeat (1981: 111 n27) who follows Ross 1949: 529. For a different view, see Barnes 1993: 129.) In that case, Aristotle's definition may be summarized: to have unqualified scientific knowledge of x is to know that y is the cause because of which x is necessary.

²⁹ The objects of scientific knowledge hold either 'always' or 'for the most part'. (See *APo* 1.30.) Those that hold always are necessary strictly speaking (e.g., all triangles have 2R); those that hold for the most part seem not to be. Thus for the sciences of the sublunary world (e.g., biology) Aristotle seems to relax the necessity requirement on the objects of scientific knowledge. For further discussion, see Judson 1991b. In *APo* 1.8 (75b33–6), Aristotle indicates that objects that hold 'often' (*pollakis*, 75b33), such as lunar eclipse, also in a way hold always. As Barnes (1993: 134) notes, these objects should not be assimilated to those that hold for the most part. Aristotle's idea, I take it, is that insofar as lunar eclipse essentially involves, say, the moon being screened from the sun by the earth, whenever the moon is in this condition, it is always eclipsed. Insofar as objects that hold often also in this way hold always, they are necessary.

³⁰ See Kosman 1973: 383–4.

discussion in *APo* 1.13 (see also 2.16) of two syllogisms, one ‘of the fact that’ (I) and another ‘of the reason why’ (II):³¹

Syllogism I

(A) Nearness to the earth belongs to all (B) celestial bodies that are non-twinkling

(B) Non-twinkling belongs to all (C) planets

(A) Nearness to the earth belongs to all (C) planets

Syllogism II

(A) Non-twinkling belongs to all (B) celestial bodies that are near the earth

(B) Nearness to the earth belongs to all (C) planets

(A) Non-twinkling belongs to all (C) planets

The two syllogisms contain the same three terms differently arranged.³² In Syllogism I, the planets are proved to be near the earth through their being non-twinkling. In II, the planets are proved to be non-twinkling through their being near the earth. Aristotle says that Syllogism I is ‘of the fact that’ (*to hoti*) and II is ‘of the reason why’ (*to dioti*) because the nearness of the planets explains their non-twinkling and not vice versa. That is, in II but not in I the middle term signifies the cause of the connection between the items signified by the major and minor terms. The person who grasps only Syllogism I knows what is in fact the cause of the planets’ non-twinkling (their being near the earth) without knowing it *as* the cause. It follows that, for Aristotle, it is possible to know a set of facts (including at least some of the non-explanatory inferential relations among them) that *are* explanatorily connected without knowing them *as* explanatorily connected. That is, it is possible to have knowledge (*gnōsis*) of a set of facts without having unqualified scientific knowledge (*epistēmē haplōs*) of them.³³ This is the situation of the person who grasps only Syllogism I. She knows *x* and *y*, where *y* is the cause of *x* and *x* is caused by *y*, but she does not know *x* or *y* as such—so she does not have scientific knowledge.³⁴

Explanation and necessity are the essential ingredients of scientific knowledge. They are also essential to demonstration:

³¹ On the two syllogisms, see also Brody 1972, Koslicki 2012, and Lennox 1987 and 1991.

³² Note that the first premises are different. However, Aristotle seems to assume that among celestial bodies, the attributes of being near the earth and being non-twinkling are co-extensive with each other, so that the first premises are convertible (there is a hint of this at *APo* 1.13, 78b11–13). (That is, the first premises are ‘commensurate universal’ propositions, on which see Inwood 1979.) In what follows I assume that the scientist who knows all the propositions in Syllogism I also knows all those in II, for I assume that she knows that the first premise of I is convertible.

³³ Here *gnōsis* has the sense it has in use (iii) discussed in Chapter 1§5: lower-level, non-scientific knowledge.

³⁴ She does not have unqualified scientific knowledge (*epistēmē*) as defined in T9, but in *APo* 1.13 (78a22) Aristotle says that she has *epistēmē*: namely, of the fact that but not of the reason why. Perhaps Aristotle calls her knowledge of the fact *epistēmē* because she knows that the fact is necessary, so that her knowledge satisfies the necessity requirement in T9. For simplicity’s sake, I have cast the distinction as one between *gnōsis* and *epistēmē*.

T10 we say that we do in fact know through demonstration (*di' apodeixeōs*). And a demonstration, I say, is a scientific syllogism; and a scientific [syllogism], I say, is one in virtue of which, by grasping it, we know scientifically.³⁵ So then if scientific knowledge is the sort of thing we have posited [it to be], it is also necessary that demonstrative scientific knowledge be from things that are true, primary, immediate, better known than, prior to, and explanatory of the conclusion; for in this way too the principles (*archai*) will be appropriate to the thing proven. For there will be a syllogism even without these things, but there will not be a demonstration; for it will not produce (*poiēsei*) scientific knowledge.³⁶ (*APo* 1.2, 71b17–25)

Given that having scientific knowledge of *x* consists in knowing that *y* is the cause of *x* and that *x* is necessary, and given that one has scientific knowledge if one grasps a demonstration, a demonstration must perform two functions. First, it must prove deductively that *x* is necessary. I shall call this its 'probative function'. Second, it must reveal *x*'s cause. I shall call this its 'explanatory function'.³⁷ A demonstration carries out these two functions only if its premises meet a strict set of requirements (which I discuss in Chapter 4§2).

It is important to see that a demonstration reveals the explanation without deducing it as a conclusion. The conclusion of a demonstration states the fact explained, not its explanation. It is the premises—and in particular the middle term—that state the explanation. For Aristotle, if one grasps a demonstration, one has scientific knowledge of the explanation of a fact *as* its explanation. The explanation is revealed *as* the explanation over the demonstration as a whole. So in *APo* 1.13, when Aristotle contrasts demonstration 'of the fact that' (Syllogism I) with demonstration 'of the reason why' (Syllogism II), he has in mind demonstration in its explanatory function, in its capacity to reveal the real explanatory relation between

³⁵ Here Aristotle makes grasping (*echein*) a demonstration a sufficient condition for having demonstrative scientific knowledge. In *APo* 1.3, he argues that a necessary condition for having demonstrative scientific knowledge of *x* is that one have non-demonstrative scientific knowledge (*nous*) of the indemonstrable premises of the demonstration of *x*. Therefore, in T10 Aristotle must have a demanding conception of what it is to 'grasp' a demonstration. It is this demanding conception I have in mind when I claim (as I do in the main text) that if one grasps a demonstration, one has demonstrative scientific knowledge. (I return to this issue in Chapter 4§2.) In Chapter 11§§4–6, I argue that a student can learn the demonstration of *x* without thereby acquiring demonstrative scientific knowledge of *x*. It follows that a student can know, in some way, the demonstration of *x* without 'grasping' it in the demanding way Aristotle has in mind in T10. The same is true of the inquirer I discuss in Part II, who learns demonstrations as a means of acquiring *nous*.

³⁶ ἀπόδειξιν δὲ λέγω συλλογισμόν ἐπιστημονικόν· ἐπιστημονικόν δὲ λέγω καθ' ὃν τῷ ἔχειν αὐτὸν ἐπιστάμεθα. εἰ τοῖνυν ἐστὶ τὸ ἐπίστασθαι ὅσον ἔθεμεν, ἀνάγκη καὶ τὴν ἀποδεικτικὴν ἐπιστήμην ἐξ ἀληθῶν τ' εἶναι καὶ πρώτων καὶ ἀμέσων καὶ γνωριμωτέρων καὶ προτέρων καὶ αἰτίων τοῦ συμπεράσματος· οὕτως γὰρ ἔσονται καὶ αἱ ἀρχαὶ οἰκείαι τοῦ δεικνυμένου. συλλογισμὸς μὲν γὰρ ἔσται καὶ ἄνευ τούτων, ἀπόδειξις δ' οὐκ ἔσται· οὐ γὰρ ποιήσει ἐπιστήμην.

³⁷ See Tierney (2001) for an unorthodox interpretation according to which revealing the explanation is not part of the function of a demonstration.

the fact stated in the conclusion and the facts stated in the premises. This is also how we should interpret his remark in *APo* 2.11 (94a23–4) that all four causes are ‘shown (*deiknuntai*) through the middle term (*dia tou mesou*)’. He does not mean that each of the four causes can be proved from a middle term. He means that each of the four causes can be used as a middle term in a demonstration and thereby shown to be explanatory of the fact stated in the conclusion.³⁸

4. What is Learning by Demonstration?

We are now in a position to see what Aristotle means by learning by demonstration for experts. I have argued for two principal claims:

- (i) It is possible to know a set of facts that are explanatorily connected to each other without knowing them as such (i.e., without having demonstrative scientific knowledge of them).
- (ii) Demonstration reveals the cause or explanation not by deducing it as a conclusion, but by exhibiting it as the syllogism’s middle term in such a way that the explanatory relation among all the facts stated in the syllogism is revealed.

(i) roughly describes the epistemic state of the scientist prior to her learning and (ii) is key to understanding how her learning comes about. I shall now discuss two types of learning by demonstration. In the first, the scientist acquires scientific knowledge of an explanatory relation she did not previously know, a relation that holds among facts each of which she did previously know. In the second, a scientist who knows that all Cs are A learns that this particular thing is A upon learning that it is a C.

First type

In this case, the scientist’s learning does not consist in deducing a new conclusion from known premises. Rather, it consists in discovering a previously unknown explanatory connection among facts of which the scientist already has knowledge but not demonstrative scientific knowledge.³⁹ Prior to learning, she knows *x* and *y*, where *y* is the cause of *x* and *x* is caused by *y*, but she does not know *x* or *y* as such. She learns by demonstration when she apprehends *y* as the cause of *x*, or—what is the same thing—*x* as caused by *y*. As a result of her learning she now has (demonstrative) scientific knowledge of *x*, which she previously knew only non-scientifically.

³⁸ So Tredennick’s ‘exhibited’ (in his Loeb translation) and Ross’s ‘can appear’ (in Ross 1949: 637) are preferable to Barnes’s ‘proved’ for *deiknuntai* at 94a23–4. In Chapter 10, I discuss *APo* 2.8, where Aristotle indicates that demonstration can reveal, without proving as a conclusion, the essence of a demonstrable attribute (e.g., eclipse, thunder).

³⁹ In Chapter 4§6, I note that the scientist who learns by demonstration has prior non-demonstrative scientific knowledge (*nous*) of the demonstration’s premises, if they are first principles. As I state in the main text here, she also has prior knowledge of the conclusion, but not scientific knowledge of it.

Learning by demonstration, then, effects not so much the change from ignorance to knowledge as the change from non-scientific to scientific knowledge.⁴⁰ And this is possible because of the way in which a demonstration carries out its explanatory function: by revealing, without deducing, the cause *as* the cause. While it is true that the expert scientist cannot learn by demonstration what she already knows scientifically, she can learn by demonstration what she already knows non-scientifically.⁴¹

I have emphasized that a demonstration reveals the cause and that when a scientist learns by demonstration (in the first way) she acquires scientific knowledge of the cause. However, there is bivalence in this. In revealing the cause, a demonstration tells the scientist something new about the fact stated in the conclusion: it tells her what its cause is. It also tells her something new about the cause itself: it tells her that it is the cause of that fact.⁴² So in virtue of learning by demonstration, the scientist acquires knowledge both of a fact as explained by its cause and of the cause as explanatory of that fact—these are two descriptions of one and the same mental state. This points to a more general claim about Aristotle's theory: although the proper object of demonstrative scientific knowledge is the fact stated in the conclusion, knowing in this way requires grasping the whole demonstration. For one has demonstrative scientific knowledge when one grasps the conclusion in light of the premises and the premises in light of the conclusion, and not the one in isolation from the other.⁴³

These last claims have important implications for Aristotle's account of the prior knowledge required for learning by demonstration. If learning by demonstration (for experts) produces knowledge of the facts stated in the premises as explanatory of the fact stated in the conclusion, then prior to learning the scientist cannot already know the facts stated in the premises as explanatory of the fact stated in the conclusion. For if she did, she could not learn by demonstration, whereas Aristotle thinks she can. What, then, must the scientist know in order to be able to learn by demonstration? This question is part of my focus in Chapter 4. Answering it should further clarify the nature of learning by demonstration for experts.

Objection

One might object that I have failed to show that the scientist learns *because* of a demonstration.⁴⁴ Rather, I have shown that the scientist learns because of a certain kind of reasoning the result of which is knowledge of a demonstration. The scientist can construct a demonstration of *x* because she grasps the cause of *x*; she doesn't grasp the cause because she constructs a demonstration. As Locke says: 'A Man knows first, and then he is able to prove syllogistically.'⁴⁵

⁴⁰ See Burnyeat (1981: 115–20) who makes a very similar point about how students learn. He does not, however, extend the point to experts.

⁴¹ See *APo* 1.1, 71b7–8 (in T4).

⁴² See Kosman 1973: 379.

⁴³ See Byrne 1997: 90.

⁴⁴ I am grateful to an anonymous reviewer for raising this objection.

⁴⁵ Locke 1975: 679.

The objection assumes that the term ‘demonstration’ (*apodeixis*) in Aristotle refers only to the result of a certain kind of reasoning: an explanatory syllogism. However, when Aristotle says that we learn by demonstration and that demonstration produces scientific knowledge, ‘demonstration’ seems to refer to the reasoning itself—namely, the reasoning by which one grasps the cause. Now there is a close connection between these two uses of ‘demonstration’: the object of the scientist’s grasp, when she learns by demonstration (second use), is faithfully represented by a demonstration (first use). A demonstration is both the syllogism the scientist constructs and the reasoning in virtue of which she is able to construct it.

Second type

The second type of learning by demonstration involves the discovery of new facts in a way that the first does not. We already saw an example of it in the previous chapter: an expert geometer, who has scientific knowledge of the fact that all triangles have 2R, learns that and why this particular figure has 2R upon learning that it is a triangle.

Syllogism III

2R belongs to all triangles [Prior knowledge]

Triangle belongs to C [Discovery]

2R belongs to C [Discovery]

The geometer learns by demonstration that C has 2R from her prior knowledge that all triangles do. Another example of this type of learning moves from a truth about a kind to a truth about one of its sub-kinds. An expert botanist knows that all broad-leaved plants shed their leaves because they undergo coagulation of sap at the stem of the leaf. In her research she discovers a new sub-species of broad-leaved plant: fig trees. She discovers that fig trees shed their leaves by bringing the sub-species under the universal truth:

Syllogism IV

Leaf-shedding belongs to all broad-leaved plants [Prior knowledge]

Broad-leaved plant belongs to all fig trees [Discovery]

Leaf-shedding belongs to all fig trees [Discovery]

In these examples, as in learning by demonstration of the first sort, the scientist moves not so much from ignorance to knowledge but from one form of knowledge to another about the same fact: she moves from knowing universally (or potentially) the fact stated in the conclusion to knowing it without qualification. (See Chapter 1§8.)

Syllogisms III and IV point to an important feature of Aristotle’s theory of science and demonstration. A science is made up of chains of demonstrations in which the conclusions of higher demonstrations can serve as premises in lower ones. In *APo* 1.19–22, Aristotle argues at length that such demonstrative chains must be finite—a science has both a top and a bottom, so to speak. At the top are demonstrations in the strict sense, which proceed from indemonstrable first principles to theorems (e.g., all

triangles have 2R),⁴⁶ which can in turn be used as premises in demonstrations further down the chain (e.g., Syllogisms III and IV). At the bottom are demonstrations that proceed from premises to conclusions whose minor terms are ultimate subjects of predication (i.e., terms that signify primary substances in the *Categories* 5 sense: individual subjects that have attributes but are not themselves attributes of any subject) (e.g., Syllogism III).⁴⁷ (See *APo* 1.21, 82a39–82b1.) In the next chapter, I introduce another way in which demonstrations form an explanatory chain.

Conclusion

I have argued that in Aristotle's view an expert scientist can learn by demonstration. In some cases she does so by syllogistically deducing new conclusions from known premises. However, this occurs only when the scientist actualizes the potential (or universal) knowledge she has of a type or token falling under a universal truth she already knows. In other (perhaps more interesting) cases she learns by apprehending an explanatory connection among facts she already knows. A demonstration is a showing forth of an explanation.⁴⁸ In some cases, it is a showing forth of a new explanation *to oneself*.

However, although a scientist can learn by demonstration, Aristotle's theory of demonstration does not set out a method of scientific discovery—that is, a set of rules or recommendations a scientist should follow in order to make discoveries. Rather, the theory gives us, in part, a faithful description of the culminating moment of the successful application of such a method. Looking at the theory of demonstration does not tell us much about how an Aristotelian scientist should go about inquiring and learning, but it does tell us about what happens when she makes a (certain kind of) discovery, when she learns (in a certain way). Aristotle's remarks on inquiry come later in the *APo*, beginning in Book 2. If the central character of Book 1 is the expert scientist, then that of Book 2 is the researcher, the inquirer, whom I turn to in Part II. In this chapter, I have sought to show that even the expert of Book 1 may have something to learn and that she can do so by means of demonstration.

⁴⁶ Syllogism II is an example, if we assume that being near the earth is essential to being a planet.

⁴⁷ For the distinction between the type of demonstration that moves from first principles to a theorem and the type that applies the theorem (or a first principle) to a more specific case, see Lennox 1987, who calls them 'type B' and 'type A explanations', respectively.

⁴⁸ See the helpful remarks on the meaning of the Greek word *apodeixis* in Kosman 1973.

3

Belonging ‘In Itself’ and Aristotle’s Theory of Demonstration

In this chapter, I discuss the structure of demonstrative propositions and the different models of demonstration with which they are connected. This detour through some of the intricacies of Aristotle’s theory of demonstration will help us better understand his account of knowledge and learning. In sections 1–3, I discuss Aristotle’s account of belonging ‘in itself’. This will prove useful in the next chapter, where I examine his account of non-demonstrative scientific knowledge (*nous*) of first principles. In section 4, I argue that there are two principal models of demonstration in the *APo* and I suggest how they are connected. This will prove useful in Part II, where I attempt to reconstruct Aristotle’s account of our acquisition of *nous* of first principles.

1. Belonging ‘In Itself’ (*Kath’ Hauto*): *APo* 1.4

The propositions in a demonstration must meet several requirements. First, they must all be necessary.¹ In addition, the premises must be true, primary, immediate, better known than, prior to, and explanatory of the conclusion.² (I return to these requirements in Chapter 4§§2–3.) In *APo* 1.4, Aristotle indicates that the premises and conclusion must be ‘universal’ (*katholou*), which he defines in this context in a strict way: ‘I call universal that which belongs in every case and in itself and as such.’³ (73b26–7) In this sentence what Aristotle calls ‘universal’ is the attribute that is predicated of a subject in a demonstrative proposition of the form ‘P belongs to all S’. In a demonstration there are three such propositions, where A is the

¹ See especially *APo* 1.6. Malink (2013: 164–5 n24) distinguishes two ways of interpreting the necessity requirement: (1) Demonstrative propositions are ‘modally qualified propositions such as “A necessarily belongs to all B”’. (2) Demonstrative propositions are ‘assertoric propositions such as “A belongs to all B” which are true by necessity’. If (1) is correct, the theory of demonstration is part of the theory of modal syllogistic Aristotle develops in the *Prior Analytics*. If (2) is correct, it is not. Malink opts for (2), as does Barnes 1993: xxi–xxii and 2007: 484–7. For discussion, see Bronstein 2015 and Leunissen 2015. For a different perspective on the necessity requirement, see Angioni 2014. For the sake of convenience, I shall assume that (1) is true, but nothing in my account hangs on this.

² *APo* 1.2, 71b21–2 (in T10).

³ καθόλου δὲ λέγω ὃ ἂν κατὰ παντός τε ὑπάρχει καὶ καθ’ αὐτὸ καὶ ἢ αὐτό.

major (attribute) term, C is the minor (subject) term, and B is the 'middle' (explanatory) term:

A belongs to all B
B belongs to all C
 A belongs to all C

Aristotle's claim in 73b26–7 (just quoted) is that in every demonstrative proposition (i) P belongs to all S,⁴ (ii) P belongs in itself to S, and (iii) P belongs as such to S. Earlier in *APo* 1.4, he says that P belongs to all S just in case if something is S then it is P. (73a28–34) For example, being an animal belongs to every human being just in case if something is a human being then it is an animal. At 73b28–9 he says that belonging 'in itself' and 'as such' are the same.⁵ Aristotle devotes a large part of *APo* 1.4 to explaining what he means by belonging 'in itself' (*kath' hauto*).

For Aristotle, a *kath' hauto* relation holds between a subject (S) and an attribute (P). To say that S is P *kath' hauto* is to say that S is P because of, or in virtue of, S itself. In other words, the phrase *kath' hauto* signifies a causal or explanatory relation.⁶ As we are about to see, the two main *kath' hauto* relations are definitional. As is often the case with Aristotle, definitional and explanatory relations are closely connected. This is a major theme of Part II, where I examine the account of definitional inquiry in *APo* 2.⁷ To seek to define something, for Aristotle, is to seek its essence, and to seek its essence is to seek its cause. Similarly, to seek to explain something—to seek why something is, its cause—is to seek what it is, its essence.⁸

Aristotle signals the close connection between essence and cause in his discussion of the first two uses of 'in itself' (*kath' hauto*) in *APo* 1.4 (73a34–b5):⁹

- In itself₁*: P belongs in itself₁ to S if and only if P belongs to S and P is (part of) the essence of S.
- In itself₂*: P belongs in itself₂ to S if and only if P belongs to S and S is part of the essence of P.¹⁰

⁴ Later in *APo* 1, Aristotle seems to relax this requirement, for he permits negative demonstrations and particular demonstrations. See *APo* 1.24–5.

⁵ So (iii) is not a separate condition from (ii) and the second *kai* at 73b27 is epexegetic. Alternatively, when Aristotle says that the two conditions are the same, he means that they are necessarily co-occurring. This leaves room for thinking that they are different in some way. For a view along these lines, see Ferejohn 2013: 84–95.

⁶ Aristotle says that if something belongs *kath' hauto* (in either of the two senses introduced in *APo* 1.4, 73a34–b5 and discussed just below), then it belongs *di' hauto* ('because of itself') (*APo* 1.4, 73b16–18). Sometimes he uses *kath' hauto* and *di' hauto* interchangeably (e.g., 1.6, 75a35–7). See also *Met* 5.18, 1022a19–22.

⁷ It is also a major theme in Charles 2000.

⁸ See especially *APo* 2.2, which I discuss in Chapter 7.

⁹ I ignore the third and fourth uses of 'in itself' Aristotle discusses (73b5–16). Both are relevant to his theory of demonstration, but I shall not argue that here.

¹⁰ In *APo* 1.4 (73b18–24) and 1.6 (74b8–10), Aristotle seems to say that if P belongs in itself₂ to S, then P is one of a pair of opposites one or the other of which necessarily belongs to S. This is a notoriously difficult part of Aristotle's account. On the reading I favour, this is a feature of some but not all in itself₂

For example, animal belongs in itself₁ to human being because animal is an attribute of human being (all human beings are animals) and animal is part of the essence and definition of human being. Odd, on the other hand, belongs in itself₂ to number because odd is an attribute of number (some numbers are odd) and number is part of the essence and definition of odd.

It is interesting that Aristotle introduces in itself₂ as a relation distinct from in itself₁. We might have thought that if number is part of the essence of odd, Aristotle would express this by saying that number belongs in itself₁ to odd, but he does not. The reason seems to be that number does not belong to odd: odd is an attribute of number and not vice versa. In cases where an attribute is defined partly in terms of the subject to which it belongs, Aristotle prefers to say not that the subject belongs to the attribute, but that the attribute belongs to the subject *in a special way*: namely, in itself₂. Put differently, it is only genuine subjects to which attributes belong in itself₁. Attributes also have essences, and their essences include the subjects of which they are attributes. However, it does not follow that their subjects are also their (in itself₁) attributes.¹¹ So in both in itself relations, what is by nature an attribute belongs to what is by nature a subject. In in itself₁, the attribute is part of the essence of the subject. In in itself₂, the subject is part of the essence of the attribute.

In the rest of this book, I shall argue that this account, which makes the subject/attribute distinction central to Aristotle's theory of science, is confirmed by the rest of the *APo*. In a science, for Aristotle, there is one kind of entity that is the subject of essential attributes and another kind of entity that is the attribute of a subject partly in terms of which it is defined. (These are not the only entities studied in a science. See Chapter 11§§1–3.) Aristotle distinguishes two main types of definable entity and two types of essence by which they are respectively defined. The first type of definable entity is what I call a 'subject-kind' (e.g., line, triangle, animal, human being). These are natural kinds (species and genera) whose individual members are primary substances (e.g., Socrates) or substance-like entities (e.g., this particular triangle).¹² (As I noted in Chapter 2§4, primary substances in the *Categories* 5 sense are subjects that have attributes but are not attributes of any subject.¹³) Subject-kinds are that to

attributes: namely, differentiae such as odd and even, but not demonstrable attributes such as eclipse and 2R. (In section 2 below, I argue that some demonstrable attributes, such as eclipse and 2R, are in itself₂ attributes of their subjects.) For further discussion, see Granger 1981, Tiles 1983: 5–8, and Wedin 1973.

¹¹ On the other hand, Aristotle is happy to treat one subject as the attribute of another: line is both (i) a subject to which point belongs as an essential attribute and (ii) an essential attribute of triangle. See *APo* 1.4, 73a34–5.

¹² In *APo* 2.2 (90a9–13, in T17), triangle is an example of a substance (*ousia*) and subject (*hupokeime-non*). I take it that the kind *triangle* is a secondary substance, a species, whose individual members are primary substances or substance-like entities. As Malink (2013: 160 n15) notes, in the *Analytics* mathematical terms such as 'line', 'triangle', 'unit', and 'number' seem to signify substances. (See also Goldin 1996: 72–5, Ross 1949: 633.)

¹³ Point and line pose special problems because Aristotle treats individual points and lines both as subjects and as attributes (see n11). We may regard them as exceptions to a general rule.

which essential attributes belong in itself₁ and their essences are composed of genus and differentia(e) (or something analogous; see Chapter 9§5). The second type of definable entity is a demonstrable attribute of a subject-kind. Many of these are defined partly in terms of the subject-kinds to which they belong (e.g., thunder, eclipse, 2R). That is, many demonstrable attributes are in itself₂ attributes of their subjects. (See next section.) In many cases, a demonstrable attribute P of this sort has a causally complex essence of the form 'A–C because of B', where A is a phenomenon closely associated with P and mentioned in a certain kind of description of it, C is the subject to which P belongs in itself₂, and B is the cause because of which of P belongs to it. (I argue for these claims in more detail in Part II.)

2. In Itself₂: Demonstrable Attributes

Aristotle's account of the in itself₂ relation is obscure. He complicates matters by introducing as his first and main examples attributes that are differentiae of a genus.¹⁴ For example, odd and even are differentiae of the genus *number*: they exhaustively divide number and each appears in the essence of different species of number (two, three, and so on). However, we should not put too much weight on these examples. Aristotle may have chosen them because they are especially clear cases of attributes that belong to subjects partly in terms of which they are defined. This is important because the in itself₂ relation plays a crucial role in Aristotle's account of demonstration and definition in *APo* 2 (although he never mentions it as such) and many of the in itself₂ attributes that are central to the *APo* 2 account (e.g., eclipse, thunder) are not differentiae. It is the connection between *APo* 2 and the account of 'in itself₂' in *APo* 1.4 that I now want to explore.

In *APo* 2, Aristotle says that in a demonstration the middle term signifies the essence of the attribute that is demonstrated.¹⁵ Consider the demonstration of lunar eclipse:

Eclipse belongs to all screening of the sun by the earth¹⁶

Screening of the sun by the earth belongs to all moon¹⁷

Eclipse belongs to all moon¹⁸

¹⁴ See *APo* 1.4, 73a38–40 and 73b18–24.

¹⁵ See *APo* 2.2, with my discussion in Chapter 7, and *APo* 2.17 (99a21–3), where Aristotle says that 'the middle term is an account (*logos*) of the major term [i.e., the demonstrable attribute], which is why all the sciences come about through definition (*di' horismou*).' (ἔστι δὲ τὸ μέσον λόγος τοῦ πρώτου ἄκρου, διὰ πᾶσαι αἱ ἐπιστῆμαι δι' ὁρισμοῦ γίνονται.) Later in the passage (at 99a27–9) it becomes clear that by *logos* Aristotle means 'definition': he says that the middle term in the demonstration of leaf-shedding (his example, in this part of the text, of a demonstrable attribute) is what leaf-shedding is (*ti esti*), that is, its essence.

¹⁶ Not every case of the earth screening the sun is a case of lunar eclipse, so for the demonstration to work the middle term would have to be enhanced with further features of the cause of lunar eclipse.

¹⁷ I take it that, for Aristotle, 'moon' signifies a natural kind that has exactly one member, namely, the earth's moon.

¹⁸ *APo* 2.2, 90a15–18 (in T15), 2.8, 93a30–3 (in T34).

Aristotle says that the middle term signifies the cause and thus part of the essence of eclipse.¹⁹ He makes the same claim about other demonstrable attributes: thunder (2.8, 93b7–14, T30), which belongs to cloud; harmony (2.2, 90a18–23, in T15), which belongs to high and low notes; leaf-shedding (2.16, 98b33–8, 2.17, 99a21–9), which belongs to broad-leafed plant. We would call these processes or events, but it is characteristic of Aristotle's thinking in the *APo* that he treats them as attributes of an underlying subject, just like 2R, which is an attribute of triangle. He indicates that the complete essence and definition of each of these attributes includes both the cause (signified by the middle term) and the subject to which the attribute belongs. For example, the essence of eclipse is loss of light from *the moon* because of screening of the sun by the earth; of thunder, noise in *the clouds* because of fire extinguishing; of harmony, a numerical ratio between *high and low notes*; of leaf-shedding, coagulation of sap in *broad-leafed plants*.²⁰ Since each of these attributes belongs to a subject partly in terms of which it is defined, each belongs in itself₂ to its subject. In addition, since each can be demonstrated to belong to its subject through a middle term that signifies part of the attribute's essence, each is a demonstrable attribute of its subject. This yields the following account:

In itself₂ demonstrable attribute: P is an in itself₂ demonstrable attribute of S if and only if (i) P belongs in itself₂ to S, (ii) there is an E_P such that E_P is part of the essence of P, and (iii) P belongs to S because of E_P.

3. In Itself Accidents: Demonstrable Attributes

In itself₂ demonstrable attributes are not the only type of demonstrable attribute Aristotle recognizes. In several passages he mentions 'in itself accidents' (*kath' hauta sumbebēkota*).²¹ As these are usually (and I think correctly) understood, they are necessary attributes of a subject that belong not in the subject's essence but because of it.²² As such, they are demonstrable attributes of their subjects.

In itself accident: A is an in itself accident of S if and only if (i) A is not part of the essence of S, (ii) there is an E_S such that E_S is (part of) the essence of S, and (iii) A belongs by necessity to S because of E_S.²³

¹⁹ See *APo* 2.2 and 8, with my discussion in Chapters 7 and 10, respectively.

²⁰ I discuss these and other similar examples of definitions in Chapter 7 §§6–10.

²¹ See *APo* 1.7, 75b1 (in T38), 1.22, 83b19–20. See also 1.10, 76b6–7, b13–15 (in T39), 2.13, 96b20, b23–4 (in T19).

²² See *Met* 5.30, 1025a30–2. See also Ross 1949: 577.

²³ Aristotle thinks that all essential attributes of a subject-kind S are necessary attributes of it but not all necessary attributes of it are essential attributes of it. The necessary, non-essential attributes of S belong to it (ultimately) because of its essence. That is, they are its in itself accidents.

For example, suppose being a rational animal is the essence of human being. Suppose too that rationality requires the capacity for speech. It follows that human beings are capable of speech. Being (essentially) rational animals explains why human beings are (necessarily) animals capable of speech. Therefore, being capable of speech is an 'in itself accident' and a demonstrable attribute of human being.

4. Two Models of Demonstration

The two types of demonstrable attribute (in itself₂ and in itself accidents) point to two different models of demonstration, each of which is emphasized in a different part of the *APo*. According to Book 1, the middle term in a demonstration signifies (part of) the essence of the item signified by the minor term. That is, the middle term signifies (part of) the subject's (S's) essence (E_S).²⁴ Here the attribute that is demonstrated is an in itself accident. According to Book 2, the middle term signifies part of the essence of the item signified by the major term. That is, the middle term signifies part of the attribute's (P's) essence (E_P).²⁵ Here the attribute that is demonstrated is an in itself₂ demonstrable attribute.

Model 1:

P belongs to all E_S

E_S belongs to all S

P belongs (as an in itself accident) to all S

Model 2:

P belongs to all E_P

E_P belongs to all S

P belongs (in itself₂) to all S

A demonstration in *APo* 1.13 (discussed in the previous chapter) conforms to Model 1 (on the assumption that nearness to the earth is part of the essence of planet):

Model 1: Non-twinkling belongs to all celestial bodies that are near the earth

Nearness to the earth belongs to all planets

Non-twinkling belongs (as an in itself accident) to all planets

APo 2.16–17 contains a Model 2 demonstration. For, as we saw above in section 2, coagulation of sap is the cause and thus part of the essence of leaf-shedding.²⁶

Model 2: Leaf-shedding belongs to everything that undergoes coagulation of sap

Coagulation of sap belongs to all broad-leafed plants

Leaf-shedding belongs (in itself₂) to all broad-leafed plants²⁷

How, if at all, are the two models of demonstration connected? As far as I can see, Aristotle in the *APo* does not answer this question. I now want to suggest, briefly,

²⁴ See *APo* 1.4, 73b31–2, 1.5, 74a30–4, 2.13, 96b15–25 (T19).

²⁵ See *APo* 2.17, 99a21–9, with n14.

²⁶ See *APo* 2.16, 98b33–8, 2.17, 99a21–9, with n14. See also the demonstrations of eclipse and thunder in *APo* 2.2, 2.8, and 2.10 (discussed in Chapters 7, 9, and 10).

²⁷ I assume, on the basis of analogous cases in *APo* 2 (eclipse, thunder, harmony), that 'broad-leafed plant' is included in the essence and definition of leaf-shedding. If so, leaf-shedding belongs in itself₂ to broad-leafed plant. See Charles 2000: 207 n18.

how he could have answered it. My principal claim is that every Model 2 demonstration is explanatorily grounded in a Model 1 demonstration. Start with the Model 2 demonstration. The first (major) premise predicates an attribute, leaf-shedding, of part of its essence, coagulation of sap. Thus the first premise is immediate and indemonstrable, for the connection between a thing and its essence is immediate and indemonstrable.²⁸ The second (minor) premise, by contrast, seems to be demonstrable. It is reasonable to think that there is a cause of the fact that coagulation of sap belongs to broad-leaved plants. Now Aristotle thinks that all of a subject's demonstrable attributes belong to it (ultimately) because of its essence (see *APo* 2.13, 96b22–3, quoted below). Therefore, it is reasonable to think that the cause is the essence of broad-leaved plant ($E_{\text{BROAD-LEAFED PLANT}}$):

Model 1: Coagulation of sap belongs to all $E_{\text{BROAD-LEAFED PLANT}}$
 $E_{\text{BROAD-LEAFED PLANT}}$ belongs to all broad-leaved plants
 Coagulation of sap belongs to all broad-leaved plants²⁹

The second (minor) premise is the definition of the subject (the attribute belongs in itself₁ to the subject), so it is immediate and indemonstrable. The conclusion is the second premise of the Model 2 demonstration. Therefore, the Model 1 demonstration provides the ultimate explanatory grounds of the Model 2 demonstration. Putting the two together, we have the complete explanation of why broad-leaved plants shed their leaves, an explanation that appeals to the essences both of the subject and of the attribute involved.³⁰ I submit that all Model 2 demonstrations (including those of eclipse and thunder, the main examples in *APo* 2.2, 8, and 10) are explanatorily grounded in this way in Model 1 demonstrations. In each case, the attribute belongs to the subject because of the attribute's essence (Model 2) and the attribute's essence belongs to the subject (ultimately) because of the subject's essence (Model 1), from which it follows that the attribute belongs to the subject (ultimately) because of the subject's essence.³¹

My interpretation is admittedly speculative. However, if it is right, it confirms one of the central theses of the *APo*: all of a subject's demonstrable attributes are explanatorily grounded in its essence. As Aristotle says in 2.13 (96b22–3, in T19),

²⁸ Aristotle's view seems to be that 'leaf-shedding' and 'coagulation of sap' are co-extensive terms. The definition of leaf-shedding is 'leaf-shedding is_{def} coagulation of sap in broad-leaved plants'. (See Chapter 7§6.) From this we can derive 'leaf-shedding belongs to everything that undergoes coagulation of sap'—the major premise in the Model 2 demonstration.

²⁹ For a different interpretation of the leaf-shedding example, see Ferejohn 2013: 98–155 (especially 147–55).

³⁰ This is admittedly a highly idealized and abstract way of presenting the explanation. In reality it may take several demonstrative steps to link the attribute's essence to the subject's essence.

³¹ Note that in each model, the demonstration contains at least one immediate premise, which is either a definition (the minor premise in Model 1) or is derived from one by switching the position of the *definiendum* and *definiens* terms (the major premise in Model 2). Therefore, each one is a genuine demonstration, since in each case the conclusion is demonstrated from at least one immediate, definitional premise.

the essence and definition of a subject 'is a principle of everything'.³² Aristotle does not mean that the essence of a subject is the *sole* (one and only) cause of all of its demonstrable attributes. Rather, he means that it is the *ultimate* cause of all of its demonstrable attributes, some of which belong to the subject also because of other causes, including and especially their own essences.³³ For example, broad-leafed plants shed their leaves because they undergo coagulation of sap at the stem of the leaf, which is the cause and part of the essence of leaf-shedding. And they undergo coagulation of sap because of one or more of their essential features. So leaf-shedding is explanatorily grounded in its subject's essence, which is its ultimate, but not its only, cause. Some of a subject's attributes are explained directly from its essence, as coagulation of sap is explained directly from $E_{\text{BROAD-LEAFED PLANT}}$ (let's suppose). Other attributes are explained indirectly through the attribute's essence, as leaf-shedding is explained indirectly from $E_{\text{BROAD-LEAFED PLANT}}$ through coagulation of sap. In these cases, to know scientifically why the attribute belongs to its subject, one must know that it belongs not only because of the attribute's essence (Model 2) but also because of the subject's essence (Model 1). Constructing a science is largely a matter of explanatorily linking Model 2 to Model 1 demonstrations. In Part II, I argue that this is also the way in which we acquire *nous* of first principles.

One might object that my interpretation commits Aristotle to causal over-determination. However, this is wrong. There are not two independent causes, the attribute's essence and the subject's essence, each sufficient for explaining why broad-leafed plants shed their leaves. Rather, my interpretation commits Aristotle to the transitivity of essence-based explanation (i.e., formal causation): if P belongs to S because of P's essence, and P's essence belongs to S because of S's essence, then P belongs to S because of S's essence.

It follows from this that all in itself₂ demonstrable attributes are also in itself accidents.³⁴ For if P is an in itself₂ demonstrable attribute of S, then P belongs to S because of P's essence (in addition to the fact that P is defined partly in terms of S). But if P belongs to S because of P's essence, then, according to my interpretation, P also belongs to S because of S's essence. In that case P, an in itself₂ demonstrable attribute, meets the criteria for being an in itself accident. However, it may be that some in itself accidents are not in itself₂ demonstrable attributes. For it may be that not every attribute that belongs to S because of S's essence also belongs to S because of its own essence and is defined partly in terms of S. For it may be that some of the in itself accidents of S do not themselves have essences. So there are two sub-classes of in itself accidents: those that are and those that are not in itself₂ attributes. I shall use 'in itself accident' and 'demonstrable attribute' interchangeably as generic labels for all demonstrable attributes, whether or not they are also in itself₂ attributes.

³² I discuss this passage in more detail in Chapters 8§4 and 12§1.

³³ For further discussion of this issue, see the exchange between myself and Marko Malink in Bronstein 2015 and Malink 2015.

³⁴ I am grateful to Marko Malink for discussion here.

4

Scientific Knowledge and Demonstration

In Chapter 2, I argued that expert scientists can learn—that is, acquire new scientific knowledge—by demonstration. All intellectual learning requires prior knowledge. What prior knowledge does learning by demonstration require? My aim in this chapter is to answer this question. In *APo* 1.3, Aristotle argues that having demonstrative scientific knowledge requires having non-demonstrative scientific knowledge (which he also calls *nous*) of the first principles of demonstrations. Therefore, when experts learn by demonstration they must have non-demonstrative scientific knowledge of first principles. So, to understand the prior knowledge that experts require for learning by demonstration, we need to understand the nature of non-demonstrative scientific knowledge and the first principles known thereby. This is my topic in sections 1–7. In section 8, I re-examine learning by demonstration in light of this discussion.

1. Non-Demonstrative Scientific Knowledge (*Nous*)

Recall how Aristotle defines scientific knowledge (*epistēmē*) in *APo* 1.2 (I first discussed this passage in Chapter 2§3):

- T9** We think that we have scientific knowledge of each thing without qualification (*epistasthai...haplōs*), and not in the sophistic sense accidentally, whenever we think that we know the cause because of which the object is (*to pragma estin*), that it is the cause of that [object], and that this [object] cannot be otherwise. (71b9–12)

To have scientific knowledge of *x* is to know that *y*, which is the cause of *x*, is the cause of *x* and that *x* is necessary.

As we saw in Chapter 2, one has scientific knowledge as defined in T9 if one grasps a demonstration. This is demonstrative scientific knowledge (*epistēmē apodeiktikē*). In *APo* 1.3, Aristotle argues that not all scientific knowledge is demonstrative. For if it were, then either there would be an infinite regress of demonstrations or demonstrations would proceed in a circle and either way there would be no scientific knowledge. So some scientific knowledge is non-demonstrative and its objects are the primary, indemonstrable principles of demonstration, especially

definitions.¹ Aristotle calls this knowledge *nous*.² The question I shall now consider is whether non-demonstrative scientific knowledge (*nous*) is a form of scientific knowledge as defined in T9. If (as I shall argue) it is, then there are two types of scientific knowledge as defined in T9: demonstrative and non-demonstrative. If it is not, then it seems that the definition in T9 applies to demonstrative scientific knowledge alone.

Several commentators take T9 to define demonstrative scientific knowledge alone.³ On this view, ‘the object’ (*to pragma*) of scientific knowledge is the fact that an attribute P belongs to a subject S. To have unqualified scientific knowledge, then, is to know that M, which is the cause of P’s belonging to S, is the cause of P’s belonging to S and that P belongs to S by necessity—that is, it is to know a demonstration. Since, on this reading, scientific knowledge as defined in T9 is restricted to demonstrative scientific knowledge, non-demonstrative scientific knowledge does not fall under the definition in T9. Rather, it is some other form of knowledge. Now the most important first principles, and the ones Aristotle says we know when we have non-demonstrative scientific knowledge, are definitions.⁴ So Aristotle’s view, on this reading, is that our non-demonstrative, noetic knowledge of definitions is not scientific knowledge as defined in T9.

¹ *APo* 1.3, 72b18–25, 1.33, 88b36.

² *APo* 2.19, 100b12–16. See also 1.33, 88b35–7, where Aristotle says: ‘But neither (*oude*) is *nous* [concerned with what is true but can be otherwise] (for by *nous* I mean a principle of scientific knowledge) nor (*oude*) is non-demonstrative scientific knowledge; for this is the judgment of an immediate premise.’ (ἀλλὰ μὴν οὐδὲ νοῦς (λέγω γὰρ νοῦν ἀρχὴν ἐπιστήμης) οὐδ’ ἐπιστήμη ἀναπόδεικτος· τοῦτο δ’ ἐστὶν ὑπόληψις τῆς ἀμέσου προτάσεως.) Barnes (1993: 199) and Ross (1949: 606–7) state that the second *oude* (‘nor’, b36) means ‘i.e., not’, in which case Aristotle uses *nous* and ‘non-demonstrative scientific knowledge’ synonymously. This reading is congenial to the view I develop in the main text, where I assume that *nous* and non-demonstrative scientific knowledge are the same cognitive state, which, I argue, falls under Aristotle’s definition of unqualified scientific knowledge in T9. Barnes’s and Ross’s reading has been challenged by Harari (2004: 18), Leshner (1973: 54–5), and Perelmutter (2010: 239–41) who argue that although *oude* can mean ‘i.e., not’, the phrase *oude...oude* (‘neither...nor’, 88b35–7) normally signifies ‘strong opposition’ (Leshner 1973: 55) and the negation of two independent, non-synonymous phrases. On this reading, 88b35–7 indicates that *nous* and non-demonstrative scientific knowledge are different cognitive states. However, even if these commentators are right that *oude* at b36 does not mean ‘i.e., not’, it does not follow that *nous* and non-demonstrative scientific knowledge are different cognitive states. For in this passage Aristotle may be giving two different names for and two different descriptions (‘principle of scientific knowledge’ and ‘judgement of immediate premise’) of the same cognitive state. Evidence for this is *APo* 1.3 (72b23–5): ‘we say that there is not only [demonstrative] scientific knowledge but also some principle of [demonstrative] scientific knowledge by which we know definitions.’ (καὶ οὐ μόνον ἐπιστήμην ἀλλὰ καὶ ἀρχὴν ἐπιστήμης εἶναι τινὰ φαμεν, ἥ τοὺς ὅρους γνωρίζομεν.) (For the expression ‘principle of *epistēmē*’, see also 2.19, 100a8, in T55). Just before this Aristotle says that there is non-demonstrative scientific knowledge of immediate premises. Now definitions are the immediate premises of demonstrations. Since *nous* is the principle of scientific knowledge (*APo* 1.33), and since this principle is that by which we know definitions (1.3), which are the immediate premises of which we have non-demonstrative scientific knowledge (1.3 and 1.33), it follows that *nous* and non-demonstrative scientific knowledge are the same cognitive state. (Philoponus’s interpretation of 88b35–7 (*in An Post* 323.27–324.12) is similar to my own, if I understand him correctly.)

³ See, e.g., Philoponus *in An Post* 20.23–4, 22.24–23.8, Aydede 1998: 15, 22–3, Fine 2010: 129 n16, 139, Goldin 2013: 199–200, McKirahan 1992: 276 n15, Perelmutter 2010: 236–7, Taylor 1990: 120.

⁴ *APo* 1.3, 72b24–5.

There are at least two problems with this reading. First, there is a problem with Aristotle's use of the term *epistēmē*. On this reading, either non-demonstrative *epistēmē* (*nous*) is a type of *epistēmē* or it is not. If it is not, then it is misleading of Aristotle to call it *epistēmē*. If it is, then since on this reading it is not a type of *epistēmē* as defined in T9, *epistēmē* seems ambiguous. In the strict (*haplōs*) sense it is demonstrative. In another (less strict or non-strict?) sense it is non-demonstrative (noetic). Since Aristotle fails to explain what this other sense of *epistēmē* is, he fails to explain the sense in which non-demonstrative *epistēmē* (*nous*) is *epistēmē*. This is an unfortunate omission given the importance of *nous* in his account. Second, this reading leaves Aristotle vulnerable to the objection that he brings in *nous* as a kind of *deus ex machina*. It enters just in time to save the theory of demonstration from regress and circularity, but at the price of incoherence. Aristotle's view is that demonstrative *epistēmē*, which centrally involves knowledge of an explanation, is grounded in *nous* of first principles. Since, on this reading, *nous* is not a type of *epistēmē* as defined in T9, it seems that *nous* does not centrally involve knowledge of an explanation. Rather, it seems to consist in some sort of immediate, intuitive, non-explanation-involving grasp of first principles. But then it seems mysterious how the first form of knowledge could be grounded in the second.⁵

In my view, there is a plausible and attractive solution to these difficulties: both demonstrative and non-demonstrative *epistēmē* fall under the definition in T9.⁶ There are at least two benefits to this interpretation. First, the expression 'non-demonstrative *epistēmē*' is neither misleading nor ambiguous. Second, as I shall now argue, there is nothing mysterious about *nous*. Rather, it is scientific—that is, explanation-involving—through and through.

Aristotle first alludes to *nous* shortly after T9:

T11 So then if there is another way of having scientific knowledge, let us say later, but we say that we do in fact know (*eidenai*)⁷ through demonstration. And a demonstration, I say, is a scientific syllogism; and a scientific [syllogism], I say, is one in virtue of which, by grasping it, we know scientifically.⁸ (71b16–19)⁹

On the reading I reject, when Aristotle indicates that there is a different type of scientific knowledge, he means different from the type defined in T9: unqualified scientific knowledge. However, I suggest he means different from the type he immediately goes on to mention: knowing by means of a demonstration.¹⁰ On my reading, Aristotle is not saying that there are two types of scientific knowledge, one unqualified and demonstrative and the other qualified (somehow) and non-demonstrative. Rather,

⁵ I am grateful to Whitney Schwab for help in formulating these two objections.

⁶ See Barnes 2014b: 75–6, Deslauriers 2007: 176–7.

⁷ Here *eidenai* stands in for *epistasthai*. See Chapter 1§5.

⁸ *Εἰ μὲν οὖν καὶ ἕτερος ἔστι τοῦ ἐπίστασθαι τρόπος, ὅστερον ἐροῦμεν, φαμέν δὲ καὶ δι' ἀποδείξεως εἰδέναι. ἀπόδειξιν δὲ λέγω συλλογισμόν ἐπιστημονικόν· ἐπιστημονικὸν δὲ λέγω καθ' ὃν τῷ ἔχειν αὐτὸν ἐπιστάμεθα.*

⁹ T11 also appears as part of T10 in Chapter 2§3.

¹⁰ See Barnes 1993: 93.

he is saying that there is one type of unqualified scientific knowledge (the one defined in T9) of which there are two sub-types: demonstrative and non-demonstrative (*nous*).

To be sure, in the *APo* and elsewhere Aristotle sometimes uses the term ‘scientific knowledge’ (*epistēmē*) alone when he means demonstrative scientific knowledge in particular. For example, in the last passage of the work he contrasts *epistēmē* with *nous*.¹¹ Here *epistēmē* and *nous* are what in *APo* 1.3 (72b18–25) Aristotle calls ‘demonstrative *epistēmē*’ and ‘non-demonstrative *epistēmē*’, respectively. So we may take this as another example of Aristotle’s practice of sometimes using a genus term also in a narrower sense to refer to one of its species.¹² And there is other evidence to suggest that when Aristotle uses the phrase ‘unqualified *epistēmē*’ he has both forms in mind.¹³ Setting these terminological issues aside, I now want to argue that the definition in T9 offers an attractive account of what non-demonstrative scientific knowledge (*nous*) is. Indeed, while I am convinced that the problems I have raised with the alternative reading are significant, I wish to base my defence of my reading of T9 mainly on the positive reasons I shall now offer for thinking that Aristotle’s definition of unqualified *epistēmē* fits well with his account of what *nous* is.

Consider once again the first part of the definition: to have scientific knowledge of ‘each thing’ is to know that ‘the cause because of which the object is (*tēn t’aitian . . . di’ hēn to pragma estin*)’ is the cause of that object. Since the term *pragma* can signify several different things, the quoted phrase can cover simultaneously and consistently several different causal relations:

- (i) *Pragma* can signify a fact expressed in a proposition of the form ‘P belongs to S’, in which case the phrase reads: ‘the cause because of which the fact that P belongs to S is the case’.¹⁴
- (ii) *Pragma* can signify an attribute P, in which case the phrase reads: ‘the cause because of which P is’.¹⁵ Since P is an attribute of a subject S, ‘P is’ is shorthand for ‘P belongs to S’.
- (iii) *Pragma* can signify a subject S, in which case the phrase reads: ‘the cause because of which S is’, where ‘S is’ is shorthand for ‘S is P’ (which is equivalent to ‘P belongs to S’).¹⁶

¹¹ *APo* 2.19, 100b5–17. See also *NE* 6.3 and 6.6.

¹² See Chapter 1§5.

¹³ See *APo* 1.4, 73b16–18, where Aristotle claims that the objects of unqualified *epistēmē* include propositions expressing in itself_i belonging. A proposition expressing in itself_i belonging is either a complete or a partial definition. Non-demonstrative *epistēmē* (*nous*) is of definitions. Therefore, non-demonstrative *epistēmē* is *epistēmē* of the unqualified sort.

¹⁴ See *APr* 2.16, 64b10, *APo* 1.2, 72a25, 1.6, 74b33, b36, 2.5, 91b14.

¹⁵ See *APo* 2.8, 93a22–3 (in T32) (where thunder and eclipse (attributes) are examples of *pragmata*), 2.16, 98b30.

¹⁶ For *pragma* as subject, see *APr* 1.27, 43b3–4, b12, 1.30, 46a25 (in T20), *APo* 1.4, 73b28, 1.6, 74b7, 1.22, 84a12, 2.8, 93a22–4 (in T32) (where human being (a subject) is an example of a *pragma*).

- (iv) *Pragma* can signify a subject S alone, in which case the phrase reads: 'the cause because of which S is', where 'S is' is not shorthand for 'S is P' but means something different.¹⁷

(i), (ii), and (iii) amount to the same reading of the key phrase: the object of scientific knowledge is the fact that P belongs to S, which one knows scientifically if and only if one knows that M is its cause and that it is necessary. This is demonstrative scientific knowledge. (iv) is different: the object is the subject S itself, which one knows scientifically only if one knows 'the cause because of which S is'. But what is the cause because of which S is? And what, in this context, does the phrase 'S is' mean? In *APo* 2.2, Aristotle says that the essence of a subject is the cause of its 'being not this or that but without qualification'.¹⁸ For something to cause a subject to be 'without qualification', I suggest, is for it to cause that subject to be the very thing that it is. Aristotle's claim in 2.2, then, is that the essence of a subject S is the cause because of which S is the very thing that it is. That is, S's essence is its formal cause, its explanatorily basic feature. Returning to the definition of scientific knowledge, I suggest that 'S is' in (iv) means 'S is the very thing that it is'. Therefore, according to (iv), one has scientific knowledge of S if and only if one knows (a) that E, which is the essence of S, is the cause because of which S is the very thing that it is and (b) that S is the very thing that it is by necessity. This is non-demonstrative scientific knowledge. It is important that *pragma* in this instance signifies a *subject-kind*: a natural kind whose individual members are primary substances or substance-like entities (e.g., human being, triangle). (See Chapter 3§1.) For it is subject-kinds and their essences, which are stated in their definitions, that are the objects of non-demonstrative scientific knowledge.¹⁹

¹⁷ My claim is that (i)–(iv) exhaust the possible meanings of *pragma* in T9 alone, not in Aristotle's works more generally. For a broad discussion of the meanings of *pragma* in ancient Greek philosophical texts, see Hadot 1998.

¹⁸ *APo* 2.2, 90a9–11 (in T17): 'the cause of the substance (*tēn ousian*) being not this or that but without qualification . . . is the middle term' (τὸ γὰρ αἴτιον τοῦ εἶναι μὴ τοδὶ ἢ τοδὶ ἀλλ' ἀπλῶς τὴν οὐσίαν . . . τὸ μέσον ἐστίν). The rest of 2.2 makes it clear that 'the cause' and 'the middle term' of a substance is its essence. So Aristotle thinks that the essence of a substance (subject) is the cause of its 'being not this or that but without qualification'. See Chapter 7§1 and 7§§11–12.

¹⁹ See *APo* 1.3, 72b24–5, which I mention again just below. Here Aristotle says that non-demonstrative scientific knowledge (*nous*) is of definitions. Definitions of what? Aristotle thinks that both subject-kinds and demonstrable attributes have definitions. So in 1.3 he could mean that *nous* is of definitions of (a) subject-kinds alone, or (b) demonstrable attributes alone, or (c) both subject-kinds and demonstrable attributes. In my view, he means (a). The reason is as follows. The *definiens* phrase in a definition of a demonstrable attribute can be re-arranged into a demonstration. (See *APo* 1.8, 75b30–2, 2.10, 93b38–94a14.) An example of a definition of a demonstrable attribute is 'eclipse is a loss of light from the moon because of the screening of the sun by the earth' (see *APo* 2.2, 90a15–18, in T15). The *definiens* phrase can be re-arranged into a demonstration showing that (A) loss of light (i.e., eclipse) belongs to (C) the moon because of (B) screening of the sun by the earth. Therefore, to have knowledge of the definition of eclipse is, in effect, to have knowledge of a demonstration. But in that case knowledge of the definitions of demonstrable attributes cannot be non-demonstrative scientific knowledge (*nous*). So *nous* is limited to the definitions of subject-kinds. For the *definiens* phrase in a definition of a subject-kind cannot be re-arranged into a demonstration. (For example, supposing 'human being is a tame two-footed animal' is a definition, the *definiens* phrase cannot be re-arranged into a demonstration.) I discuss these and other aspects of Aristotle's theory of definition in Part II, especially Chapters 7, 9, 10, and 12.

But *pragma* can also signify a demonstrable attribute of a subject-kind or the fact that some subject-kind has some demonstrable attribute, and this is the object of demonstrative scientific knowledge. The word *pragma* is perfectly chosen to cover the objects of both types of scientific knowledge.

In *APo* 1.3 (72b24–5), Aristotle states that non-demonstrative scientific knowledge (*nous*) is of definitions, which are first principles. This is analogous to claiming that demonstrative scientific knowledge is of demonstrations. One has demonstrative scientific knowledge of the fact that P belongs to S when one grasps the demonstration of P's belonging to S. One has non-demonstrative scientific knowledge (*nous*) of S when one grasps the definition of S. To have *nous* of the definition of S is to know that the essence E, which is stated in the definition of S, is the essence and thus the (formal) cause of S. And to know this is to know that E is the explanatorily basic feature of S, that which makes S the very thing that it is.

We can see, then, how the definition of unqualified scientific knowledge in T9 applies to both forms:²⁰

Demonstrative Scientific Knowledge:

One has demonstrative scientific knowledge of the fact that P belongs to S if and only if one knows (a) that M is the cause of the fact that P belongs to S and (b) that P belongs to S by necessity.

Non-Demonstrative Scientific Knowledge (i.e., Nous):

One has non-demonstrative scientific knowledge (*nous*) of the subject-kind S if and only if one knows (a) that E is the cause of S's being the very thing that it is and (b) that S is the very thing that it is by necessity.²¹

The facts we know by means of demonstrative scientific knowledge are the *explananda* in a science. Aristotle describes how they are sought and then explained in *APo* 2.1–2 and 8. (See Chapters 6–10.) The definitions we know by means of

²⁰ In *APo* 1.13 (78a22–3), Aristotle distinguishes between scientific knowledge (i) of 'the fact that' (*epistasthai to hoti*) and (ii) of 'the reason why' (*epistasthai to dioti*). (See Chapter 2§3.) (ii) is demonstrative scientific knowledge. (i), by contrast, is not a form of scientific knowledge as defined in T9. However, it does seem to satisfy T9's necessity requirement: if one has scientific knowledge (merely) of the fact that S is P, then one knows that S is P by necessity.

²¹ In *APo* 1.9 (76a4–6), Aristotle offers the following as a definition of scientific knowledge: 'We have scientific knowledge of each thing non-accidentally whenever we know [it] in virtue of that in virtue of which it *huparchei* (belongs, is), from the principles of that thing as that thing' (*Ἐκαστον δ' ἐπιστάμεθα μὴ κατὰ συμβεβηκός, ὅταν κατ' ἐκείνου γινώσκωμεν καθ' ὃ ὑπάρχει, ἐκ τῶν ἀρχῶν τῶν ἐκείνου ἢ ἐκείνου*). This definition can be seen to apply to both forms of scientific knowledge. We have demonstrative scientific knowledge of an attribute P whenever we know that P belongs (*huparchei*) to S in virtue of the principles because of which it belongs—namely, the explanatory premises from which it is demonstrated. We have non-demonstrative scientific knowledge of a subject-kind S whenever we know that S is (*huparchei*) in virtue of the principles because of which it is the very thing that it is—namely, its essential attributes. (I am grateful to Breno Zuppolini for suggesting this interpretation to me.)

non-demonstrative scientific knowledge (*nous*) are the first, indemonstrable explanatory principles in a science. Aristotle describes how they are sought in *APo* 2.13. (See Chapter 12.)

2. Scientific Knowledge and Explanation

A definition of a subject-kind is a first principle. As such, it is explanatorily basic. If E is the essence of S, then E is part of the explanation of why S has all the other necessary attributes (in itself accidents) that it has. S's being E, on the other hand, is not explained by anything else—the fact that S is E is indemonstrable. However, I have suggested that definitions, like demonstrations, express explanations, but in a different way: if E is the essence of S, then E is the cause that makes S the very thing that it is. In this way, our non-demonstrative, noetic knowledge of definitions is explanation-involving; the difference is that the explanations involved are primitive. Demonstrative scientific knowledge involves knowing the explanation of why one thing belongs to another. Non-demonstrative scientific knowledge involves knowing the explanation of why one thing is the very thing that it is. So it is not the case that Aristotle grounds one kind of scientific knowledge in another, completely different kind. Scientific knowledge is explanation-involving all the way up.

It may be helpful to put this in a slightly different way. The explanations one grasps in demonstrative scientific knowledge are triadic: P belongs to S because of M. The explanations one grasps in non-demonstrative scientific knowledge are dyadic: S is the very thing that it is because of E (the essence).²² In the previous chapter, I suggested that any in itself accident P of a subject-kind S belongs to S either because of S's essence alone or because of a combination of S's essence and P's essence. Either way, S's essence is at work in triadic explanation. It is also at work in dyadic explanation. So Aristotle has a univocal conception of (unqualified) scientific knowledge: to have (unqualified) scientific knowledge is to grasp an essence-based explanation of some necessary feature of the world—either that S is P (demonstrative scientific knowledge) or that S is the very thing that it is (non-demonstrative scientific knowledge). Furthermore, on this account, explanation (and thus demonstration) is neither circular nor infinitely regressive: it ends in the dyadic, essence-based explanations that are expressed by the definitions of subject-kinds and known as such by *nous*.

I have argued that we can give a non-mysterious, non-intuition-involving account of what having *nous* of first principles consists in. It may be, however, that we acquire *nous* by a mysterious, intuition-involving process. In Parts II–III, I defend an intuition-free account of our acquisition of *nous*—the Socratic Picture—according to which the activities of explaining and defining are central.

²² I borrow the language of 'triadic' and 'dyadic' explanation from Angioni 2014.

3. *Epistēmē*, *Nous*, and *Logos*

Let's consider in a bit more detail what demonstrative *epistēmē* and *nous* have in common. In the last passage of the *APo* (2.19, 100b5–17), Aristotle says that all *epistēmē* is 'with an account' (*meta logou*) (100b10). He infers from this that there is no *epistēmē* of first principles (100b10–11), since (his argument assumes) there is no account of first principles.²³ He concludes (from these and other claims) that *nous* is the cognitive state in which we know first principles. It follows (although Aristotle himself does not draw this conclusion) that *nous* is not 'with an account'. However, in 1.3 (72b24–5), Aristotle indicates that *nous* is of definitions and a definition is 'an account of the what it is [i.e., the essence]' (*logos tou ti esti*) (2.10, 93b29). So Aristotle seems to say (in 2.19) that *nous* is not with an account and (in 1.3) that it is. The tension disappears once we realize that 'account' (*logos*) in the phrase 'all *epistēmē* is with an account' (100b10) is synonymous with 'demonstration'. Aristotle's claim in 2.19, then, is that all *epistēmē*—that is, all demonstrative *epistēmē*—involves the grasp of a demonstration and *nous* does not. However, if we take 'account' more broadly to include definition, then *nous* is with (i.e., involves the grasp of) an account.²⁴ Since *nous* is a type of *epistēmē* (i.e., the non-demonstrative type), Aristotle thinks that all unqualified *epistēmē* is with an account. For all unqualified *epistēmē* is either demonstrative or non-demonstrative and in both its forms it is with an account (either a demonstration or a definition).²⁵ Again, Aristotle has a univocal conception of unqualified *epistēmē*.

4. The Objects of Scientific Knowledge

Two further aspects of my interpretation are worth calling attention to here. Both have to do with the objects of scientific knowledge. First, I take it that, for Aristotle, the objects of demonstrative scientific knowledge are mind-independent facts, such as the fact that all triangles have 2R, which are expressed in propositions, and the objects of non-demonstrative scientific knowledge are mind-independent objects, such as the subject-kind *triangle*, which are signified by terms. For Aristotle, propositions and terms are linguistic items. Propositions are sentences in subject-predicate

²³ This is a case where the term *epistēmē* signifies demonstrative *epistēmē* in particular.

²⁴ In *NE* 6.1 (1139a6–8) and 6.3 (1139b14–17), *nous* is one of the excellent states of the part of the soul that has *logos*. In *NE* 6.8 (1142a25–6), Aristotle says that '*nous* is of the definitions (*horoi*), of which there is no account (*logos*)' (*ὁ μὲν γὰρ νοῦς τῶν ὁρῶν, ὧν οὐκ ἔστι λόγος*). (See also *NE* 6.11, 1143a35–b1.) Here, as in *APo* 2.19 (100b10), 'account' (*logos*) is synonymous with 'demonstration': Aristotle's claim is that definitions, which are the objects of *nous*, are indemonstrable. However, since in another sense of 'account' definitions are accounts (i.e., they are statements of essence), *nous* is with an account, as Aristotle implies in *NE* 6.1 and 6.3.

²⁵ Alexander of Aphrodisias, in his now lost commentary on the *APo*, seems to have held a similar view. See Moraux 1979: 81–2.

form and terms are parts of propositions.²⁶ The facts that are the objects of demonstrative scientific knowledge are mind-independent relations among real, non-linguistic items in the world, and the subject-kinds that are the objects of non-demonstrative scientific knowledge are among the real, non-linguistic items in the world about which there exist mind-independent facts. Aristotle sometimes talks as though the objects of scientific knowledge are propositions or terms and I sometimes follow his lead, but we should bear in mind that what we know scientifically are the facts or objects signified by propositions or terms. So, for example, I sometimes say that demonstrative scientific knowledge is of demonstrations and *nous* is of definitions. A demonstration is a special kind of argument (one that states the explanation) and a definition is a special kind of proposition (one that states the essence), so these are linguistic items. Strictly speaking, scientific knowledge is of the facts and objects signified by these linguistic items.

Second, I have gone back and forth between saying that the object of demonstrative scientific knowledge is a demonstration and saying that it is a fact that is demonstrated, and between saying that the object of non-demonstrative scientific knowledge (*nous*) is a definition and saying that it is a subject-kind that is defined. This reflects Aristotle's own way of speaking. In T9, it is clear that the object of scientific knowledge is a *pragma*. Aristotle's claim is that having scientific knowledge of a *pragma* consists in knowing that its explanation is its explanation, where its explanation is expressed either in a demonstration (if the *pragma* is a fact) or a definition (if it is a subject-kind). So, what one knows scientifically is either a fact or a subject-kind. However, having scientific knowledge of each of these consists in knowing a demonstration or a definition of it. (That is, having scientific knowledge of a fact consists in knowing the explanation stated in a demonstration and having scientific knowledge of a subject-kind consists in knowing the explanatory essence stated in a definition.) Aristotle places strict requirements both on the knowledge of a demonstration in which demonstrative scientific knowledge of a fact consists and on the knowledge of a definition in which non-demonstrative scientific knowledge (*nous*) of a subject-kind consists. I shall explore these requirements below in sections 6 and 7 and in Part II.

For the time being, we can note one of the implications of my account for our understanding of *nous*. The object of *nous* is a single item: a subject-kind *S*. However, Aristotle does not think that knowing noetically consists in an unmediated or unanalyzable apprehension of that item. Rather, knowing noetically consists in knowing that *S* is (by necessity) the very thing that it is because of its essence *E*, or (what amounts to the same thing) knowing that *S*'s essence *E* is the cause because of which *S* is (by necessity) the very thing that it is. Here we might distinguish between the object and the content of *nous*. The object is the single item *S*. The

²⁶ *APr* 1.1, 24a16–17 and b16–18, on which Malink (2013: 23–4) is helpful.

content is the (formal) causal relation that obtains between S and its essence E. The content of *nous* is not a proposition, but it can be given propositional form. Therefore, the content of *nous* can be true. (In fact, it always is: *APo* 2.19, 100b7–8.) Hence Aristotle claims in *Nicomachean Ethics* 6.3 (1139b15–17) that *nous* is one of the five cognitive states in which the soul attains truth by affirmation or denial (the others being craft (*technē*), *epistēmē* (i.e., demonstrative *epistēmē*), practical wisdom (*phronēsis*), and wisdom (*sophia*)).²⁷

5. Scientific vs. Non-Scientific Knowledge

I want to conclude my discussion of Aristotle's definition of scientific knowledge in T9 by making two qualifications to my account. These point ahead to my explanation in Part II of how we acquire scientific knowledge.

The definition of demonstrative scientific knowledge I offered in section 1 states that knowing that M is the cause of the fact that P belongs to S (and that P belongs to S by necessity) is sufficient for having demonstrative scientific knowledge.²⁸ However, this claim requires qualification. Aristotle thinks that one has demonstrative scientific knowledge of the fact that P belongs to S only if one has non-demonstrative scientific knowledge of the first principles (especially definitions) from which 'P belongs to S' is demonstrated. In addition, he thinks that one can know that M is the cause of the fact that P belongs to S, and thus grasp the relevant demonstration, including its first principles, without having non-demonstrative scientific knowledge of those principles. (See Chapter 6§4.) It follows that one can know that M is the cause of the fact that P belongs to S without having demonstrative scientific knowledge: Aristotle allows for demonstrative knowledge (*gnōsis*) that falls short of demonstrative scientific knowledge (*epistēmē*). So knowing that M is the cause of the fact that P belongs to S is not sufficient for having demonstrative scientific knowledge. When Aristotle indicates that it is (as he does in T9), he must have in mind a demanding conception of what it is to know that M is the cause of the fact that P belongs to S, a conception that includes having non-demonstrative scientific knowledge of the relevant first principles. Similarly, when he indicates that grasping (*echein*) a demonstration is sufficient for having demonstrative scientific knowledge, he must have in mind a demanding conception of what it is to grasp a demonstration.²⁹

Similarly, the definition of non-demonstrative scientific knowledge I offered in section 1 states that knowing that E (S's essence) is the cause of S's being (by necessity) the very thing that it is is sufficient for having *nous* (non-demonstrative scientific knowledge) of S.³⁰ This claim also requires qualification. One has noetic

²⁷ See also *APo* 2.19, 100b5–6.

²⁸ It also states that it is necessary, but that is not my focus here.

²⁹ See *APo* 1.2, 71b16–19 (T11), with n35 in Chapter 2§3.

³⁰ It also states that it is necessary, but again that is not my focus here.

knowledge of S only if one knows that E (S's essence) is the explanatorily basic feature of S. However, one can know that E is the essence of S, and thus grasp the definition, without knowing that E is S's explanatorily basic feature: Aristotle allows for definitional knowledge that falls short of noetic knowledge. (See Chapter 6§4 and Chapter 12.) So knowing that E is the cause and essence of S is not sufficient for having *nous* of S. When Aristotle indicates that it is (as he does on my reading of T9), he must have in mind a demanding conception of what it is to know that E is the cause and essence of S, a conception that includes knowing (in the way required) that E is S's explanatorily basic feature. In Part II, I shall argue that *APo* 2 contains all the elements of an explanation of how we move from non-noetic to noetic knowledge of definitions and from non-scientific to scientific knowledge of demonstrations.

6. The Requirements for Principles of Demonstration

Aristotle thinks that one has demonstrative scientific knowledge of a fact only if one has non-demonstrative scientific knowledge of the first principles (*archai*) of the demonstration of that fact. Aristotle discusses the nature of first principles at some length in *APo* 1.2 (72a14–24).³¹ In this section, I shall explore these requirements with the aim of better understanding Aristotle's Prior Knowledge Requirement for learning by demonstration, which I turn to in the next section.

First principles are the indemonstrable truths in a science. There are two main types: (1) common principles, or 'axioms', which are common to all (or at least to more than one of) the sciences and proper to none (e.g., the principle of non-contradiction) and (2) proper principles, or 'theses', which are peculiar to their sciences.³² Theses, in turn, divide into two groups: (a) hypotheses, in which the existence of the primary subject-kind studied by a science is assumed (e.g., unit in arithmetic, point and line in geometry, animal in zoology) and (b) definitions, which state the essences of subject-kinds and attributes. For purposes of demonstration, definitions are the most important type of principle, for they are the most likely candidates to serve as premises in demonstrative syllogisms. For example, as we saw in the previous chapter, Aristotle says that the middle (explanatory) term in some demonstrations is the account (i.e., the definition) (*logos*) of the major term (*APo* 2.17, 99a21–2) and he sometimes calls definitions 'the principles of demonstration'.³³

In *APo* 1.2 (71b20–2, in T10), Aristotle sets out six requirements for the principles of demonstration: they must be (i) true, (ii) primary, (iii) immediate, (iv) better

³¹ I discuss the different kinds of principle in Chapter 11§1. For a useful discussion, including several terminological difficulties that I pass over, see McKirahan 1992: 36–49; see also Hintikka 1972 and 1974 with Frede 1974, and Landor 1981.

³² For the distinction between common and proper principles, see *APo* 1.10, 76a37–b2.

³³ See *APo* 1.33, 89a18, 2.3, 90b24, 2.13, 96b22–3 (in T19), 2.17, 99a3–4, 99a21–3; see also *Top* 8.3, 158b1–4, *DA* 1.1, 402b25–403a1 (in T18), *Met* 7.9, 1034a30–2, 13.4, 1078b24–5.

known than, (v) prior to, and (vi) explanatory of the conclusion.³⁴ These criteria divide neatly into two groups. The first three are what I shall call ‘the intrinsic criteria’. These are properties that principles possess in themselves, irrespective of their relation to other propositions, including conclusions (theorems), in the relevant science. The second three are what I shall call ‘the relational criteria’. These are properties that principles possess in relation to conclusions.³⁵

I now want to argue that the distinction between the two groups of criteria maps onto the distinction between non-demonstrative and demonstrative scientific knowledge. To have non-demonstrative scientific knowledge (*nous*) is to know the principles of a demonstration as satisfying the intrinsic criteria—that is, as true, primary, and immediate. To have demonstrative scientific knowledge is to know the principles as satisfying the relational criteria—that is, as better known than, prior to, and explanatory of the conclusion.

One argument for this interpretation is this. Suppose, for the sake of argument, that having *nous* of the principles consists in knowing them as satisfying all six criteria, including the relational ones. To know that principles P_1 and P_2 satisfy the relational criteria involves knowing that they are explanatory of a conclusion C . However, knowing that P_1 and P_2 explain C describes *demonstrative* scientific knowledge. For having demonstrative scientific knowledge of a fact C consists in knowing it as explained by its principles P_1 and P_2 , and ‘knowing C as explained by P_1 and P_2 ’ and ‘knowing P_1 and P_2 as explanatory of C ’ are two descriptions of one and the same cognitive state. Since our knowledge of the principles as satisfying the relational criteria is demonstrative, having *nous* of the principles cannot involve knowing them in this way. For if it did, there would be no distinction between non-demonstrative and demonstrative scientific knowledge, but Aristotle thinks there is.

To have *nous* of the principles of a demonstration, then, does not consist in knowing them as better known than, prior to, or explanatory of the conclusion—this is the work of demonstrative scientific knowledge. Rather, to have *nous* is to know the principles as satisfying the intrinsic criteria: it consists in knowing that they are true, primary, and immediate. A principle is primary and immediate if it is explanatorily basic. A proposition is explanatorily basic if it satisfies three further requirements. First, the attribute that belongs to the subject is the essence and cause of that subject (i.e., the attribute belongs in itself₁ to the subject). Second, there is no further cause that explains why the attribute belongs to the subject (it is immediate, indemonstrable). Third, the fact that the attribute belongs to the subject explains other things about that subject. That is, a proposition is explanatorily basic if it is a

³⁴ These requirements apply primarily to the proper principles and in particular to definitions. I discuss the requirement that the premises be better known than the conclusion in Chapter 8§5.

³⁵ I take it that in *APo* 1.2 principles and conclusions are propositions (linguistic items) and that Aristotle’s claims about principles and conclusions apply to the facts signified by these propositions. I shall follow Aristotle’s lead and say, for example, that a principle is explanatory of a conclusion, by which I (like Aristotle) mean that the fact signified by a principle is explanatory of the fact signified by a conclusion.

principle from which explanations proceed, at which explanations cease, and within which the explanation is primitive. As Aristotle says in *Generation of Animals* 5.7 (788a14–16): ‘for this is what a principle is: a cause of many things with nothing else above it.’³⁶ As we have seen, the definitions of subject-kinds meet all three requirements: in the definition ‘S is_{def} E’, E is the essence and thus the cause of S, insofar as E makes S the very thing that it is; the fact that S is E is indemonstrable; and E is the ultimate cause of all of S’s demonstrable attributes. Therefore, definitions of subject-kinds are primary and immediate principles and they are known as such by non-demonstrative scientific knowledge (*nous*). In this section, I have argued that having *nous* of the definitional principle ‘S is_{def} E’ does not consist in knowing that E is the cause of S’s being P, where P is one of S’s demonstrable attributes—rather, this is demonstrative scientific knowledge. Having *nous* of the definitional principle instead consists in knowing that E is the cause of S’s being S.

7. The Prior Knowledge Requirement for Learning by Demonstration

Here is a second argument for my claim that having non-demonstrative scientific knowledge (*nous*) of principles consists in knowing them as satisfying the intrinsic criteria alone. When a scientist learns by demonstration (in the first way I explained in Chapter 2§4), she acquires new demonstrative scientific knowledge of principles P₁ and P₂ as explanatory of some other fact C (which she previously knew in some other way). Her learning requires non-demonstrative scientific knowledge (*nous*) of P₁ and P₂. Suppose, for the sake of argument, that having *nous* of principles involves knowing them as satisfying the relational criteria. It follows that her learning requires prior knowledge of P₁ and P₂ as explanatory of C. In that case her learning is impossible, for she will already know what she is supposed to learn in the very way she is supposed to learn it. On the other hand, if she is completely ignorant of P₁ and P₂, then she cannot learn by demonstration either. A Meno’s Paradox-style dilemma lurks in the background of Aristotle’s account.

The solution is clear: learning by demonstration is possible, but only if the scientist is in an intermediate cognitive condition in which she knows P₁ and P₂ in some way but not as explanatory of C. Non-demonstrative scientific knowledge (*nous*) fits the bill exactly. For in this state we know the principles of a demonstration as true, primary, and immediate, but not as better known than, prior to, or explanatory of the conclusion. In this way, Aristotle’s account of *nous* leaves room for expert scientists to learn by demonstration. If a scientist has noetic knowledge of E as the cause and essence S, then there is room for her to learn that E is the cause of S’s being P.

³⁶ τοῦτο γάρ ἐστι τὸ ἀρχὴν εἶναι, τὸ αὐτὴν μὲν αἰτίαν εἶναι πολλῶν, ταύτης δ’ ἄλλο ἄνωθεν μηθέν.

8. Learning by Demonstration, Revisited

When a scientist learns by demonstration (in the first way I discussed in Chapter 2§4) she acquires new scientific knowledge of the explanatory connection among facts she previously knew. I have argued that this is possible only if she knows all of the demonstration's propositions beforehand but does not know (what turns out to be) the conclusion as explained by (what turn out to be) the premises or the premises as explanatory of the conclusion. This is not to say, however, that her prior knowledge of each of the demonstration's propositions will be the same in kind. A science, for Aristotle, is a body of truths ascending from facts that are more particular and sensible ('closer to perception') to ones that are more universal and intelligible ('further from perception'),³⁷ culminating in the highest truths of all: the first principles, especially definitions. This is important, for it suggests that a trained scientist will be able to pick out those facts that are derivative and posterior—that is, explainable—by determining that they are not among the principles of her science, of which she has *nous*. That is, she will be able to identify an *explanandum* as an *explanandum* without knowing what its explanation is.³⁸ We have also seen that to have *nous* of the principles is to know them as true, primary, and immediate, but not as explanatory of conclusions.³⁹ Before learning by demonstration, then, a scientist knows the premises as first principles and the conclusion as an *explanandum*, but she does not know the premises as explanatory of the conclusion. To arrive at this knowledge she must connect the propositions together in an act of reasoning in such a way that their explanatory connection becomes clear to her.

Consider once again the two syllogisms of *APo* 1.13:

Syllogism I

(A) Nearness to the earth belongs to all (B) celestial bodies that are non-twinkling
(B) Non-twinkling belongs to all (C) planets
 (A) Nearness to the earth belongs to all (C) planets

Syllogism II

(A) Non-twinkling belongs to all (B) celestial bodies that are near the earth
(B) Nearness to the earth belongs to all (C) planets
 (A) Non-twinkling belongs to all (C) planets

Suppose being near the earth belongs in itself₁ to (is an essential attribute of) planets. In that case, the fact that the planets are near is a first principle. Suppose an astronomer has non-demonstrative scientific knowledge (*nous*) of it as a first

³⁷ *APo* 1.2, 72a1–5.

³⁸ I return to this idea in Chapters 7 and 8, where I explain how an inquirer comes to know an *explanandum* as such without at the same time coming to know what its explanation is.

³⁹ I am not denying that a scientist who has *nous* of principles knows them as explanatory of conclusions. I am denying that her knowledge of them as explanatory of conclusions is *nous* (rather, it is demonstrative scientific knowledge).

principle.⁴⁰ Suppose too she knows that all and only celestial bodies near the earth are non-twinkling. She can know these facts without knowing them as explanatory of the fact that the planets do not twinkle, which she may also know. For she may have never thought about the first two facts in conjunction with each other or with the fact that the planets do not twinkle. Upon forming the two syllogisms, or upon having them presented to her, she will be able to determine which is a demonstration and which not. For she will see that only Syllogism II moves from what is primary and definitional to what is posterior and explainable.

We might wonder how the astronomer came to think just these three propositions together in the first place. Imagine she is trying to explain the fact that the planets do not twinkle. She looks to the first principles of her science and in particular to the essential (in itself₁) attributes of planets in order to find the appropriate basis for an explanation. She comes upon her knowledge that the planets are near the earth and that all and only celestial bodies near the earth do not twinkle. Because she knows that 'planets are near the earth' is a first principle, when she considers these two facts in conjunction with each other and with the fact that planets do not twinkle, she learns that the non-twinkling of the planets is explained by their nearness and not vice versa. She learns by demonstration, and her learning is grounded in, and made possible by, her noetic knowledge of the in itself₁ relation between a subject-kind and one of its essential attributes.

We can also see how this works for demonstrations in a looser sense. Now suppose that the fact that the planets are near the earth is demonstrable. Suppose too that the expert astronomer knows the demonstration of this fact. In that case, when she considers the three propositions together, she grasps that the non-twinkling of the planets cannot explain their nearness to the earth, since she knows that this is explained by something else. From this she concludes that nearness explains non-twinkling. She learns by demonstration.

We are now in a position to answer a question that has perplexed commentators on *APo* 1.13—namely, how can an expert scientist grasp which of the two syllogisms is a demonstration? One way is by having prior noetic knowledge that 'planets are near the earth' is a first principle. I have also outlined a second way. An expert scientist understands far more than the three propositions contained in these two bits of syllogistic reasoning. She also understands their place in the broader system of knowledge to which they belong.⁴¹ Assuming all three propositions are demonstrable, she understands that two of the three are explained by other facts further up the demonstrative chain. From this she can infer that the third proposition cannot explain them and that they must rather explain it.

⁴⁰ This interpretation presupposes an account of how the astronomer learns in the first place that nearness to the earth is an essential attribute of the planets. In Chapter 12, I argue that Aristotle provides such an account in *APo* 2.13.

⁴¹ See Kosman 2004: 253.

Conclusion

In Chapters 2–4, I have examined Aristotle’s theory of demonstration. I have focused on the ways in which demonstration can be a source of new demonstrative scientific knowledge for expert scientists. In the following chapters, I turn from the expert to the second main protagonist of the *APo*: the inquirer. As we shall see, demonstration plays an important role in the types of learning the inquirer needs to undertake in order to become an expert. Notably, demonstration plays a role in her acquisition of noetic knowledge of first principles.

PART II

Learning by Definition

5

Learning by Definition: Introduction

All intellectual learning, Aristotle says, comes to be from prior knowledge.¹ Learning by demonstration (of the first type I described in Chapter 2§4) comes to be from prior knowledge of the facts to be explained and the first principles that (turn out to) explain them. The most important first principles are definitions. How do we acquire knowledge of definitions? My goal in Part II is to explain Aristotle's answer to this question, as it appears in *APo* 2. I shall argue that in *APo* 2.1–10 and 13 Aristotle presents an account of how we search for and discover definitions, an account that responds to different instances of Meno's Paradox and other puzzles reminiscent of it. Most of these puzzles are implicit in the text; Aristotle does not identify them as such. However, they are closely connected to claims he explicitly makes, and careful attention to them helps illuminate his account. I shall then argue, in Part III, that in his discussion of learning by induction in *APo* 2.19, Aristotle explains how we acquire the prior knowledge necessary for learning definitions in the manner described earlier in Book 2. If my account is right, then Aristotle's explanation of our acquisition of first principles is found not in his account of learning by induction in 2.19 (as is often supposed), but in his account of scientific inquiry and discovery—what he elsewhere calls 'learning by definition'—in 2.1–10 and 13. As he says in the *Topics*, we get to know first principles by means of defining.² In these remaining chapters, therefore, I shall continue to argue that the three types of learning Aristotle identifies in *Metaphysics* 1.9 (992b30–3, T2) (demonstration, definition, and induction) provide the unifying theme around which the *APo* is organized. In this chapter, I introduce the topic of learning by definition.³

¹ *APo* 1.1, 71a1–2 (T1).

² *Top* 8.3, 158b1–4.

³ In *APo* 1.18 (81a40), Aristotle says that 'we learn either by induction or by demonstration' (*μανθάνομεν ἢ ἐπαγωγῇ ἢ ἀποδείξει*). What about learning by definition? First, as I shall argue, learning by definition encompasses several different methods all of which aim at discovering some object's essence: demonstration, division, and induction. Now division shares features in common with induction and demonstration. (See Chapter 12§§2–12.) So if Aristotle means to say that *all* learning is by induction or by demonstration, then perhaps learning by definition is included in so far as it shares features with both. Second, it's not clear that Aristotle does mean to say this, for he puts the claim in conditional form: 'if we learn either . . .'.

1. Some Preliminaries

For Aristotle, a definition (*horismos*, *horos*) is a statement (*logos*) of the ‘what it is’ (*ti esti*) or essence of a thing.⁴ For example,

‘Human being is a two-footed tame animal’

‘Eclipse is a loss of light from the moon because of the screening of the sun by the earth’

are both definitions because the terms in the predicate position state the essence of the object signified by the term in the subject position (let’s suppose). A definition expresses an immediate, indemonstrable connection between the thing defined and the thing(s) that define it.

In *APo* 2, Aristotle uses different terms for essence interchangeably: what it is (*ti esti*), the what-it-is-to-be (*to ti ēn einai*), essence (*ousia*), and the being for *x* (*to einai* for *x*). In 2.11 (94a20–1), he notes that the what-it-is-to-be is a cause (the formal cause), and in 2.2 he says that what something is is the same as the cause or reason why it is (90a14–15, in T15). Aristotle also uses different terms for definition interchangeably: *horos* and *horismos* both of which usually signify the *definiens* (the defining phrase) alone,⁵ and not the whole proposition in which the *definiens* is predicated of the *definiendum*.⁶

Despite this terminological variation Aristotle’s view is clear: the definition of *x* states its essence, which is the cause of its existence, that which makes it the very thing that it is. I shall argue that in *APo* 2 there are two types of entity that have essences and thus two types of definable entity: subject-kinds (e.g., triangle, human being) and demonstrable attributes (e.g., 2R, eclipse). Definitions of subject-kinds serve as the minor premises of Model 1 demonstrations, where the middle term signifies (part of) the essence of the subject signified by the minor term. Definitions of demonstrable attributes supply the major premises of Model 2 demonstrations, where the middle term signifies the cause and (part of) the essence of the attribute signified by the major term. These definitions also include the subject to which the attribute belongs; hence they are definitions of attributes that belong in itself₂ to their subjects. (See Chapter 3.)

Occasionally Aristotle uses ‘definition’ (*horismos*) to refer to the process of defining something, of constructing and thereby discovering a definition.⁷ Since a definition states the essence of a thing, to define something is to learn what its essence is.

⁴ *APo* 2.10, 93b29, *Top* 1.5, 101b38–102a1.

⁵ See Landor 1981: 311.

⁶ So, for example, in *APo* 2.3–7, when Aristotle discusses the problem of whether there can be a demonstration of the *horismos*, the problem is whether the *horismos* can be demonstrated to belong to the thing it defines. (This is Aristotle’s standard formulation: to say that P can be demonstrated is to say that it can be demonstrated to belong to some subject, S.) So here the *horismos* is the defining phrase alone. For a helpful discussion of Aristotle’s different terms for definition and essence, see Chiba 2010.

⁷ See *APo* 2.7, 92b38 (in T27), *Top* 8.3, 158b4 (cited above). In *Met* 1.9 (992b32, in T2), Aristotle speaks of learning ‘by definitions’ (*di’ horismōn*). He does not mean to pick out the learning we do through or from definitions we already know. Rather, he means to pick out the learning we do by constructing

Learning by definition—or better, by defining—is thus the process by which we acquire knowledge of the essences of the subjects and attributes studied within a science.

The expression ‘learning by definition’ does not occur in *APo* 2.⁸ However, there can be little doubt of Aristotle’s interest in the phenomenon to which the expression refers.⁹ Terms for inquiry, discovery, and knowledge acquisition occur frequently in *APo* 2.¹⁰ In 2.1–2, Aristotle discusses the objects of scientific inquiry (*zētēsis*), which include the essence (*ti esti*) of a thing. In 2.3–7, he raises a series of puzzles (*aporiai*) directed against the claim that an essence can be demonstrated. By the end of 2.7 it becomes clear that one of Aristotle’s primary concerns is how we can acquire knowledge of an essence expressed in a definition.¹¹ In 2.8, he solves the main *aporia* by showing in what way there is and in what way there is not, and in what cases there is and in what cases there is not, demonstration of essence. (See Chapter 10.) The conclusion of 2.8 (93b15–20, T29) states explicitly that demonstration is necessary for getting to know certain essences—that is, for learning by definition. In 2.13, Aristotle devises a method for constructing definitions by the use of division. Here too he is concerned to explain how we discover essences and definitions. (See Chapter 12.) At the end of the chapter he explains how to acquire by induction other definitions, apart from those acquired by division. (See Chapter 12§12.) Finally, in 2.19, Aristotle again discusses induction, this time arguing that it is the means by which we learn certain universal propositions, which are the preliminary accounts required for seeking and discovering essences and definitions in the ways presented in 2.8 and 13. (See Chapter 13.) In sum, in *APo* 2.1–10, 13, and 19, Aristotle exhibits an abiding concern with the question of how we get to know essences. So he is concerned with learning by definition.

In *APo* 2, Aristotle presents three different methods for discovering definitions and thus three different ways of learning by definition: demonstration (2.8), division

(i.e., seeking and discovering) definitions we do not already know. The bracketed bit that follows (992b32–3) and the parallels with learning ‘by demonstration’ (b31) and ‘by induction’ (b33) make this clear.

⁸ But Aristotle does speak of ‘getting to know the essence by defining’, *APo* 2.7, 92b38 (in T27).

⁹ One might object to this by citing the following: ‘We have never gotten to know anything by defining—not any of the attributes [that belong] in themselves nor any of the accidents.’ (οὐδὲν γὰρ πώποτε ὀρισάμενοι ἔγνωμεν, οὔτε τῶν καθ’ αὐτὸ ὑπαρχόντων οὔτε τῶν συμβεβηκότων.) (*APo* 2.3, 90b14–16) However, it is clear from the context, and from Aristotle’s reference to ‘the attributes’ and ‘the accidents’, that his claim is that we cannot get to know demonstrable attributes by defining them, but *only if* defining them is different from and does not involve the activity of demonstrating them. For having scientific knowledge of a demonstrable attribute requires knowing its demonstration. As we shall see in Chapter 10, in *APo* 2.8 Aristotle thinks that when we discover the demonstration (i.e., the cause) of a demonstrable attribute, we discover its essence, and thus we define it. In other words, defining a demonstrable attribute and explaining (demonstrating) it are the same activity.

¹⁰ See especially *APo* 2.1–2, 8, and 13 for frequent occurrences of *zētein* (to inquire, to search; e.g., 89b24 (in T12), 90a1 (in T14), 93a17 (in T31), 97a16 (in T48)), *heurein* (to discover; e.g., 89b27 (in T13), 93a35 (in T34)), *gignōskein* (to get to know; e.g., 93b18 (in T29)); see also *ginetai gnōrimon* (become known, 93b15–16 (in T29)) and *thēreuein* (to hunt out, 96a22 (in T42)).

¹¹ See 2.7, 92b37–8, in T27.

(2.13), and induction (2.13).¹² These methods correspond to two different types of essence that a definition can state: the type that is in some way demonstrable (discovered by demonstration) and the type that is in no way demonstrable (discovered by division or induction). These different types of essence belong to different types of entity: demonstrable (or what I call ‘causally complex’) essences belong to demonstrable attributes; indemonstrable (or what I call ‘causally simple’) essences belong to subject-kinds. (See Chapters 7 and 9.)

2. Learning by Demonstration and by Definition

In *APo* 2.1, Aristotle makes an important claim about the temporal order of inquiry: first we seek the fact that, then we seek the reason why (89b29–30, 34–5, in T13). In 2.2, he states that knowing the reason why *x* is, its cause, is the same as knowing what *x* is, its essence, which is expressed in a definition (90a14–23, T15). For example, once the inquirer learns that the moon is eclipsed she seeks the reason why it is eclipsed, which is the same as seeking what eclipse is, its essence. Learning by definition, therefore, involves getting to know causes. However, I argued in Chapters 2 and 4 that learning by demonstration involves getting to know causes. What, then, is the relationship between the two types of learning?

The question is pressing, for, as I mentioned above, demonstration is one of the methods Aristotle devises in *APo* 2 for learning essences; that is, one form of learning by definition centrally involves demonstration. This is a consequence of the fact, just noted, that seeking ‘the what’ is the same as seeking ‘the why’. For any demonstrable attribute *P*, for the inquirer to discover the essence of *P* just is for her to discover the demonstration in which *P*’s existence is proved and its cause revealed.¹³ For example, for the inquirer to discover the essence of eclipse is for her to discover the demonstration that proves that the moon is eclipsed and reveals the reason why. How does the inquirer’s learning differ from the sort of learning the expert scientist undertakes when she learns by demonstration?

The differences lie in what the expert and the inquirer each knows prior to learning and in what each discovers as a result of it. When an expert scientist learns by demonstration (in the first way I described in Chapter 2§4), she acquires new demonstrative scientific knowledge of the explanatory connection among facts she already knows. In the ideal case, the demonstration will include at least one first principle (a definition) among its premises. Therefore, in learning by demonstration the expert does not acquire knowledge of a new definition, but new understanding of the explanatory power of a definition she already knows. A new definition, on the other hand, is precisely what the inquirer of *APo* 2 seeks to learn. First she learns that

¹² See *DA* 1.1, 402a16–22, where demonstration, division, and ‘some other method’ are mentioned as possible ways of discovering essences.

¹³ For *P*’s existence to be proved is for *P* to be proved to belong to its proper subject *S*.

the moon is eclipsed, then she seeks the cause. When she discovers this, by making use of demonstration (in ways I shall explain in Chapter 10), she learns, for the first time, the definition of eclipse, its essence. In this respect her learning differs from the type of learning in which the expert engages: the expert's learning proceeds from definitions, the inquirer's learning proceeds to them. (As we shall see, however, the final stage of the inquirer's learning also proceeds from definitions: to acquire noetic knowledge of the definition of a subject-kind *S*, an inquirer must demonstrate *S*'s demonstrable attributes from it. This aspect of the inquirer's learning is similar to the expert's learning, but the two are not identical. When the inquirer demonstrates from the definition, she moves from non-noetic to noetic knowledge of it. By contrast, when the expert demonstrates from the definition, she already has noetic knowledge of it.)

Learning by demonstration and learning by definition differ both because of differences in their results and because of differences in the epistemic conditions of the persons who respectively undertake them, the expert scientist and the inquirer. These differences reflect the fact that they work at distinct phases in the development of a science. The expert works within a completed science, when most of the facts are in and have been organized into demonstrations. The inquirer works in the research phase, when the facts are being gathered and organized for the first time.¹⁴ The structure of the *APo* reflects this distinction: broadly speaking, Book 1 describes a science in its finished form and Book 2 describes how a science comes to be formed. In the following chapters, I shall argue that Book 2 also describes how an inquirer acquires the knowledge characteristic of an expert scientist, including noetic knowledge of first principles.

¹⁴ See McKirahan 1992: 189.

6

Inquiry in *APo* 2.1

APo 2.1 is Aristotle's introduction to scientific inquiry. It sets the agenda for the rest of Book 2, the aim of which is to explain how we acquire knowledge of definitions. In this chapter, I examine his account of what we inquire about, what knowledge we seek to attain by inquiring, and what order we should ideally inquire in. I conclude by discussing two puzzles—instances of Meno's Paradox—that arise from his account.

1. The Four Questions of Inquiry

APo 2.1 begins:

T12 The things we seek (*zētoumena*) are the same in number as the things we know scientifically (*epistametha*).¹ (89b23–4)

The link between *APo* 1 and 2 is clear²: inquiry (*zētēsis*) (to be discussed in Book 2) and scientific knowledge (*epistēmē*) (discussed in Book 1) share the same objects. By 'inquiry', then, Aristotle does not mean any investigation we might undertake into any matter whatsoever.³ Deliberation is a form of inquiry,⁴ but the things we deliberate about—contingent matters on which we can act—are not objects of scientific knowledge.⁵ So 'inquiry' in T12 refers to scientific inquiry. (However, in what follows I shall use 'inquiry' for 'scientific inquiry'.) This is not to say that every scientific inquiry is about something necessary. In a deliberative inquiry the conclusion might be that a certain course of action cannot be carried out. Similarly, in a scientific inquiry the conclusion might be that a certain fact is not necessary. The important point, as we shall see in Chapter 7, is that the question of whether a fact is necessary is part of scientific inquiry (in its early stages), just as the question of whether a course of action can be carried out may be part of deliberation (in its early stages).

¹ *Tà ζητούμενά ἐστιν ἴσα τὸν ἀριθμὸν ὅσα περ ἐπιστάμεθα.*

² Despite the fact that the first sentence of Book 2 contains no connecting particle, as Ross (1949: 75) notes.

³ See Barnes 1993: 205.

⁴ *NE* 3.3, 1112b20–3.

⁵ See *NE* 3.3.

Aristotle's discussion of 'the things we seek' continues (I quote the remainder of 2.1):

T13 (a) We seek four things: the fact that (*to hoti*), the reason why (*to dioti*), if it is (*ei estin*), what it is (*ti estin*). (b) For whenever we seek whether this or that is the case, setting out a number of terms, for example whether or not the sun is eclipsed, we are seeking the fact that. A sign of this is that once we discover that [the sun] is eclipsed we stop [seeking]. And if we know from the beginning that it is eclipsed, we do not seek whether it is. But whenever we know the fact that, we seek the reason why. For example, knowing that [the sun] is eclipsed and that the earth moves, we seek the reason why it is eclipsed or the reason why it moves. (c) And so [we seek] these things in this way, but some things we seek in a different way, for example, whether or not a centaur or god is; and I mean whether or not it is without qualification, not whether or not it is white. And knowing that it is, we seek what it is, for example what is god, or what is man?⁶ (89b24–35)

Scientific inquiry aims to answer the following questions, which invoke the distinction between a subject S and an attribute P:

- (1) the fact that (*to hoti*): does P belong to S?
- (2) the reason why (*to dioti*): why does P belong to S?
- (3) if it is (*ei eisti*): does S exist?
- (4) what it is (*ti esti*): what is S?⁷

Questions (1) and (2) ask about an attribute of a subject and questions (3) and (4) ask about the subject itself. Aristotle's examples support this interpretation. Examples of the 'fact that' and 'reason why' questions include 'is the sun eclipsed?' and 'why is the sun eclipsed?'; instances of the 'if it is' and 'what it is' questions include 'does god exist?' and 'what is god?'. As I noted in Chapter 3§2, while we would be inclined to call a solar or lunar eclipse an 'event', for Aristotle it is a state or affection—that is, an attribute—of an underlying subject. In this regard it is on the same ontological level as, for example, 2R, which belongs to triangle. In *APo* 2.2, Aristotle calls the sort of entity we seek in questions (3) and (4) 'the substance' (90a10, in T17), 'the underlying subject' (90a12, in T17), and 'not some one of the things that belong [to a subject]' (90a32, in T16), and he calls the sort of entity we seek in questions (1) and (2) 'some one of the things that belong in itself or accidentally [to a subject]' (90a11 (in T17), a32–3 (in T16)). Clearly then, (1) and (2) ask about attributes and (3) and (4) ask about subjects.

⁶ ζητοῦμεν δὲ τέτταρα, τὸ ὅτι, τὸ διότι, εἰ ἔστι, τί ἔστιν. ὅταν μὲν γὰρ πότερον τόδε ἢ τόδε ζητῶμεν, εἰς ἀριθμὸν θέντες, οἷον πότερον ἐκλείπει ὁ ἥλιος ἢ οὐ, τὸ ὅτι ζητοῦμεν. σημεῖον δὲ τούτου· εὐρόντες γὰρ ὅτι ἐκλείπει πεπαύμεθα· καὶ ἐὰν ἐξ ἀρχῆς εἰδῶμεν ὅτι ἐκλείπει, οὐ ζητοῦμεν πότερον. ὅταν δὲ εἰδῶμεν τὸ ὅτι, τὸ διότι ζητοῦμεν, οἷον εἰδότες ὅτι ἐκλείπει καὶ ὅτι κινεῖται ἡ γῆ, τὸ διότι ἐκλείπει ἢ διότι κινεῖται ζητοῦμεν. ταῦτα μὲν οὖν οὕτως, ἔνια δ' ἄλλον τρόπον ζητοῦμεν, οἷον εἰ ἔστιν ἢ μὴ ἔστι κένταυρος ἢ θεός· τὸ δ' εἰ ἔστιν ἢ μὴ ἀπλῶς λέγω, ἀλλ' οὐκ εἰ λευκός ἢ μὴ· γινόντες δὲ ὅτι ἔστι, τί ἔστι ζητοῦμεν, οἷον τί οὖν ἔστι θεός, τί ἔστιν ἄνθρωπος.

⁷ See Barnes 1993: 203–4, McKirahan 1992: 189, Ross 1949: 609–10.

There are at least three reasons why the subject/attribute distinction is a natural one for Aristotle to use as the basis of his account of inquiry. First, the distinction is intuitive. It is one thing to ask whether the moon is eclipsed, quite another to ask whether it exists at all. The moon can exist without being eclipsed (it usually isn't!), although it cannot of course be eclipsed without existing. And one can know that the moon exists without knowing whether or not it is eclipsed, but one cannot know that the moon is eclipsed without knowing that it exists. Second, according to *APo* 1.22, predicating a term that signifies an underlying subject of a term that signifies an attribute—as, for example, in the sentence ‘the white thing is a log’—‘is either not predicating at all or is predicating not without qualification but accidentally’⁸ (83a15–17). We should instead say ‘the log is white’ (83a17–18). The second sentence is better formed than the first because it better represents the structure of reality. The log is not an attribute of anything; it is rather the underlying subject of attributes, such as the colour white. This suggests that, for Aristotle, the subject/attribute distinction is a basic feature of reality, one that should be adequately represented in our scientific discourse, as it is in the four questions of inquiry in *APo* 2.1.

Finally, Aristotle’s theory of science and scientific knowledge draws heavily on the subject/attribute distinction. He says that there are three things involved in demonstration: the attribute that is demonstrated to belong to its subject; the subject to which it is demonstrated to belong; and the principles (in particular the explanatory middle term) from which it is demonstrated.⁹ To have demonstrative scientific knowledge, therefore, is to know why an attribute belongs to its subject. In addition, definitions exhibit subject/attribute structure: the essence *E* of a subject-kind *S* belongs in itself₁ to *S*. To have non-demonstrative scientific knowledge of a definition involves knowing that *E* belongs in itself₁ to *S*. Since Aristotle’s account of the objects of scientific knowledge draws heavily on the subject/attribute distinction, and since ‘the things we seek are the same in number as the things we know scientifically’ (89b23–4, T12), it is natural that the distinction should also shape his account of the objects of inquiry.

2. Inquiry and Scientific Knowledge

Inquiry and scientific knowledge share the same objects: (1) that *S* is *P*, (2) why *S* is *P*, (3) that *S* exists, (4) what *S* is. Let’s look at scientific knowledge, first of (1) and (3) and then of (2) and (4). I shall then turn to Aristotle’s account of inquiry.

Having scientific knowledge (1) that *S* is *P* without knowing why it is, and having scientific knowledge (3) that *S* exists without knowing what it is, do not count as scientific knowledge as defined in *APo* 1.2 (T9; see Chapter 4). In *APo* 1.13 (78a22–3), Aristotle distinguishes between scientific knowledge of ‘the fact that’

⁸ τὸ δ’ ἐκείνως ἥτοι μηδαμῶς κατηγορεῖν, ἢ κατηγορεῖν μὲν μὴ ἀπλῶς, κατὰ συμβεβηκὸς δὲ κατηγορεῖν.

⁹ *APo* 1.7, 75a39–b2 (T38), 1.10, 76b11–22 (in T39).

and of ‘the reason why’. (See Chapter 2§3.) To have scientific knowledge of the fact that *S* is *P* without knowing the reason why, it seems, is to know that, but not why, *S* is *P* by necessity. Similarly, Aristotle may think that to have scientific knowledge that *S* exists, without knowing what *S* is, is to know that *S* exists by necessity. On the other hand, scientific knowledge of (2) why *S* is *P* and of (4) what *S* is do count as scientific knowledge as defined in *APo* 1.2 (T9). As we saw in Chapter 4§§1–4, to know scientifically (2) why *S* is *P* is to know that *M* is the cause of the fact that *S* is *P* (and that *S* is *P* by necessity)—it is to have demonstrative scientific knowledge. To know scientifically (4) what *S* is is to know that *E*, *S*’s essence, is the cause because of which *S* is the very thing that it is (and that *S* is the very thing that it is by necessity)—it is to have non-demonstrative scientific knowledge (*nous*). In this way, the first sentence of *APo* 2 refers implicitly to *nous*. This has significant consequences for how we should understand Aristotle’s project in *APo* 2, as I shall now explain.

Let’s begin by examining the connection between inquiry and scientific knowledge. An inquiry is a search for something one does not know in some way, the successful outcome of which is a discovery. As such, inquiry is not necessary for acquiring scientific knowledge, for one can acquire it by learning from a teacher without a search—that is, by didactic learning. However, as we saw in Chapter 1§4 and 1§8, some learning is not didactic but zetetic. Indeed, all of the sciences originally develop through zetetic learning. So inquiry is necessary for the zetetic acquisition of scientific knowledge. This gives us the first point of connection between the two. There is a second: scientific knowledge is the aim of inquiry. When we seek the cause of some fact (question (2)), we aim to acquire scientific knowledge of that fact. When we seek the essence of some object (question (4)), we aim to acquire scientific knowledge of that object. Inquiry and scientific knowledge share the same objects not by accident but because scientific knowledge is the goal of inquiry and inquiry is necessary for its non-didactic acquisition.

There is a third point of connection between the two: successful inquiry is sufficient for the acquisition of scientific knowledge. However, there are significant complications here. In *APo* 2, Aristotle explains the nature of inquiry as it occurs in the research phase of the development of a science, when the facts are being discovered and organized into demonstrations for the first time. The immediate outcome of a successful inquiry is a discovery, and, I shall now argue, the cognitive condition first produced by a discovery (in the research phase) is a lower grade of knowledge than scientific knowledge—it is *gnōsis* but not *epistēmē*. Then, in section 4, I shall suggest that Aristotle’s account of inquiry in *APo* 2 also contains all the elements required to explain our acquisition of scientific knowledge.

3. Knowledge in *APo* 2

In his positive account of inquiry in *APo* 2 (chapters 1–2, 8–10, and 13), Aristotle never uses *epistēmē* or its verbal cognate *epistasthai* after the first sentence of 2.1 (nor

does he use *nous*).¹⁰ For example, in 2.1 (T13) he uses *eidenai* ('to know') for the knowledge we have as a result of discovering that S is P.¹¹ At the start of 2.2 he says, referring back to the objects of inquiry in 2.1: 'the things that we seek and that, having discovered them, we know (*ismen*, a form of *eidenai*) are these and so many'¹² (89b36–7). The outcome of a successful inquiry is a discovery, and the cognitive condition produced by a discovery is *eidenai* ('knowing').¹³ Similarly, he uses *gignōskein* ('to know') for the knowledge we have as a result of discovering that S exists (*gnōntes... hoti esti*, 89b34 (in T13)). In *APo* 2.2 and 8, Aristotle again uses *eidenai* and *gignōskein*, this time for our knowledge of the cause and essence of eclipse, and in 2.8 he also uses *echein* ('to have', 'to grasp') for our knowledge of the fact that something exists (93a17, in T31). At the end of 2.8, he uses *lambanein* ('to get hold of') for our grasp of the essence; here *lambanein* seems to mean 'to get to know'.¹⁴ So, Aristotle uses *eidenai*, *gignōskein*, and *echein* interchangeably for the knowledge we have as a result of a successful inquiry, and he uses *lambanein* for the process by which we acquire it. *Eidenai*, *gignōskein*, and *echein* can (but need not) indicate a lower grade of knowledge than *epistēmē* (see Chapter 1§5), and *lambanein* very likely does.

In *APo* 2.13, Aristotle explains how we discover the essence (*ti esti*) and definition of a subject-kind S. The highest cognitive state in which we know S's essence is *nous*. (See Chapter 4§§1–4.) In 2.13, Aristotle speaks of 'hunting out' (*thēreuein*, 96a22 (in T42)), 'getting hold of' (*labonta*, 96b19 (in T19); see also 96a33–4 (in T44), b5, 97a24), 'working out' (*sullogizesthai*, 96b27–8 (in T45)), and 'arriving at' (*elthē(i)*, 97b12 (in T49)) the essence. He does not say what cognitive state results from these processes, but it is reasonable to think that it is of a lower grade than *nous*. For if it were *nous*, we would have expected him to say so, given the high value he places on its achievement.

I take the evidence in *APo* 2 to suggest that the immediate outcome of the sorts of inquiries and discoveries Aristotle describes is knowledge that falls short of scientific knowledge (demonstrative or noetic). He uses various terms for this lower-grade knowledge. Reflecting his own practice, I shall use 'knowledge' (*gnōsis*) for all of them, and I shall sometimes use 'non-scientific knowledge' and 'non-noetic knowledge' to emphasize their lower-grade status. (See Chapter 1§5.)

4. From Non-Scientific to Scientific Knowledge

In *APo* 2, then, Aristotle explains how we come to have non-scientific knowledge of the things we inquire about. In addition, *APo* 2 contains all the elements required to

¹⁰ See Ackrill 1981: 366. ¹¹ 89b28, b29, b30.

¹² Ἄ μὲν οὖν ζητοῦμεν καὶ ἃ εὐρόντες ἴσμεν, ταῦτα καὶ τοσαῦτά ἐστιν.

¹³ In *APo* 2.1 (89b27–9, in T13), 'having discovered' (*heurontes*) is equivalent to 'knowing' (*eidenai*). In *APo* 2.8 (93a35–6, in T34), Aristotle says that once we discover something (*heurōmen*), we know it (*ismen*).

¹⁴ 93b15–16 (in T29): 'How the essence is gotten hold of and becomes known' (Ὡς μὲν τοίνυν λαμβάνεται τὸ τί ἐστι καὶ γίνεται γνώριμον); καὶ ('and') may be epexegetic.

explain how we come to have scientific knowledge (*epistēmē*) of them. As we have seen, to have demonstrative scientific knowledge that a demonstrable attribute P belongs to its subject S, one must have *nous* of the definition of S. Having *nous* of the definition of S consists in knowing that E, S's essence, is the cause because of which S is the very thing that it is. That is, it consists in knowing the definition as an explanatorily basic principle in the relevant science. (See Chapter 4§§1–2.) How do we acquire *nous* of S's definition as explanatorily basic? According to *APO* 2, on the reading I shall defend, we acquire it in two stages. First, we discover the definition, using the methods of inquiry Aristotle prescribes for answering the 'what is it?' question: division and induction (discussed in *APO* 2.13; see Chapter 12). The immediate result of our discovery is knowledge of the definition, but not *nous* (as I argued in the previous section). Second, we use the definition to explain (i.e., demonstrate) S's in itself accidents (demonstrable attributes).¹⁵ By apprehending that E, S's essence, explains other necessary attributes of S and is not explained by any of them, we acquire knowledge of the definition as explanatorily basic—that is, *nous*. This is not to say that having *nous* of the definition consists in knowing it *as* the explanation of S's in itself accidents. Rather, this is the work of demonstrative scientific knowledge. To have *nous* is not to know that E causes S to be P; it is to know that E causes S to be the very thing that it is. (See Chapter 4§§1–4.) However, to know E in this way one must have previously apprehended it as the cause of S's in itself accidents. When we apprehend, at this earlier stage, S's essence as the cause of its in itself accidents, we know that and why S has them, but we do not yet have demonstrative scientific knowledge, for we do not yet have *nous*; rather, we are on our way to it.

On my interpretation, then, in the research phase in the development of a science, when we first discover the reason why S is P, we have knowledge, and knowledge by means of a demonstration, but not scientific knowledge. For having demonstrative scientific knowledge of why S is P requires *nous* of the definition of S. However, we first discover why S is P prior to acquiring *nous* of the definition. Indeed, we discover it on our way to acquiring *nous*. Similarly, when we first discover what S is, we have knowledge, and knowledge by means of a definition, but not scientific knowledge (*nous*). For in order to acquire *nous* of S's definition, we must explain S's in itself accidents from its definition, and we do this after we discover its definition. So when we first discover S's definition, we do not yet have *nous*. In the order of inquiry, we first acquire non-noetic knowledge of what S is, and then non-scientific knowledge of why S is P. We then acquire *nous* of what S is, and thus scientific knowledge of why S is P. (See Chapters 8§4 and 12§1.)

The result is that when we finally acquire demonstrative and non-demonstrative (noetic) scientific knowledge, we acquire them *at the same time* and *by the same activity*. We take the step from non-noetic to noetic knowledge of the definition of

¹⁵ Aristotle gestures at this two-stage process in *APO* 2.13, 96b15–25 (T19). See Chapters 8§4 and 12§1.

S as soon as we have finished demonstrating all or most of S's in itself accidents from it. And we take the step from non-scientific to scientific knowledge of those in itself accidents as soon as we acquire *nous* of the definition. Furthermore, since, as I shall argue in Chapters 8 and 12, we define all or most of a science's subject-kinds at one stage and then explain all or most of their in itself accidents at another—that is, since inquiry is significantly holistic—there is a way in which, at the final stage, we acquire scientific knowledge of a whole science all at once.¹⁶ (By contrast, we acquire non-scientific knowledge of a science piece by piece.)

On the account I have sketched (and shall defend in subsequent chapters), successful inquiry is necessary and sufficient for acquiring scientific knowledge in a non-didactic way, if inquiry is taken on a grand scale, as encompassing all four questions Aristotle introduces in *APo* 2.1 and all the methods he later outlines for answering them. To move from non-noetic to noetic knowledge of S's definition, no other form of inquiry is needed apart from seeking 'the fact that' and 'the reason why' with respect to all or most of the in itself accidents of S. Similarly, to move from non-scientific to scientific knowledge of why S is P, no other form of inquiry is needed apart from seeking 'the fact that' and 'the reason why' with respect to all or most of S's in itself accidents other than P. Answering the four questions Aristotle introduces in *APo* 2 is necessary and sufficient for the non-didactic acquisition of scientific knowledge, if they are asked about all or most of the objects in the science.

To return now to the first sentence of *APo* 2.1 (T12), if my interpretation is right, then while Book 1 explains what scientific knowledge is, the opening of Book 2 raises the expectation that it will explain how scientific knowledge is acquired. Furthermore, since essences are the objects of *nous*, which is a type of scientific knowledge, and since the essence of a subject is one of the four objects of inquiry *APo* 2.1 introduces, Aristotle seems to register at the very beginning of Book 2 an intention to explain our acquisition of *nous* of definitional principles, and to do so by means of his account of scientific inquiry, as set forth in 2.1–10 and 13. The *APo* is sometimes faulted for not adequately explaining how we acquire *nous* of first principles. It is true that Aristotle is not as explicit as we might have liked. However, Book 2 contains the outline of a detailed and compelling explanation, although it takes some work to see what it is and even that it is there.

5. The Objects of Inquiry

Let's consider what we seek to discover when we ask each of the four questions: (1) Does P belong to S? (2) Why does P belong to S? (3) Does S exist? (4) What is S?

¹⁶ My account leaves room for expert scientists to learn by demonstration. For once the science is established and the expert possesses scientific knowledge in both its forms, new facts may be discovered the explanations of which she learns by demonstration, as I argued in Chapters 2 and 4.

When we inquire whether P belongs to S, for example, whether eclipse belongs to the moon, one possibility is that we seek whether the moon is eclipsed right now, whether what we are presently observing is a particular instance of lunar eclipse. However, although this may form part of our inquiry, it is not our primary goal. We do not have scientific knowledge that the moon is now eclipsed, for scientific knowledge is of universal or for the most part truths, not particular ones.¹⁷ Since scientific knowledge and inquiry are concerned with broadly the same facts, it follows that when we inquire whether the moon is eclipsed, we are seeking whether there is a universal or for the most part connection between the moon and being eclipsed.¹⁸ (We might express this by saying that we are seeking whether the moon is susceptible to being eclipsed, or whether lunar eclipses happen.¹⁹) Furthermore, Aristotle says that after we discover that the moon is eclipsed, we seek the reason why, the cause. However, it is only universal or for the most part connections for which there are causes we can discover. The causes themselves are also connected universally or for the most part to the things of which they are the causes, and they admit of scientific knowledge.²⁰ Therefore, to seek the reason why the moon is eclipsed is to seek the universal cause.

Aristotle has something similar in mind with his 'if it is' question. The object sought is 'the underlying subject' (*APo* 2.2, 90a12, in T17) and 'not some one of the things that belong [to a subject]' (2.2, 90a32, in T16). Aristotle invokes the *Categories* concept of a primary substance: individuals, such as Socrates and this horse, that are subjects of attributes and not attributes of any subject. However, scientific knowledge and inquiry are concerned with universals, not individuals. Therefore, the objects sought in the 'if it is' question must be the natural kinds (the *Categories*' 'secondary substances') of which primary substances are members. I have been calling these 'subject-kinds'. So, to ask whether S exists, is to ask whether a putative natural kind (e.g., human being or centaur) exists.²¹ After discovering whether human being exists, we go on to seek what it is, the essence, which we state in its definition.

If this is right, then two alternative interpretations of the 'if it is' question are ruled out. The first is G.E.L. Owen's view that the question asks whether the concept 'human being' is instantiated; that is, it asks whether there is at least one human being.²² The second is Alfonso Gómez-Lobo's view that the question employs what

¹⁷ We can, however, apply our knowledge of the universal truth to particular cases, reasoning, for example, that since every lunar eclipse is caused by the earth screening the moon from the light of the sun, and since the moon is now screened in this way, the moon is now eclipsed. For a parallel case, see Chapter 1§8.

¹⁸ This is not to say that we are seeking whether the moon is always or usually undergoing an eclipse. Obviously it isn't. Rather, as I shall argue, it means that we are seeking whether the moon's being eclipsed admits of causal explanation, which involves seeking whether lunar eclipse is a regular (predictable) occurrence. See Chapter 7§5. See also *APo* 1.8 (75b33–6), (which I discuss in Chapter 2§3 n29).

¹⁹ I am grateful to Ben Morison for this suggestion.

²⁰ See *APo* 1.31.

²¹ For further discussion of the 'if it is' question, see Charles 2002 and Upton 1991.

²² Owen 1986: 270.

he calls ‘the predicative elliptical’ use of the Greek phrase *ei esti*: to ask *ei estin anthrōpos* is to ask whether a certain individual is a human being.²³ The problem with both of these interpretations is that they orient the ‘if it is’ question too much toward individuals. Consider the example of centaur (89b32, in T13). In seeking to answer the ‘if it is’ question we will likely want to determine (Owen-style) whether there are any centaurs, and this may very well involve determining (Gómez-Lobo-style) whether a particular specimen is a centaur. But, for Aristotle, the scientifically interesting question is whether there exists a certain *kind* of thing, namely, *centaur*.²⁴ So the two tasks Owen and Gómez-Lobo respectively assign to the ‘if it is’ question find their place in inquiry, but they are in the service of determining whether the relevant natural kind exists. And it is this, I contend, that is the aim of the ‘if it is’ question.

Once we know that the natural kind *human being* exists, we are in a position to seek what it is, the essence, which, I have argued, we eventually know by *nous*. In *APo* 2.2, Aristotle says that to seek what human being is is to seek why it is, the cause. Similarly, to seek why eclipse belongs to the moon is to seek what eclipse is, the essence. The what and the why—the essence and the cause—are the same. (See Chapter 7.)

Nonetheless, as *APo* 2.1 emphasizes, there is a difference between seeking what human being is and why the moon is eclipsed. The difference comes down to the ontological difference between subjects and attributes. In both cases we are seeking something universal, something that admits of scientific knowledge. However, particular eclipses are by nature such as to belong to a subject (the moon), whereas particular human beings are by nature such as to be the subjects to which attributes belong without belonging to any subject (they are *Categories* primary substances). We can ask ‘why does eclipse belong to moon?’ but we cannot intelligibly ask ‘why does human being belong to S?’ because a human being is not the sort of thing that can belong to any subject.²⁵ The species *human being* (a secondary substance) *is* such as to belong to a subject, namely, to particular human beings. However, we do not seek to define the species as an attribute of primary substances. Rather, we seek to define the species as a natural kind whose members are primary substances. Therefore, the essence we seek is not the answer to the question, ‘why does human being belong to S?’, or the question ‘why is Socrates a human being?’, but the question ‘what is human being?’, where the question and answer are informed by the fact that to be a

²³ Gómez-Lobo 1980. See also Gómez-Lobo 1981.

²⁴ The existence of a single freak centaur would, I imagine, be of scientific interest to Aristotle, but it would not be an object of scientific knowledge.

²⁵ There is, however, another way of thinking about the nature of particular human beings: they are composites of form and matter. Understood in this way, it is possible to talk of human being belonging to a subject, so long as by ‘human being’ we mean the human soul or form or essence and the subject is the human body or matter. This ‘hylomorphic’ conception of substance, central to Aristotle’s *Metaphysics*, *Physics*, *De Anima*, and other works, is absent from the *APo*. The two conceptions of substance are not necessarily incompatible. They do, however, provide different orientations for scientific inquiry. I return to some of these issues in Chapter 7§7.

human being is to be a subject and not an attribute. On the other hand, when we seek to define eclipse, we seek to define it as an attribute of its proper subject, the moon. For it is in the nature of particular eclipses to belong to the moon. So the moon is part of the essence of eclipse. (That is, eclipse belongs in itself₂ to the moon.)

There is evidence for this reading at the end of *APo* 2.1, where Aristotle distinguishes the two sets of questions—(1)–(2) and (3)–(4)—in a revealing way:

- T13** (c) And so [we seek] these things [the fact that and the reason why] in this way, but some things we seek in a different way, for example whether or not a centaur or god is; and I mean whether or not it is without qualification, not whether or not it is white. (89b31–3)

Seeking (3) whether S exists is seeking something different, and seeking it in a different way, from seeking (1) whether P belongs to S. Again, Aristotle's examples suggest that the two ways of inquiring differ because they are concerned with different types of entity—subjects (whether they exist and what they are) and attributes (whether they belong to their subjects and why), respectively. If this is right, then Aristotle may also think that seeking (4) what S is and (2) why P belongs to S consists in seeking two different things in two different ways. (In Chapters 7–12, I argue that this is Aristotle's view: seeking what S is involves either division (if S is a subordinate subject-kind (a species) or induction (if S is a primary subject-kind (a genus)); seeking why P belongs to S involves demonstration.) In sum, *APo* 2.1 gives the impression, first, that the difference in logical form between (1) 'the fact that' and (2) 'the reason why' questions on the one hand and the (3) 'if it is' and (4) 'what it is' questions on the other reflects an ontological difference between the types of entity sought in each case, and second, that this ontological difference entails a difference in the types of inquiry required ('we seek in a different way' (*allon tropen zētoumen*), 89b31–2, T13c). As we shall see in the next chapter, when Aristotle introduces the crucial concept of 'the middle term' in *APo* 2.2, he complicates and enriches this picture without fundamentally altering it.

6. The Stages of Inquiry

Aristotle divides the four questions of inquiry into two pairs—(1)–(2) and (3)–(4)—and remarks that inquiry proceeds differently in each case. He also says that within each pair of questions there is a temporal order of inquiry: first we seek (1) whether S is P, then we seek (2) why; first we seek (3) whether S exists, then we seek (4) what it is. Aristotle repeats these and similar claims throughout *APo* 2.1–10. He says, for example, that although in certain exceptional cases we can discover at the same time that and why S is P, we cannot seek or know why S is P unless we know that it is. Similarly, he says that we cannot seek or know what something is if we do not know that it exists, although we can—again, exceptionally—discover the two simultaneously.²⁶

²⁶ See *APo* 2.2, 89b36–90a9 (T14), 90a24–30, 2.8, 93a16–37 (T31–32).

In sum, *APo* 2.1 presents a general picture of successful scientific inquiry according to which, as David Charles has argued, inquiry divides into three stages.²⁷

Questions (1)–(2):

- Stage 1: We do not know whether S is P, and we seek whether it is.
- Stage 2: We know that S is P, but we do not know why, and we seek the reason why.
- Stage 3: We know why S is P.

Questions (3)–(4):

- Stage 1: We do not know whether S exists, and we seek whether it exists.
- Stage 2: We know that S exists, but we do not know what S is, and we seek what it is.
- Stage 3: We know what S is.

(In Chapter 8, I return to the stages of inquiry and argue for an interpretation that integrates all four questions.) In *APo* 2.2, as we shall see, Aristotle aligns questions (1) and (3) as questions of existence and questions (2) and (4) as questions of essence (to seek why S is P is to seek what P is, and to seek what S is is to seek why S is). Aristotle's view, then, is that in the order of inquiry questions of existence precede questions of essence. Commentators have tended to focus on questions of essence (Stages 2 and 3) at the expense of questions of existence (Stage 1). In my view this is a mistake. To understand Aristotle's account of inquiry we need to understand where and how it begins. With this in mind, I shall now discuss two puzzles that arise from Aristotle's account of Stage 1, as it appears in *APo* 2.1.

7. Meno's Paradox

Aristotle's account of the temporal order of inquiry gives rise to puzzles reminiscent of Meno's Paradox.²⁸ Start with questions (3) and (4): whether and what S is. Aristotle says that first we know that S exists, then we seek what S is. Now suppose S is a subject-kind whose existence can be demonstrated—for example, triangle. Knowing that triangle exists, it seems, consists in having the demonstration that triangle exists. The demonstration takes triangle's essence (what it is) as its middle term.²⁹ It follows that knowing that triangle exists requires prior knowledge of what it is. But, according to the stages of inquiry, seeking what triangle is requires prior knowledge that it exists. It seems, then, that we can learn neither that nor what triangle is. Learning the first requires prior knowledge of the second, and vice versa.

²⁷ Charles 2000, especially 23–77. In presenting the stages of inquiry Charles does not divide off questions (1) and (2) from (3) and (4) as I do here. In Chapter 8, I discuss Charles's view under the rubric of what I call the 'Explanationist Picture', which I argue against. I argue instead for the 'Socratic Picture', according to which inquiry divides into five stages. Nonetheless, my account owes much to Charles's strategy of dividing inquiry into different stages.

²⁸ See Charles 2000: 64–7, Ackrill 1981: 364–7.

²⁹ See Chapter 11§§6–7.

Either we have the knowledge we seek, in which case we do not need to seek, or we do not have it, in which case we cannot seek.³⁰

The problem rests on the assumption that if S's existence is demonstrable, then having the demonstration is the only way to know that S exists. Aristotle rejects this assumption. He distinguishes between different ways of knowing that triangle exists: with and without demonstration. Having the demonstration that S exists is sufficient but not necessary for knowing that S exists. This seems to solve the problem: first you know without demonstration that triangle exists, then you seek its essence. Once you discover this, you construct the demonstration of S's existence.³¹

However, as soon as this problem is cast aside, another instance of Meno's Paradox emerges. Notice that the solution assumes that one can know (non-demonstratively) that S exists without knowing what it is. Suppose one knows that S exists as a result of inquiring successfully whether it exists. The problem is, how can one inquire whether S exists without first knowing what it is? How would one know what to look for? And if one already knows what S is, then, given the order of inquiry, one must already know that it exists. But in that case one would have no need to, and arguably could not, seek whether it exists.³² To paraphrase Burnyeat's summary of a different epistemological puzzle, it seems that a necessary condition for seeking whether S exists (i.e., knowing what S is) is also a sufficient condition for not doing so.³³

- (1) Prior to seeking whether S exists, either one knows what it is or one does not.
- (2) If one knows what S is, then one cannot inquire whether it exists.
- (3) If one does not know what S is, then one cannot inquire whether it exists.
- (4) Therefore, one cannot inquire whether S exists.

The problem, which closely resembles Socrates's dilemma (see Chapter 1§2), has to do with the prior knowledge required for seeking whether S exists. Let's examine each premise in more detail.

Premise (3) has textual support in the *APo*. In particular, it has its basis in Aristotle's Prior Knowledge Requirement for intellectual learning (T1, 71a1–2). If we inquire it does not follow that we learn, for an inquiry may be unsuccessful. However, if an inquiry is successful, then we do learn and we learn in virtue of the inquiry. So, for example, a successful search for whether S exists results in our learning zetetically that S exists. Learning that S exists requires prior knowledge, for all intellectual learning does. It is reasonable to think that learning zetetically that

³⁰ A closely related problem appears in *APo* 2.7 (92b4–18). Suppose we could demonstrate what S is, its essence. Having the demonstration presupposes knowing that S exists. But knowledge that S exists must be obtained via the demonstration that S exists in which the middle term is S's essence. See Goldin 1996: 112–13.

³¹ See Ackrill 1981: 366–7, Bayer 1995: 246. For a different solution, one that rejects the idea of different ways of knowing, see Charles 2000: 65–6.

³² See *NE* 6.9 (1142a34–b1): 'people do not inquire about what they already know' (οὐ γὰρ ζητοῦσι περὶ ὧν ἴσασιν).

³³ Burnyeat 1990: 77, on the puzzle of false judgment in Plato's *Theaetetus*.

S exists requires prior knowledge at least partly because inquiring whether S exists does. Zetetic learning requires a deliberate search, and to launch a deliberate search we need some prior knowledge of what we are searching for. Otherwise, how would we know what to search for? If this is right, then Aristotle's Prior Knowledge Requirement extends to inquiry: all inquiry requires prior knowledge. Since, for Aristotle, the existence of S is an object of inquiry, there is some textual support for (3): in order to seek whether S exists, we need to know what we are searching for—what S is. The question is whether there is a way of knowing what S is that does not involve or require knowing its essence.

There is also textual support for (2). Aristotle says that we cannot know what S is without knowing that it exists (*APo* 2.8, 93a26–7, in T32). So if we know what S is, we cannot seek whether it exists, because we already know that it does. The question is whether there is a way of knowing what S is that does not involve or require knowing that it exists and thus leaves room for inquiring whether it exists. It is clear that having scientific knowledge of what S's essence is requires knowing that it exists. But perhaps knowing scientifically S's essence is not the only way of knowing what S is.

(2) and (3) also have some intuitive appeal. Surely we must have some grip on what something is before we can seek whether it exists. Consider an analogy. Start with (3). Suppose you are asked to seek whether a certain person, Meno, exists. Your first question would likely be, 'who is he? For whom am I searching?' That is, you would need to know who Meno is before you could seek whether he exists. But now suppose you were told that you cannot know who Meno is before determining whether he exists. Surely you would be confused about how to begin your search. On the other hand, turning to (2), if your knowledge of who Meno is is such that it already involves knowledge that he exists, then there would be no need for you to search. Again, the puzzle pushes us to ask about the kind of prior knowledge of a thing we need in order to be able to seek whether it exists.

Let's now consider (1). One way of reading it, which receives some support from the analogous premise in the puzzle in *APo* 1.1 (see Chapter 1§9), is what I have called the 'all or nothing' reading: we must be in one of two cognitive conditions vis-à-vis what S is, complete ignorance or complete knowledge. To be in a state of complete ignorance about *x* is to lack all *gnōsis* (knowledge) of *x*. *Gnōsis* covers a wide range of cognitive states, from perception to *nous*. To deny that we have any *gnōsis* of *x*, therefore, is to assert that we are in a state of complete ignorance about *x*, a cognitive blank. To have complete knowledge of *x* is to have unqualified scientific knowledge (*epistēmē*)—knowledge that cannot be improved upon. If we are completely ignorant of what S is, then, it seems, we cannot inquire whether it exists (premise (3)). On the other hand, if we have unqualified scientific knowledge of what S is, then by Aristotle's own lights we have no need to, and arguably cannot, inquire whether it exists, for we must already know that it does (premise (2)). If these are the only two cognitive conditions vis-à-vis what S is available to us, then the conclusion follows: we cannot inquire whether S exists. However, since (1), read 'all or nothing',

seems false, the puzzle may be solved. For while (2) and (3) (read ‘all or nothing’) seem true, they may not exhaust the possibilities. There may be intermediate cognitive conditions vis-à-vis what S is that fall between complete knowledge and ignorance and allow us to search.

A second way of reading (1) is as an innocuous instantiation of the law of the excluded middle.³⁴ There are only two possibilities: either we have knowledge (*gnōsis*) of what S is or we do not. But one can know what S is without knowing it scientifically. So on the innocuous reading, while (1) is true, (2) may be false. (2) is false if there are different ways of knowing what S is that fall short of unqualified scientific knowledge and allow us to search. Alternatively, (1) states that there are only two possibilities: either we have unqualified scientific knowledge (*epistēmē*) of what S is or we do not. But one can lack scientific knowledge of what S is and still know it in some other way. So on this version of the innocuous reading, (1) is true, but (3) may be false. (3) is false if there are different ways of lacking scientific knowledge of what S is that exceed total ignorance and allow us to search.

The three readings of (1) point to the same solution: we can inquire whether S exists if we have some prior knowledge of what S is that falls short of complete knowledge but exceeds total ignorance and allows us to search. That is, all three solutions appeal to the existence of intermediate cognitive states. And this, as we saw in Chapter 1, is the key to Plato’s and Aristotle’s approaches to Meno’s Paradox.

The first set of solutions puts pressure on the meaning of ‘knows’ in the puzzle. A second set of solutions may also be available to Aristotle, one that puts pressure on the meaning of ‘what S is’.³⁵ Suppose ‘knows’ means ‘has *gnōsis* of’ throughout the argument. If (3) is true, then it states that if one does not know an *identifying description* of S, then one cannot inquire whether S exists, for one does not know what to search for. If (2) is true, it states that if one knows *the complete essence* of S, then one cannot inquire whether S exists, for one must already know that it exists. So the argument trades on an ambiguity: ‘what S is’ means something different in each premise.

Suppose ‘what S is’ means ‘an identifying description of S’ throughout the argument. In that case Aristotle could argue that (3) is true but (2) is false. One can inquire whether S exists if we know an identifying description of S, so long as the description is not identical to S’s (complete) definition and so long as one’s knowledge of it does not involve or require knowing that S exists.³⁶ Now suppose ‘what

³⁴ See Fine 2014: 87–94, 135, 206. In Chapter 1, I argued that that the ‘all or nothing’ reading gives us the best account of Socrates’s dilemma in the *Meno* and Aristotle’s puzzle in *APO* 1.1, given the available textual evidence. I’m not as confident about the puzzles I argue are implicit in *APO* 2.1 and 2.2. (See Chapter 7§4.) For this reason I offer different readings of the puzzles, something I did not do in Chapter 1. The key point, which I make in the main text, is that these different readings point to the same solution.

³⁵ See Ryle 1976, discussed by Fine 2014: 94–9. See also Matthews 1999: 59.

³⁶ In fact, having a grasp of an identifying description of S, a grasp that does not involve or presuppose knowledge of S’s existence, would seem to be a necessary condition for seeking whether S exists. I return to this in Chapters 10–11.

S is' means 'the complete essence of S' throughout the argument. In that case Aristotle could argue that (2) is true but (3) is false. One can lack knowledge of S's complete essence and still seek whether S exists. For one might know a description of S that identifies (what turns out to be) one or more but not all of S's essential attributes without knowing that S exists. Alternatively, one might know a description of S that identifies (what turns out to be) one of its necessary but non-essential attributes (an in itself accident) without knowing that S exists. The two readings of 'what S is' converge on the same solution: one can seek whether S exists if (and, it seems, only if) one knows an identifying description of S, one that is not identical to S's definition (in which S's complete essence is stated) and does not involve or presuppose knowledge of S's existence.

The two sets of solutions I have sketched are much the same. Both posit that we can seek whether S exists if (and only if) we grasp a certain kind of identifying description of S (what I shall call a 'preliminary account'³⁷), one that is rich enough to allow us to search but not so rich as to make searching pointless. This solution also seems to help solve another instance of Meno's Paradox. Even if we manage to discover that S exists, how can we then go on to seek what it is? Either we already know what S is, in which case searching seems unnecessary and, arguably, impossible, or we do not, in which case searching seems impossible. As we shall see in Chapter 12, where I examine part of Aristotle's account of definitional inquiry, grasping a preliminary account of S, an account of the same sort we grasp prior to seeking whether S exists, solves the dilemma (and other puzzles connected to it).

Contrary to Meno's Paradox, we can seek whether and what S is if (and only if) we grasp an identifying description (a preliminary account) of S. This solution does not commit Aristotle to the view that seeking *x* always requires prior knowledge of *x*, the very thing we are seeking. For example, it does not commit him to the view that seeking what S's essence is requires prior knowledge of S's essence. It does commit him to the view that seeking what S's essence is requires (some sort of) prior knowledge of S. In some cases, seeking what S's essence is relies on a preliminary account that identifies (what turns out to be) part of S's essence. In other cases, it relies on a preliminary account that identifies some attribute of S (that turns out to be) appropriately connected to its essence. (See Chapter 10§4.) Similarly, Aristotle's account of our search for the existence of S does not commit him to the view that seeking whether S exists requires prior knowledge that S exists. It does commit him to the view that seeking whether S exists requires (some sort of) prior knowledge of S, again in the form of a preliminary account. (See Chapter 11.)

³⁷ A preliminary account of *x* identifies a non-accidental feature of *x*, without identifying its complete essence, and thereby facilitates our search for whether and what *x* is. (See Chapter 10§§4–6.) Not all identifying descriptions are preliminary accounts: e.g., complete definitions are not.

Inquiry in *APo* 2.2

In *APo* 2.2, Aristotle develops the account of inquiry he introduces in 2.1. He makes a number of important claims, some epistemological, dealing with the way we search, others ontological, dealing with the nature of the objects for which we search. On the epistemological side, I argue that Aristotle's account of the order of inquiry—and in particular the first stage—gives rise to another instance of Meno's Paradox, this time concerning the way we seek whether an attribute belongs to a subject. On the ontological side, the main theme of 2.2 is the close connection between cause and essence. Aristotle says that to state something's essence—to define it—and to state its cause—to explain it—amount to the same thing. 2.2 will prove to be crucial in understanding Aristotle's account in the rest of *APo* 2 of how we acquire knowledge (including noetic knowledge) of definitions.

1. Searching for the Middle Term

In *APo* 2.1, the distinction between subjects and their attributes is the basis of Aristotle's account of the four questions of inquiry:

- (1) Does P belong to S?
- (2) Why does P belong to S?
- (3) Does S exist?
- (4) What is S?

In 2.2, Aristotle continues to distinguish between subject-questions and attribute-questions, but he complicates his account by contrasting questions of existence ((1) and (3)), on the one hand, with questions of cause and essence ((2) and (4)), on the other.¹ He accomplishes this re-alignment by introducing the crucial notion of the 'middle term':

- T14** (a) When we seek the fact that (*to hoti*) or whether something is without qualification (*to ei estin haplōs*), we are seeking whether or not there is a middle term for it; and when, having come to know either the fact that or whether it is either partially or without qualification, we seek in turn the reason why (*to dia ti*) or what it is (*to ti esti*), we are then seeking what the

¹ See Mansion 1976: 168.

middle term is. (b) (By ‘the fact that it is partially’ and ‘without qualification’ I mean [this]: [by] ‘partially’ [I mean] ‘is the moon eclipsed?’ or ‘is it waxing?’). For in these sorts of cases we are seeking if it is something or is not something. And [by] ‘without qualification’ [I mean] whether or not the moon, or night, exists (*ei estin ē mē*).² (c) It turns out, therefore, that in all our searches we seek either if there is a middle term or what the middle term is. For the middle term is the cause, and this is what is sought in all these cases. Is [the moon] eclipsed? Is there a cause or not? After these things, having come to know that there is [a cause], we then seek what this is.³ (89b37–90a9)

Aristotle gives prominence, in all four forms of inquiry, to the search for a cause. To seek (1), whether S is P, or (3), whether S exists, is to seek whether there exists a cause that explains why S is P or why S exists. And to seek (2), why S is P, or (4), what S is, is to seek what the cause is whose existence we previously established. It is important to note that Aristotle continues to draw a distinction between inquiries concerned with attributes and those concerned with subjects, a distinction now expressed in terms of being ‘partially’ (*epi merous*) (whether S is P) and ‘without qualification’ (*haplōs*) (whether S exists). At the same time he notes the common orientation of these inquiries toward the cause, the ‘middle term’.

The cause is what we seek in all of our scientific inquiries, whether these concern subjects or attributes.⁴ It does not follow, however, that the way we seek the cause is the same in all cases. That is, it does not follow that Aristotle is committed to a single method of inquiry that covers both subject- and attribute-questions. Indeed, his continued insistence on distinguishing between these questions suggests that he thinks in *Apo* 2.2, as he does in 2.1, that different ways of inquiring are required in each case. As I have noted in previous chapters, in *Apo* 2.8 and 13, on the reading I shall defend, Aristotle presents three methods for discovering essences: demonstration for demonstrable attributes (in 2.8; Chapter 10), division for subordinate subject-kinds (in 2.13; Chapter 12§§2–11), and induction for primary subject-kinds (also in 2.13; Chapter 12§12). In *Apo* 2.2, as we shall see, Aristotle identifies the search for the essence of a thing with the search for its cause. So, on my view,

² There is a shift in Aristotle’s terminology within T14. He begins with the familiar fact that/if it is distinction, which does duty for the attribute/subject distinction, though now he adds ‘without qualification’ to ‘if it is’. Then in the next sentences ‘the fact that’ and ‘if it is’ are used interchangeably and ‘partially’ and ‘without qualification’, added to these phrases, do duty for the attribute/subject distinction. Aristotle invokes the same concepts as those in 2.1 even if in slightly different terms.

³ ζητούμεν δέ, όταν μὲν ζητῶμεν τὸ ὅτι ἢ τὸ εἰ ἔστιν ἀπλῶς, ἀρ’ ἔστι μέσον αὐτοῦ ἢ οὐκ ἔστιν· όταν δὲ γνόντες ἢ τὸ ὅτι ἢ εἰ ἔστιν, ἢ τὸ ἐπὶ μέρους ἢ τὸ ἀπλῶς, πάλιν τὸ διὰ τί ζητῶμεν ἢ τὸ τί ἔστι, τότε ζητούμεν τί τὸ μέσον. λέγω δὲ τὸ ὅτι ἔστιν ἐπὶ μέρους καὶ ἀπλῶς, ἐπὶ μέρους μὲν, ἀρ’ ἐκλείπει ἢ σελήνη ἢ αὐξεται; εἰ γὰρ ἔστι τι ἢ μὴ ἔστι τί, ἐν τοῖς τοιούτοις ζητούμεν· ἀπλῶς δ’, εἰ ἔστιν ἢ μὴ σελήνη ἢ νύξ. συμβαίνει ἄρα ἐν πάσαις ταῖς ζητήσεσι ζητεῖν ἢ εἰ ἔστι μέσον ἢ τί ἔστι τὸ μέσον. τὸ μὲν γὰρ αἷτιον τὸ μέσον, ἐν ἅπασιν δὲ τοῦτο ζητεῖται. ἀρ’ ἐκλείπει; ἀρ’ ἔστι τι αἷτιον ἢ οὐ; μετὰ ταῦτα γνόντες ὅτι ἔστι τι, τί οὖν τοῦτ’ ἔστι ζητούμεν.

⁴ Below I suggest that Aristotle means that the cause is what we should *ideally* seek in all of our inquiries.

demonstration on the one hand and division and induction on the other are methods for discovering the causes of attributes and subjects, respectively. However, to understand more fully Aristotle's division of methodological labour we will need the distinction he makes in *APo* 2.8–9 between the sort of thing whose cause is 'other' (and whose essence is discovered by demonstration) and the sort whose cause is 'the same' (and whose essence is discovered by division or induction). I return to this in Chapter 9.

2. Attribute Questions

In T14, Aristotle says that to seek whether the moon is eclipsed is to seek whether there exists a cause (a 'middle term') that explains why the moon is eclipsed. Schematically:

- (1) Does P belong to S?

becomes

- (1') Is there an M such that M is the cause of P's belonging to S?

Aristotle's talk of a 'middle term' is a clear reference to demonstration. To seek whether P belongs to S is to seek whether there is a demonstration proving that and explaining why P belongs to S—that is, whether the proposition 'P belongs to S' is demonstrable.⁵ If it is demonstrable, then we seek what the middle term (the cause) is. So

- (2) Why does P belong to S?

becomes

- (2') What is the M such that M is the cause of P's belonging to S?

When we discover what the cause is, we grasp the demonstration:

P belongs to M	e.g., Eclipse belongs to all screening of the sun by the earth
<u>M belongs to S</u>	<u>Screening of the sun by the earth belongs to all moon</u>
P belongs to S	Eclipse belongs to all moon

In *APo* 2.2 (90a14–15, in T15), Aristotle makes another important claim about question (2): he says that the 'what is it?' and 'why is it?' questions are the same. To seek what the cause (the middle term) is that explains why P belongs to S is to seek what P is, its essence. For example, to seek why eclipse belongs to the moon is to seek what eclipse is, its essence. For Aristotle, to explain is to define.⁶

⁵ Hence an equivalent formulation of (1') is: is there an M such that 'P belongs to M, M belongs to S, P belongs to S' is a demonstration?

⁶ This is true for objects of scientific knowledge (subject-kinds and their attributes), not singular events, e.g., the Persian War, which, it seems, we explain without defining. See *APo* 2.11, 94a36–b8. (Thanks to Gail Fine for pointing this out to me.)

The close connection between definition and explanation sets the stage for Aristotle's account of inquiry in *APo* 2.3–10 and 13. For one thing, it explains his preoccupation with the question of the relationship between definition and demonstration. Given that searching for the definition (essence) of a thing involves searching for its cause, and given that demonstration is the primary vehicle for exhibiting causes, the connection between definition and demonstration is a natural topic of concern. In fact, Aristotle eventually concludes (in 2.10) that one type of definition is a sort of demonstration and that such definitions are discovered by means of demonstration. (See Chapters 9–10.)

3. The Causal and Definitional Constraints

In *APo* 2.2, then, Aristotle imposes two constraints on attribute questions. On question (1) he imposes what I shall call 'the Causal Constraint':

Causal Constraint: To seek whether P belongs to S is to seek whether there exists a cause that explains why P belongs to S.

On question (2) he imposes what I shall call 'the Definitional Constraint':

Definitional Constraint: To seek what the cause is that explains why P belongs to S is to seek what P is, its essence, which is stated in its definition.

The Causal and Definitional Constraints affect how we should conceive of the stages of inquiry, as I presented them (in a preliminary way) in the previous chapter:

Questions (1')–(2'):

- Stage 1: We do not know whether P belongs to S, in the sense that we do not know whether there is a cause that explains why P belongs to S, and we seek whether there is one.
- Stage 2: We know that P belongs to S, in the sense that we know that there is a cause that explains why P belongs to S, but we do not know what the cause is, and we seek what it is—that is, we seek P's essence.
- Stage 3: We know what the cause is that explains why P belongs to S (we know the relevant demonstration), and so we know P's essence.

In T14, Aristotle makes it clear that questions (1') and (2') belong to different stages of inquiry: Stages 1 and 2. The Causal Constraint affects the nature of the knowledge we reach at Stage 2 and how we acquire it from Stage 1. At Stage 2, it must be possible to know *that* there is a cause that explains why P belongs to S without knowing *what* the cause is. If this were not possible, then it would not be possible to be at Stage 2 without already being at Stage 3. Aristotle thinks that there are cases in which we learn at the same time that there is a cause and what it is.⁷ However, these cases are

⁷ *APo* 2.2, 90a24–30, 2.8, 93a15–20 (T31).

exceptional. More often than not these discoveries are made at different stages: first we seek whether there is a cause; if we discover that there is one, then we seek what it is. Therefore, in the move from Stages 1 to 2, there must be some way of discovering that there is a cause without at the same time discovering what it is. And within Stage 1, there must be some way of seeking whether there is a cause without already knowing what it is. In other words, there must be some way of seeking whether and discovering that ‘P belongs to S’ is demonstrable without already knowing or at the same time discovering what the middle term in the demonstration is.

In addition, our knowledge at Stage 2 that there is a cause should facilitate our search for what the cause is.⁸ Aristotle’s claim that we seek whether there exists a cause before we seek what it is suggests that that it is possible to know that the cause exists in such a way as to facilitate our search for what it is. This suggests that it is possible to know that something (e.g., the cause) exists in such a way as to facilitate our search for what it is. Whatever this knowledge is—and Aristotle will have more to say about it in *APo* 2.8—it is what the inquirer needs to achieve at Stage 2.

4. Meno’s Paradox

Aristotle’s characterization of the move from Stages 1 to 2 gives rise to an instance of Meno’s Paradox. How can we seek at Stage 1 whether there is a cause of P’s belonging to S if we do not know what P is? How would we know what to search for? But if we know what P is, then, according to Aristotle, we know the cause of P’s belonging to S. For what P is and why P belongs to S are the same. In that case we have no need to, and arguably cannot, seek whether there is a cause, for we already know that there is one. Again, it seems that a necessary condition for inquiring is also a sufficient condition for not doing so.⁹

- (1) Prior to seeking whether there exists a cause of P’s belonging to S, either one knows what P is or one does not.
- (2) If one knows what P is, one cannot seek whether there is a cause of P’s belonging to S.
- (3) If one does not know what P is, one cannot seek whether there is a cause of P’s belonging to S.
- (4) Therefore, one cannot seek whether there exists a cause of P’s belonging to S.

As with the puzzle in the previous chapter (see section 7), we need to consider what ‘knows’ means. (1) admits of the same three readings: the ‘all or nothing’ reading and two versions of the innocuous reading. On the ‘all or nothing’ reading, there are only two possibilities: either we have unqualified scientific knowledge (*epistēmē*) of what P is or we have no knowledge (*gnōsis*) at all of what it is. And if we have no

⁸ In T14a and c, when Aristotle says that we seek ‘what the middle term [i.e., the cause] is’, he does not mean that we seek what the essence of the cause is. Rather, he means that we seek which thing is the cause.

⁹ See Chapter 6§7.

knowledge at all of what P is, then we are completely ignorant of what it is. On the two innocuous readings, there are also only two possibilities, but different ones: either we have knowledge (*gnōsis*) of what P is or we do not; or, either we have unqualified scientific knowledge (*epistēmē*) of what P is or we do not.

From these three readings we can draw conclusions about how Aristotle might solve the puzzle. On the ‘all or nothing’ reading, (2) and (3) seem true, but (1) is false. Aristotle could assert that there are intermediate cognitive states that fall between unqualified scientific knowledge and complete ignorance of what P is and allow us to search for whether there is a cause of P’s belonging to S. On the first innocuous reading, he could assert that within the scope of knowing of what P is there are different grades of knowledge that fall short of unqualified scientific knowledge and allow us to search. So, while (1) is true, (2) is false. On the second innocuous reading, he could assert that within the scope of not having unqualified scientific knowledge of what P is, there are different grades of knowledge that exceed complete ignorance and allow us to search. So, while (1) is true, (3) is false. Thus the three readings converge on the same solution: we can seek whether P has a cause if we have some sort of intermediate knowledge of what P is.

Finally, Aristotle could argue that the puzzle trades on an ambiguity in the expression ‘what P is’: it could mean either ‘an identifying description of P’ or ‘P’s complete essence’. If it means ‘an identifying description of P’ throughout the argument, then (3) seems true but (2) seems false. For although the complete definition of P is an identifying description, not every identifying description is a complete definition (e.g., a preliminary account is not). On the other hand, if it means ‘P’s complete essence’ throughout the argument, then (3) seems false and (2) seems true. In the range of cases Aristotle discusses in *APo* 2.2, the complete essence of P is complex, containing both causal and non-causal parts. For example, the complete essence of eclipse mentions the subject to which it belongs (the moon), a state or affection with which eclipse is associated (loss of light), and the cause (the earth screening the sun). If one knows P’s complete essence, then one knows what its cause is and that it has one, and so one cannot seek whether it has one. However, if one knows an identifying description in the form of a preliminary account of P, then one can seek whether it has a cause, provided the account meets three conditions. First, it does not state P’s complete essence. Second, knowing it does not involve or require knowing that P has a cause. Third, knowing it facilitates our search for whether P has a cause. For example, one might have a preliminary account of eclipse that identifies it as a certain loss of light from the moon, or one that identifies one of its necessary but non-essential features. (In *APo* 2.8 Aristotle avails himself of both solutions. See Chapter 10.)

The two strategies I have considered—the one focusing on knowledge, the other on what P is—point to the same solution: we can seek whether there is a cause of P if (and only if) we have a specific kind of intermediate knowledge of P, namely, knowledge of a preliminary account.

5. The Causal Constraint for Attributes

Suppose we can solve the puzzle and progress past Stage 1. At Stage 2, the Causal Constraint requires that we have a form of knowledge that might at first glance seem puzzling: we need to know *that* there is a cause of, for example, the moon's being eclipsed without knowing *what* the cause is. That is, we need to know *that* 'eclipse belongs to the moon' is demonstrable without knowing *what* the demonstration is. How is this possible? What does it mean? Why does Aristotle introduce this claim?

At this point it is useful to recall that, for Aristotle, the aim of inquiry is scientific knowledge. More specifically, with regard to attribute questions, (1) and (2), the aim is demonstrative scientific knowledge, which Aristotle restricts to a narrow range of objects—namely, to attributes that belong to their subjects because of some knowable cause. But an attribute that belongs to its subject by chance does not have a knowable cause,¹⁰ and so it cannot be known scientifically.¹¹ The only attributes that have knowable causes and hence admit of scientific knowledge are those that belong to their subjects 'always or for the most part'.¹² This is just to say that, for Aristotle, not everything is an *explanandum*. In particular, attributes that belong by chance are not *explananda*. This is important because it means that in the early stages of inquiry it may be a genuine question whether or not an attribute is an *explanandum*, and it may be a genuine epistemic achievement when we grasp that it is one. This is what Aristotle has in mind when he introduces the Causal Constraint. To inquire at Stage 1 whether there is a cause of the moon being eclipsed is to inquire whether this is a genuine *explanandum*, whether it exists not by chance but always or for the most part in such a way as to admit of explanation. And to know at Stage 2 that there is a cause without knowing what the cause is, is to know that this *is* an *explanandum* and thus that it can be demonstrated.¹³ In this way APO 2.2 confirms what we found in 2.1, where the question 'does P belong to S?' asks whether there is a universal or for the most part connection between P and S.¹⁴ (See Chapter 6§5.)

The Causal Constraint says that when we seek (1) 'Does P belong to S?' we seek (1') 'Is there an M such that M is the cause of P's belonging to S?' However, (1) and (1') are not equivalent.¹⁵ An affirmative answer to (1) does not imply an affirmative answer to (1'): if P belongs to S it does not follow that there is a cause of its belonging—it may belong by chance. So too a negative answer to (1') does not imply a negative answer to (1): if there is no cause of P's belonging to S it does not follow that it does not belong—again, it may belong by chance. So how could seeking (1) be the same as seeking (1')?

¹⁰ Phys 2.5, 197a15–21.

¹¹ APO 1.30.

¹² APO 1.30.

¹³ See Ackrill 1981: 377, LaBarge 2006: 34–6.

¹⁴ If P is part of S's essence it belongs always or for the most part but it is indemonstrable. What place do such attributes have in Aristotle's account of inquiry? I address this question in the next chapter.

¹⁵ See Barnes 1993: 205–6.

What Aristotle means, I suggest, is that when we are seeking (1), we *should ideally* be seeking (1'). (1') states what James Lennox calls a 'norm of inquiry'.¹⁶ (1) alone does not always yield the right results. It is sufficient to rule out from further inquiry cases where P does not belong to S at all, but it does not rule out cases where P does belong to S but only by chance. So the point of the reformulation—the point, that is, of the Causal Constraint—is to draw our attention to the fact that within Stage 1 the inquirer needs some means of excluding from the domain of further inquiry attributes that belong to their subjects by chance. This is what (1') accomplishes. For Aristotle, the line between science and non-science is clear: what holds always or for the most part falls within science, the rest does not. But just because we know in general where to draw the line does not mean that we know on which side of it any given putative fact belongs. By answering (1') we answer this question. And we ask and answer (1') within scientific inquiry. The question of whether or not a putative fact is part of science is itself a scientific question.¹⁷

6. The Definitional Constraint: Introducing Causally Complex Essences

The Definitional Constraint states that in seeking why P belongs to S, we (should ideally) seek what P is.¹⁸ There is an ontological corollary: what P is (its essence) and why it is (its cause) are the same. Aristotle says:

- T15 (a) For in all these cases it is clear that what it is (*to ti esti*) and why it is (*dia ti estin*) are the same. (b) What is eclipse? Loss of light from the moon because of the earth screening. Why is there eclipse, or why is the moon eclipsed? Because the light is absent when the earth is screening. (c) What is harmony? A numerical ratio in high and low. Why does the high harmonize with the low? Because high and low have a numerical ratio. Is it possible for the high and low to harmonize? Is there a numerical ratio between them? Having grasped that there is [we] then [ask], what is the ratio?¹⁹ (90a14–23)

¹⁶ Lennox 2011.

¹⁷ I disagree with Barnes (1993: 205–6) who argues that when we ask (1') 'we presuppose that chance events have been excluded' (206). Rather, in my view asking (1') is the means by which they are excluded. Ross (1949: 611) argues that the move from (1) to (1') works only on the assumption that everything has a cause. On my view, this assumption is not needed—and indeed it contradicts Aristotle's view.

¹⁸ In general, Aristotle's claims of the form 'to seek x is to seek y' and 'when we seek x we seek y' should be taken to mean 'to seek x is ideally to seek y' and 'when we seek x we should ideally seek y', but I do not always bother to say this.

¹⁹ ἐν ᾧ αἰσιν γὰρ τούτοις φανερόν ἐστιν ὅτι τὸ αὐτό ἐστι τὸ τί ἐστι καὶ διὰ τί ἔστιν. Τί ἐστιν ἑκλειψις; στέρησις φωτὸς ἀπὸ σελήνης ὑπὸ γῆς ἀντιφράξεως. διὰ τί ἐστιν ἑκλειψις, ἢ διὰ τί ἐκλείπει ἡ σελήνη; διὰ τὸ ἀπολείπειν τὸ φῶς ἀντιφραττοῦσης τῆς γῆς. τί ἐστι συμφωνία; λόγος ἀριθμῶν ἐν ὁξεί καὶ βαρεῖ. διὰ τί συμφωνεῖ τὸ ὁξὺ τῷ βαρεῖ; διὰ τὸ λόγον ἔχειν ἀριθμῶν τὸ ὁξὺ καὶ τὸ βαρὺ. ἀρ' ἐστι συμφωνεῖν τὸ ὁξὺ καὶ τὸ βαρὺ; ἀρ' ἐστὶν ἐν ἀριθμοῖς ὁ λόγος αὐτῶν; λαβόντες δ' ὅτι ἐστι, τίς οὖν ἐστὶν ὁ λόγος.

T15 introduces a number of important ideas concerning the nature and structure of a certain type of essence, ideas that are central to the rest of *APo* 2. I shall begin with an overview of Aristotle's theory and then examine the text in detail.

Aristotle illustrates his claim, that what P is and why it is are the same, with two examples: eclipse and harmony. He treats them slightly differently, as we shall see. Let's begin with eclipse, whose complete definition, Aristotle tells us, is:

Eclipse is_{def} loss of light from the moon because of screening of the sun by the earth.

The essence has three parts, one of which is the cause of the connection between the remaining two: it is of the form 'A–C because of B'. As such, it can be set out in a demonstration:

(A) Loss of light belongs to all (B) screening of the sun by the earth

(B) Screening of the sun by the earth belongs to all (C) moon

(A) Loss of light belongs to all (C) moon

This essence conforms to a pattern exhibited in several examples in the *APo* and elsewhere. Indeed, I am eventually going to argue that it is an example of one of the two main types of essence Aristotle recognizes in the *APo*. The second type is through genus and differentia(e) (or something analogous): for example, human being is a two-footed tame animal—generally, $GD_1 \dots D_n$. I shall call essences of the first type 'causally complex' and those of the second type 'causally simple'. Essences of both types are causal in the sense that the essence of x is the cause of x —it is that which makes x the very thing that it is. This is one of Aristotle's principal claims in *APo* 2.2, the ontological corollary of the Definitional Constraint. However, this is a claim about the relationship between a thing and its essence. My labels, 'causally complex' and 'causally simple', by contrast, are intended to describe the relationship among the items within the essence. In essences of the first type (A–C because of B) the parts of the essence stand to each other in a complex causal relation, whereas in causally simple essences ($GD_1 \dots D_n$) they do not. (See Chapter 9.)

Here are some other causally complex essences Aristotle mentions in the *APo* and elsewhere (this list is not meant to be exhaustive):

Thunder is_{def} (A) noise in (C) the clouds because of (B) fire extinguishing.²⁰

Harmony is_{def} (A) blending of (C) high and low notes because of (B) a numerical ratio.²¹

Ice is_{def} (A) solidification of (C) water because of (B) the complete absence of heat.²²

Leaf-shedding is_{def} (B) coagulation of sap at the stem in (C) broad-leaved plants.²³

Anger is_{def} (A) boiling of the blood around (C) the heart because of (B) the desire for revenge.²⁴

²⁰ *APo* 2.8, 93b7–14 (T30), 2.10, 94a4–9.

²¹ *APo* 2.2, 90a18–23 (in T15). I have added 'blending'. See *Met* 8.2 (1043a10–11) and section 9 below.

²² *APo* 2.12, 95a16–21. ²³ *APo* 2.17, 99a25–9.

²⁴ *DA* 1.1, 403a29–b1. See also *Top* 6.13, 151a16–19, 8.1, 156a32–3, *Rhet* 2.2, 1378a30–2.

Sleep is_{def} (A) motionless bond on (C) perception for the sake of (B) the animal's preservation.²⁵

Human being is_{def} (A) such-and-such arrangement of (C) such-and-such matter for the sake of (B) such-and-such soul.²⁶

With one exception (leaf-shedding), every essence on this list has three parts: an affection (*pathos*) or attribute (A term), the underlying subject in which it inheres (C term), and the cause (B term). In *Metaphysics* 8.4 (1044b9–15), Aristotle applies the theory of the four causes to this type of essence. The C term signifies the material cause or its analogue (the underlying subject); the B term signifies the final cause—or, if there is no final cause, the efficient cause. The formal cause is the whole essence, which must include what Aristotle calls 'the cause' (1044b13, 15), which is signified by the B term. On our list, in the first four cases (all from the *APo*) the B term signifies the efficient cause; in the last three (from *De Anima*, *De Somno*, and *Metaphysics*, respectively) it signifies the final cause. In the *Metaphysics*, Aristotle says that eclipse does not have a final cause (8.4, 1044b12). In the *APo*, he seems to have the same view about harmony, ice, and thunder. (He mentions a possible final cause for thunder (2.11, 94b32–4) but he does not seem to take it seriously.)²⁷

Causally complex essences contain all of the elements needed for a complete causal analysis of the things they define. Nevertheless, Aristotle clearly privileges one part of the essence: the B term. Although the complete answer to the 'what is it?' question contains all three terms, when Aristotle speaks of the cause (*aition*) of eclipse he always means the efficient cause (the earth screening), the B term. There is evidence for this in *APo* 2.2 (see T14–15), where he calls the cause 'the middle term'—that is, the B term. Indeed, with respect to scientific inquiry, often (but not always) this is the only part of the essence we seek. For knowledge of the A and C terms is often presupposed in inquiry (in our preliminary accounts). So when Aristotle says in T15 that 'the what' and 'the why' are the same (90a14–15), we must treat his claim carefully. He does not mean that the complete essence and the cause are exactly the same. For the complete essence includes the cause (the middle or B term), but not only the cause (it also includes the A and C terms).

Furthermore, it is clear that in *APo* 2 Aristotle thinks that the B term in causally complex essences is part of the formal cause, even when it is also the efficient cause (as with eclipse, thunder, harmony, and ice). Evidence for this is in *APo* 2.11 (94a35–6), where he indicates that he has already discussed the formal or essential cause (*to ti ēn einai*) and its connection to the 'middle term'. This is clearly a reference to *APo* 2.8, where the middle term is the efficient cause, and so (part of) the formal cause, of eclipse and thunder. In addition, when Aristotle discusses the

²⁵ *De Som* 1, 454b25, 2, 455b20.

²⁶ *Met* 7.17, 1041a20–b11.

²⁷ Why Aristotle denies in these and other cases that there is a final cause, and what implications this has for his theory of science, are not questions I can pursue here. Note that the last three examples on the list suggest that the final cause takes precedence over the efficient cause in cases where the two are different.

efficient cause in 2.11 (94a36–b8) he does not mention eclipse or thunder but a completely different example: the Persian War. Aristotle's view, then, is that in causally complex essences the B term signifies the crucial, explanatorily basic feature of the thing defined. This is in keeping with my account of demonstration and scientific knowledge in Chapters 3–4, according to which the fundamental mode of explanation in the *APo* is essence-based explanation.

Aristotle's Definitional Constraint makes good sense. Questions of the form 'why does P belong to S?' concern attributes whose nature it is to belong to a subject. For example, it is part of the nature of (lunar) eclipse to belong to a subject, the moon, for a lunar eclipse cannot exist apart from the moon. Since part of the attribute's nature is to belong to its subject, its subject is part of its essence. This is just to say (as I argued in Chapter 3§2) that the attributes Aristotle considers in *APo* 2.2 belong in itself₂ to their subjects.²⁸ If belonging to the subject is part of the attribute's essence, then it is natural for Aristotle to say that the cause that explains why it belongs should also be part of the essence. This accounts for the fact that Aristotle defines eclipse (and other similar attributes) in terms of its subject and its cause—that is, it accounts for the C and B terms in the definition. Below I discuss the significance of the A term.

7. Attributes and Subjects

What kind of entity is defined by a causally complex essence (A–C because of B)? Commentators sometimes suppose that they are reserved, at least in the *APo*, for processes or events, for example, eclipse, thunder, and leaf-shedding. If this is right, then it seems that *APo* 2, in which such essences are prominent, marks a departure from Book 1, the focus of which is not on processes or events but on necessary attributes of subjects, such as 2R.²⁹ However, another possible view, which I have already gestured at, is that in Book 2 Aristotle broadens his conception of necessary attribute to include things that we would call processes or events but that he considers in the same general ontological category as 2R.³⁰ Eclipse, thunder, leaf-shedding, and

²⁸ Aristotle's account in *APo* 2.2 ignores the demonstrable attributes that belong not because of the attribute's essence but only because of the subject's essence. (See Chapter 3§4.) It also ignores the fact that even if P belongs to S because of P's essence, the inquirer still needs to bring the explanation back to S's essence. The first omission can perhaps be explained by the fact that Aristotle thinks that, for any subject-kind, there will be only a few attributes that belong only because of S's essence. The second omission can perhaps be explained by the fact that the causal link between a subject's essence and its attributes was already explored in *APo* 1. Aristotle does have something to say about both matters in *APo* 2.13 (96b15–25, T19); see Chapters 8§4 and 12§1.

²⁹ For a view along these lines, see Ferejohn (2013), 98–155.

³⁰ It is true that in *APo* 1.8 Aristotle gives eclipse as an example of something that 'comes about often' (75b33–6) and in this way distinguishes eclipse (thunder, etc.) from 2R. My claim is not that in the *APo* there are no differences between eclipse and 2R. My claim is that these differences do not make a difference to their status within Aristotle's theory of demonstration and definition: they are both necessary attributes of their respective subjects to which they belong in the first place because of their own essence and ultimately because of the subject's essence.

2R are all states or conditions or affections—in general, attributes—that inhere in or belong to their respective subjects because of some cause. Indeed, for Aristotle the connection between eclipse and 2R is even stronger than this. As we have seen, to explain why an attribute (e.g., eclipse) belongs to its subject (e.g., the moon) is to define what that attribute is (the Definitional Constraint). In the last lines of *APO* 2.2, Aristotle says the same about 2R:

T16 And so, as we say, knowing what something is and [knowing] why it is are the same, and this is the case whether it is without qualification and not some one of the things that belong, or [it is some one] of the things that belong, for example, *that [it has] two right [angles],* or that it is greater or less.³¹ (90a31–4)

To explain why all triangles have 2R is to define what 2R is. So 2R and eclipse are attributes that belong to their subjects because of a cause, where the subject and the cause are parts of the attribute's essence. (2R and eclipse are both in itself₂ demonstrable attributes of their subjects.) And *APO* 2.2 is no anomaly: the parallel between eclipse and 2R re-appears in 2.8 (93a33–5, in T34, Chapter 10§7).

One way in which eclipse and 2R clearly differ is that eclipse is defined partly in terms of its efficient cause (the B term: the earth screening) and 2R is not (for it has no efficient cause). In *APO* 2, Aristotle focuses on attributes defined partly in terms of their efficient causes, not because he thinks these cases require special treatment, but because they clearly exemplify his claim that many demonstrable attributes belong to their subjects because of the essence of the attribute.³² These attributes mark the point at which demonstration and definition converge. Aristotle is interested in eclipse, thunder, and leaf-shedding not as processes or events but as important cases of a certain kind of *definiendum*. He is interested, not in the fact that eclipse is brought about by an efficient cause, but in the fact that its efficient cause features in its essence, as the explanatorily basic part, and serves as the middle in the (Model 2) demonstration showing why the moon is eclipsed. In this way eclipse and 2R are strictly parallel, for the cause of 2R likewise features in its essence and is the middle term in the (Model 2) demonstration showing why triangles have 2R. In other words, as I argued in the previous section, in the *APO* Aristotle treats the efficient cause of eclipse, thunder, etc. as part of the formal cause of each. Again, the fundamental mode of explanation in the *APO* is essence-based explanation.

So far I have argued that in *APO* 2 the entities defined by causally complex essences are (in itself₂) demonstrable attributes the causes of which feature in their essences, and that such entities include eclipse, thunder, leaf-shedding, and 2R. What about the last example on the list above, human being, which is not an attribute but a substance (a subject-kind)? This seems to pose a problem for my view that in the *APO* Aristotle

³¹ Ὡσπερ οὖν λέγομεν, τὸ τί ἐστὶν εἰδέναι ταυτό ἐστι καὶ διὰ τί ἐστίν, τοῦτο δ' ἡ ἀπλῶς καὶ μὴ τῶν ὑπαρχόντων τι, ἢ τῶν ὑπαρχόντων, οἷον ὅτι δύο ὀρθαί, ἢ ὅτι μείζον ἢ ἑλαττον.

³² These attributes also belong because of the essence of the subject. See n28 and Chapter 3§4.

maintains a strict distinction between inquiries about subjects (substances) and those about attributes. If the essences of human being and eclipse are structurally isomorphic, how can there be any significant difference between the inquiries by which we discover them?

My response is this. First, all the evidence for the causally complex essence of human being is from *Metaphysics* 7.17; none is from the *APO*. Now it is true that in *Metaphysics* 7.17 Aristotle explicitly applies the *APO* account of causal inquiry to natural substances. However, he does so in a way that goes beyond the *APO* account. For in the *Metaphysics* he deploys his hylomorphic analysis of human being as a composite of form and matter. We can see this in the essence set out above: the A term identifies some feature or arrangement of human matter (perhaps two-footedness in flesh and blood), a feature that exists for the sake of the human form (perhaps rational soul).³³ However, in the *Organon* in general and in the *APO* in particular Aristotle either does not have or does not use the concept of matter, and so the hylomorphic analysis on which the *Metaphysics* definition depends is not available to him.³⁴ The essence of a natural kind should reflect the nature of its members. According to the *Metaphysics* (and other works), the human species is a natural kind whose members are form-matter composites, and thus the species should be defined by a causally complex essence, which includes formal and material parts.³⁵ According to the *APO*, the human species is a natural kind whose members are primary substances (subjects of attributes, not attributes of any subject), and thus the species is defined by a causally simple essence, which identifies the species' genus and differentia(e).³⁶ In the ontology of the *Organon*, there is simply no adequate description of what it is to be a human being that makes it such as to belong to an underlying subject. In the *Metaphysics*, however, there is: since human beings are hylomorphic composites, the definition can mention both the form and the matter (the underlying subject) in which it inheres. Therefore, on the *APO* account, the essences of eclipse and human being are not structurally isomorphic. Absent hylomorphism, the strict distinction between inquiries about attributes and those about subjects (even about what turn out to be composite substances) remains intact.

8. The A Term

Let's look a little more closely at the A term in causally complex essences (A-C because of B). Consider, for example, 'loss of light' in the essence of eclipse. Its function seems to be to describe eclipse as an *explanandum*. In general, the A term

³³ In this regard we might say that the A term in the human essence signifies not the human form (this would be the B term, which also signifies the final cause) but rather a form-like arrangement of the matter (again, perhaps two-footedness).

³⁴ See Burnyeat 2001: 8, 25, 48, 97–8.

³⁵ For further discussion of hylomorphic definition in the *Metaphysics*, see Peramatzis 2011.

³⁶ For evidence that substances are defined by genus and differentia(e), see *APO* 1.22, 83a39–b9.

identifies the thing whose cause we seek when we inquire about the object to be defined. In this way, the object signified by the A term and the object to be defined are the same. Loss of light, for example, is not what brings about an eclipse; it is what is brought about when there is one. Consider an analogy. Suppose you ask, 'Why did Alex trip?' and I say, 'Because he slipped when he stepped on a banana peel.' Alex's slipping is not the cause your question asks after—it is not the efficient cause of his tripping. If I had only said 'because he slipped' you would have been rightly dissatisfied. Rather, Alex's slipping is a description of his tripping, a description that identifies what the efficient cause brought about.

The same is true of all the A terms in the essences listed above. Each serves as an *explanandum*-fixing description of the *definiendum*—a description that identifies the thing whose cause we seek as something to be explained: eclipse, a loss of light; thunder, a noise; ice, a solidification. Now the description is more general than the *definiendum*. Not every loss of light is an eclipse. Rather, an eclipse is a highly specific loss of light—the kind that affects the full moon outside of its usual cycle of waxing and waning, etc. It is only in this highly specific way that loss of light and eclipse are the same: they are one and the same phenomenon that affects the moon and is caused by the earth screening. To explain why the moon is eclipsed is to explain why the moon loses its light in this specific way and vice versa.³⁷ So the A term seems to be an initial answer to the question 'what sort of thing is it?' and thus it may form part of a preliminary account of the *definiendum*. Its role is to get the object of inquiry into proper *explanandum* form so that we can seek its efficient or final cause.³⁸ (See Chapter 10.)

9. A Missing A Term?

The second example in T15 is harmony, which Aristotle treats slightly differently from eclipse:

- T15 (c) What is harmony? A numerical ratio in high and low. Why does the high harmonize with the low? Because high and low have a numerical ratio. Is it possible for the high and low to harmonize? Is there a numerical ratio between them? Having grasped that there is [we] then [ask], what is the ratio? (90a18–23)

The essence of harmony is: the numerical ratio *r* between high and low notes. This essence has two parts, not three: the cause (numerical ratio *r*) and the underlying subject (high and low notes). Aristotle omits the A term, but he could easily have included 'blending', which he mentions in *Metaphysics* 8.2 (1043a10–11), resulting in a three-part definition (as in the list above in section 6). The fact that Aristotle omits

³⁷ See Charles 1991: 254 n3.

³⁸ There is evidence for the role of the A term as *explanandum*-fixing description in APO 2.8. In 93b7–14 (T30), Aristotle uses 'noise' and 'thunder' interchangeably as the major (A) term in the demonstration of thunder. In explaining why there is thunder in the clouds we explain why there is a certain noise in the clouds, and vice versa. See Chapter 10§3. See also Gotthelf 1987: 181.

‘blending’ confirms what I argued above: although the A and C terms are part of a complete causal analysis, it is the B term that identifies what Aristotle calls ‘the cause’ of the object defined. Since what and why something is are the same, and since why something is is primarily the cause signified by the B term, the B term is primarily what something is, the causally basic part of the essence. The whole essence is the formal cause, but the B term is the privileged part of the formal cause.

There is further evidence for this interpretation in Aristotle’s discussion of leaf-shedding later in *APO* 2.³⁹ He says that broad-leaved plant (C term) is the proper subject of leaf-shedding and that the (efficient) cause—the coagulation of the sap at the stem (B term)—is what leaf-shedding is. He does not mention an A term. This suggests that the truncated version of the essence includes all the crucial explanatory information.

Why does Aristotle sometimes omit the A term?⁴⁰ The A term is an *explanandum*-fixing description of the object to be defined. As such, it plays an important role in inquiry by providing the target *explanandum* for a causal search. Aristotle may think that, for the most part, when the inquirer is in a position to search for the cause of, for example, harmony, she will already grasp an A term. That harmony is a type of blending is not something she discovers in finding the cause. Rather, it is part of what she knows prior to seeking it. Therefore, in stating the results of a successful inquiry, Aristotle sometimes focuses on what is discovered (the cause, the B term), leaving implicit what was known at earlier stages (the A term). In addition, in some cases (such as leaf-shedding) the *definiendum* comes ready-made in *explanandum* form. There is no clearer description of leaf-shedding required to make it the target *explanandum* of the search. Finally, the existence of an A term for this or that demonstrable attribute seems to be a contingent feature of a language. So the fact that in some cases no A term exists—as in the case of, say, 2R—does not reveal anything significant about the thing defined.⁴¹

10. Definition and Explanation

We can sum up the results of our discussion so far by comparing two sets of demonstrations that are implicit in Aristotle’s account in *APO* 2.2 (T15b–c):

(1)

Eclipse belongs to earth screening
Earth screening belongs to moon
 Eclipse belongs to moon

(2)

Loss of light belongs to earth screening
Earth screening belongs to moon
 Loss of light belongs to moon

³⁹ See *APO* 2.17, 99a21–9.

⁴⁰ There is variation in Aristotle’s treatment of these cases. In *APO* 2.10 (94a3–7), where the example is thunder, he omits the A term in stating the answer to the ‘why?’ question and includes it in stating the answer to the ‘what?’ question. In *APO* 2.2 (90a15–18, T15b), he states the A term in answering both the ‘what?’ and the ‘why?’ questions for eclipse.

⁴¹ See Ferejohn 2013: 152.

Harmony belongs to numerical ratio	[Blending] belongs to numerical ratio
<u>Numerical ratio belongs to high and low</u>	<u>Numerical ratio belongs to high and low</u>
Harmony belongs to high and low	[Blending] belongs to high and low

The difference between the two columns is that in 1 the major term is the *definien-dum* term and in 2 it is what I have been calling the ‘A term’. (I have put ‘blending’ in brackets to indicate that Aristotle does not mention it in APO 2.2.) The two columns nicely illustrate my claim that, qua thing caused, the object defined and the object signified by the A term are the same. For this reason, the demonstrations in each column contain the same explanatory information.

They do not, however, contain the same definitional information: the demonstrations in 2 contain more. If we were to read off the definition of eclipse from 1 it would be: eclipse is the moon being screened by the earth. Although Aristotle sometimes presents truncated definitions of this sort (e.g., harmony and leaf-shedding), he may think that they are less adequate than the complete versions, which include the A term, where one is available. The A term is not needed to make the essence co-extensive with the object defined—the B and C terms alone are sufficient, as the truncated definitions show. In *Metaphysics* 8.4 (1044b12–15), Aristotle says that another possible definition (eclipse is loss of light from the moon) is ‘unclear’ because it omits the cause: the earth screening. He may also think that the definition that omits ‘loss of light’ is unclear because it omits what the cause is the cause of. A definition makes clear what the thing is. To do this fully it seems that it should identify what the cause is the cause of in the relevant underlying subject—the A term, where one is available. However, as I noted above, Aristotle is not fussy about this. The type of definition we have been considering aims to reveal the explanation of the attribute that is defined, and since those definitions with only the B and C terms provide all the crucial explanatory information, they suffice as definitions.

11. Subject-Focused Inquiry

In T14, Aristotle says that to seek (1) whether P belongs to S is (ideally) to seek (1') whether there exists a middle term (a cause) that explains why P belongs to S, and to seek (2) why P belongs to S is (ideally) to seek (2') what the middle term is. Aristotle applies the same line of thought to subject-focused questions. Indeed, he says that in all of our inquiries we (should ideally) seek a middle term.⁴² To seek whether S exists without qualification is (ideally) to seek whether there exists a middle term (a cause) for S. To seek what S is is (ideally) to seek what the middle term (the cause) is.⁴³ Schematically:

⁴² APO 2.2, 90a6–7 (T14c).

⁴³ APO 2.2, 89b37–90a1 (T14a), 90a9–11 (in T17).

(3) Does S exist?

becomes

(3') Is there an M such that M is the cause of S?

And

(4) What is S?

becomes

(4') What is the M such that M is the cause of S?

Aristotle imposes the same causal constraint on question (3) as he does on question (1): to seek the existence of S is (ideally) to seek the existence of a cause of S. He also imposes a causal constraint on question (4), parallel to the Definitional Constraint on (2): to seek the essence of S is (ideally) to seek what S's cause is. The Definitional Constraint holds that to explain why P belongs to S is (ideally) to define what P is; for demonstrable attributes, explaining is defining. Now we see that to define what S is is to explain why it is; for subjects, defining is explaining. Here too there is an ontological corollary to Aristotle's claim: the essence of S is its cause.

Aristotle's reformulations of (3) as (3') and (4) as (4') affect how we should conceive of the three stages of inquiry for subjects:

Questions (3')–(4'):

Stage 1: We do not know whether S exists, in the sense that we do not know whether it has an essence (cause), and we seek whether it has one.⁴⁴

Stage 2: We know that S exists, in the sense that we know that it has an essence (cause), but we do not know what it is, and we seek what it is.

Stage 3: We know what S's essence (cause) is.

Aristotle's account of the three stages of subject-focused inquiry tells us something important about the nature of the knowledge we reach at Stage 2 and how we acquire it from Stage 1. At Stage 2, it must be possible for us to know *that* there is an essence (cause) of S without knowing *what* it is. If this were not possible, then it would not be possible to be at Stage 2 without already being at Stage 3. This suggests that in the move from Stages 1 to 2 there must be some way of discovering that S has an essence (cause) without at the same time discovering what it is. And within Stage 1 there

⁴⁴ See Lennox 2004 for an important discussion of some of the difficulties faced by Aristotle's account of this stage of inquiry. Lennox argues that the *APo* is 'silent' on the question of how one is to select and identify the natural kinds to be studied by a science. (87, 99) That is, it is silent on how to answer question (3'). (According to Lennox, Aristotle finally addresses the question in *PA* 1.) I agree with Lennox that the *APo* has little to say about this, but I do not think it is completely silent. In Chapter 11, I attempt to sketch Aristotle's account.

must be some way of seeking whether S has an essence (cause) without already knowing what it is. We encountered a similar set of claims in Aristotle's account of attribute-focused inquiry. In both cases, whether the object of inquiry exists is a genuine question, one that is asked and answered partially independently of the question of the object's essence.

12. Essence and Middle Term

What is it to seek, at Stage 1, whether S has an essence? Aristotle gives some indication in *APO* 2.2 (I quote starting from T14c):

T17 It turns out, therefore, that in all our searches we seek either if there is a middle term or what the middle term is. For the middle term is the cause, and this is what is sought in all these cases. Is [the moon] eclipsed? Is there a cause or not? After these things, having come to know that there is [a cause], we then seek what this is. For the middle term is the cause of the substance (*tēn ousian*) being not this or that but without qualification, or of its being not without qualification but some one of the things [that belong to it] in itself or accidentally.⁴⁵ By '[being] without qualification' I mean the subject (*to hupokeimenon*), for example, moon, earth, sun, or triangle, and by 'one of the things [that belong] in itself or accidentally' [I mean for example] eclipse, equal, unequal, whether it is in the middle or not.⁴⁶ (90a5–14)

Aristotle claims that to seek whether and what a subject-kind S is (ideally) to seek whether and what the cause of S is. For S's cause is its explanatorily basic feature, that which makes it the very thing that it is.

Aristotle calls S's cause a 'middle term'. There is a difficulty with this. Human being is a subject-kind whose members are ultimate subjects of attributes, not attributes of any subject.⁴⁷ How, then, can there be a middle term for human being? A middle term between what and what?⁴⁸ Aristotle's talk of the middle term is no doubt a reference to demonstration. However, unlike in the case of eclipse, there is no demonstration the conclusion of which predicates 'human being' of another subject. What then does

⁴⁵ I retain *tēn ousian* at 90a10, which is omitted by Barnes but found in nearly all the manuscripts. (The manuscript that omits *tēn ousian* omits the next four words as well, but Barnes does not.) I take *tēn ousian* to be the subject of *einai* in the articular infinitive construction that precedes it. For a similar construction, see *APO* 1.1, 71a8–9.

⁴⁶ συμβαίνει ἄρα ἐν ἀπάσαις ταῖς ζητήσεσι ζητεῖν ἢ εἰ ἔστι μέσον ἢ τί ἔστι τὸ μέσον. τὸ μὲν γὰρ αἷτιον τὸ μέσον, ἐν ἅπασιν δὲ τοῦτο ζητεῖται. ἀρ' ἐκλείπει; ἀρ' ἔστι τι αἷτιον ἢ οὐ; μετὰ ταῦτα γινόντες ὅτι ἔστι τι, τί οὖν τοῦτ' ἔστι ζητοῦμεν. τὸ γὰρ αἷτιον τοῦ εἶναι μὴ τοδὶ ἢ τοδὶ ἀλλ' ἀπλῶς τὴν οὐσίαν, ἢ τοῦ μὴ ἀπλῶς ἀλλὰ τι τῶν καθ' αὐτὸ ἢ κατὰ συμβεβηκός, τὸ μέσον ἐστίν. λέγω δὲ τὸ μὲν ἀπλῶς τὸ ὑποκείμενον, οἷον σελήνην ἢ γῆν ἢ ἥλιον ἢ τρίγωνον, τὸ δὲ τί ἐκκλεῖμιν, ἰσότητα ἀνισότητα, εἰ ἐν μέσῳ ἢ μὴ.

⁴⁷ *APO* 1.22, 83a24–5 seems to suggest that in the *APO* the notion of a substance is that of an ultimate subject of predication.

⁴⁸ See Gómez-Lobo 1980, Ross 1949: 611–12.

Aristotle mean when he says that the middle term is ‘the cause of the substance being without qualification’ (90a9–10)?

According to the interpretation of the order of inquiry I sketched in the previous chapter and defend in the next, after we discover S’s essence (by division or induction), we transform our non-noetic knowledge of it into *nous* by using it as the middle term in demonstrations of S’s in itself accidents (demonstrable attributes). When Aristotle calls the essence (cause) of S ‘the middle term’ in T17, he is alluding to its role as the explanatorily basic feature in these (Model 1) demonstrations. So in seeking whether S exists, we are seeking whether S is the sort of thing to have a middle term—that is, an essence. The essence is the middle term for S because it is the feature of S that serves as the middle term in demonstrations that explain S’s in itself accidents. Seeking whether there exists a middle term for or essence of S consists in seeking whether S is the sort of thing to have an essence—that is, whether S is a genuine natural kind.

In this way, Aristotle’s reformulation of (3) as (3’) in *APo* 2.2 confirms what we found in his discussion of (3) in *APo* 2.1: to seek whether, for example, human being exists is to seek whether human being is a genuine, essence-bearing natural kind whose members are primary substances.⁴⁹ In asking (3’) the inquirer seeks to determine whether a candidate natural kind is a genuine one. Therefore, it is not the case that at Stage 1 the inquirer presupposes that those entities that are not genuine natural kinds (e.g., centaur) have already been excluded from the domain of inquiry. Rather, asking (3’) at Stage 1 is the means by which she excludes them.

Conclusion

In *APo* 2.2, Aristotle transforms the four questions of inquiry of 2.1 by introducing the crucial concept of the middle term. In *APo* 2.1–2, he identifies both the questions we should ideally seek to answer in scientific inquiry and the temporal order in which we should ideally seek to answer them. Some of his claims give rise to instances of Meno’s Paradox, his solutions to which I discuss further in Chapter 10§§8–9, 12 and Chapter 12§10. For now, I want to examine more closely Aristotle’s account in *APo* 1–2 of the order of inquiry.

⁴⁹ Or in the case of, e.g., triangle, substance-like entities.

8

The Socratic Picture of the Order of Inquiry

In this chapter, I examine Aristotle's account of the order of inquiry in *APo* 2. In sections 1–2, I consider an objection to the reading of *APo* 2.2 I advanced in the previous chapter, and I discuss two accounts of the order of inquiry based on this objection. In section 3, I respond to the objection and present my own account of the order of inquiry, which I call 'the Socratic Picture' because it owes its inspiration to Socrates's claim in several of Plato's dialogues that before we seek what a thing is like (e.g., whether virtue is teachable) we should first seek what it is, its essence (e.g., what virtue is).¹ In defending this interpretation I aim to show that *APo* 2 contains all the elements of a grand theory of inquiry, one that explains not only our acquisition of isolated bits of knowledge but also our acquisition of expert knowledge of a science as a whole, including (as I suggested in Chapter 6§4) noetic knowledge of its definitional first principles. In section 4, I defend the Socratic Picture by arguing that it is supported by three important methodological passages (one each from *De Anima*, the *Prior Analytics*, and *APo* 2). In section 5, I discuss the account of our acquisition of *nous* suggested by the Socratic Picture. I conclude by addressing an objection to my account.

1. The Intuitionist Picture

Let's consider an aspect of Aristotle's account of inquiry I have so far ignored. We've seen that the four questions divide into two pairs and that there is a temporal order of inquiry within each pair: first one seeks (1) whether P belongs to S, then (2) why it belongs; first one seeks (3) whether S exists, then (4) what it is. A natural question to ask is whether there is a temporal order *between* the two pairs. Do we first inquire about attributes and then about subjects? Or is it the other way around? Or is there a more complicated order? Aristotle thinks that we cannot seek whether P belongs to S or what S is unless we know that S exists. Therefore, we must pursue question (3) first. So we can rule out the view that we pursue both attribute questions prior to

¹ See, e.g., *Laches* 190b7–c2, *Meno* 71a3–b8, 86d3–e3.

both subject questions (i.e., (1), (2), (3), (4)), and any other view that does not place (3) first. Several other possibilities remain. To decide among them I need to return to the account of attribute-focused inquiry I presented in the previous chapter.

As we saw, in *APo* 2.2 Aristotle transforms the four questions of 2.1:

- | | |
|-----------------------------|---|
| (1) Does P belong to S? | → (1') Is there an M such that M is the cause of P's
belonging to S? |
| (2) Why does P belong to S? | → (2') What is the M such that M is the cause of P's
belonging to S? |
| (3) Does S exist? | → (3') Is there an M such that M is the cause of S? |
| (4) What is S? | → (4') What is the M such that M is the cause of S? |

I stated that Aristotle's talk of a 'middle term' in connection with (1') clearly refers to demonstration.² To seek whether P belongs to S is (ideally) to seek whether there is a cause that can feature as the middle term in a demonstration proving that and explaining why P belongs to S—that is, it is to seek whether the proposition 'P belongs to S' is demonstrable. If it is demonstrable, then we seek what the middle term or cause is, (2'). I also argued that the move from (1) to (1') reflects the inquirer's concern to distinguish demonstrable facts from chance connections, which she then excludes from the domain of further inquiry. If there is no middle term that explains why P belongs to S, then she ceases inquiring about P, either because it does not belong to S or because it belongs by chance.

However, one might object that I have not made room for another possibility: the enquirer concludes that there is no middle term that explains why P belongs to S because she discovers that P is part of S's essence, so that the connection between them is immediate (i.e., indemonstrable). The objector might further argue that ignoring this possibility strips question (1') of much of its heuristic value. In concluding that P belongs essentially to S the inquirer makes an important scientific discovery and takes a significant step toward answering question (4'): what is S's essence? On this view, (1') provides her with a means of identifying not only demonstrable facts but definitional ones too—not only conclusions but first principles. Indeed, the objector might point out, this is a natural way of reading (1'). To ask whether an attribute is demonstrable is also to ask whether it is indemonstrable, and an attribute can be indemonstrable in one of two ways: either because it belongs by chance or because it belongs essentially. There is a hint of this idea in *APo* 2.2:

- T14** (a) when, having come to know either the fact that or whether it is either partially or without qualification, we seek in turn the reason why (*to dia ti*) or what it is (*to ti esti*), we are then seeking what the middle term is. (89b38–90a2)

² See *APo* 2.2, 89b37–90a9 (T14).

On the objector's reading, Aristotle is saying that once we have discovered a fact of the form 'P belongs to S', *if* we then seek its cause, we seek what the middle term is. This leaves room for discovering facts of the form 'P belongs to S' for which we do *not* seek a cause (middle term) because P is part of S's essence. And such facts are discovered by answering question (1').

All told, the objector's view is that in asking (1') the inquirer expects one of four outcomes:

- (a) P does not belong to S (no middle term).
- (b) P belongs to S by chance (no middle term).
- (c) P belongs to S essentially (no middle term).
- (d) P belongs to S demonstrably (middle term).

If this is right, then by answering (1') the inquirer identifies both S's demonstrable attributes and its essential ones. So in the order of inquiry questions (1') and (4') are answered at the same time. Assuming, as Aristotle does, that we cannot seek whether P belongs to S unless we know that S exists, we ask the four questions in the following order: (3'), (1')/(4'), (2'). On this view, which for reasons I shall soon explain I call 'the Intuitionist Picture',³ there are four stages of inquiry covering both subject- and attribute-focused searches:

Intuitionist Picture:

- At Stage 1, the inquirer seeks whether a subject-kind S exists, in the sense that she seeks whether S has an essence.
- At Stage 2, she knows that S exists, in the sense that she knows that S has an essence, and she seeks at the same time what its essence is and what its demonstrable attributes are.
- At Stage 3, she knows what S's essence is and what its demonstrable attributes are, and she seeks the causes of these.
- At Stage 4, she knows both what S's essence is and the causes of its demonstrable attributes—she has achieved complete scientific knowledge of S.

The key to the Intuitionist Picture is Stage 2. Here we do not inquire about only one attribute of a subject-kind in isolation from the rest. Rather, we engage in a broad search for its attributes, both demonstrable and essential. We begin at Stage 1 with a single candidate subject-kind, and the goal we hope to achieve by Stage 4 is complete scientific knowledge of it, including knowledge of all or most of its demonstrable attributes, their causes, and its essence. An advantage of this view is that it makes inquiry holistic, which is in keeping with some of Aristotle's most important remarks on the subject. (See T18–20 in section 4.)

³ See Lennox (2001a: 161–2) for a clear and concise discussion of both the Intuitionist Picture and what in the next section I call 'the Explanationist Picture' (which Lennox defends).

Stage 2 has another important feature. It is natural to wonder how the inquirer is able to discover at this stage whether a given attribute *P* belongs to its subject *S* demonstrably or essentially. Recall that the inquirer does not yet know what *S*'s essence is. Rather, this is one of the things she is seeking to discover. On the Intuitionist Picture, when the inquirer determines (presumably by empirical means) that *P* belongs to *S* always or for the most part (and thus not by chance), she at the same time grasps, by exercising her faculty of intuitive discovery (i.e., *nous*), either that *P* belongs to *S* essentially or that it belongs demonstrably, depending on what kind of attribute *P* is.⁴ The intuitionist's claim is that essential attributes are self-evident: to a mind suitably endowed with the faculty of intuitive discovery and suitably prepared by experience and empirical inquiry (of the sort that occurs at Stages 1–2), an attribute's essentiality is immediately obvious. The mind only needs to grasp that an essential attribute belongs to its subject in order to grasp that it belongs to it *as such*. Presumably it will also be evident to such a mind that an attribute belongs demonstrably, if only because it lacks the obvious essentiality of the other kind of attribute.

Although the Intuitionist Picture has a venerable pedigree, appearing in different forms of traditional Aristotelianism and defended by several important contemporary commentators, it has come under attack in recent decades.⁵ The attack has been waged on at least two fronts. First, the view lacks textual support. Especially but not only in the *APo*, Aristotle consistently characterizes *nous* not as a faculty for *acquiring* knowledge of first principles (including definitions) but for *knowing* them, once the hard work of acquisition is done. In addition, as I hope to show in the rest of this chapter and in Chapters 10–13, Aristotle's account of scientific inquiry contains all the elements of a complete explanation how we acquire knowledge of definitions by outlining a number of methods (demonstration, division, and induction) none of which appeal to a faculty of intuitive discovery.

The second front on which the Intuitionist Picture has been attacked is philosophical. The view is not particularly satisfying. The interesting question is how we discover that an attribute is part of the essence of its subject. The Intuitionist Picture appeals to perception, experience, and empirical inquiry in just the way one would expect given Aristotle's remarks on the subject—but then stops short, appealing to a mysterious faculty in order to deliver us the relevant knowledge. In this way it leaves

⁴ For *nous* as a faculty of intuitive discovery, see Bayer 1997, Irwin 1988: 134–50, Kahn 1981, Ross 1949: 84–6. (I discuss this view as it applies to *APo* 2.19 in Chapter 13§§1–2.) It is important to note that experience and empirical inquiry play a crucial role in intuitionist accounts. This is especially clear in Irwin (1988: 136) (see also Ross 1949: 86) who writes: 'The acquisition of *nous* [of first principles] is not meant to be magical, entirely independent of inquiry.' Experience and empirical inquiry are preparatory stages for intuition, which is needed, in Irwin's view, for the justification of first principles, inquiry being insufficient for that task. I attempt to capture this aspect of the intuitionist view by depicting intuition as operating within Stage 2, as the outcome of the inquirer's empirical search for a subject's attributes. In my view, while intuition is not entirely independent of inquiry, there is still something mysterious about it. (See later in this section.)

⁵ See Barnes 1993: 259–71, Bronstein 2012 and Chapter 13§§1–2, Burnyeat 1981, Charles 2000: 245–73, Kosman 1973.

off right at the point at which the question becomes most interesting. Arguably the more philosophically satisfying view follows Aristotle all the way, finding in the empirical methods he outlines the whole story of how we come to know definitional first principles. The question we now need to examine is what it looks like to follow Aristotle all the way. As we shall see, there are competing interpretations of what we find.

2. The Explanationist Picture

In place of the Intuitionist Picture, a number of commentators have defended what I shall call 'the Explanationist Picture' of the order of inquiry.⁶ The explanationist begins with the same objection to my interpretation of question (1') is there an M such that M is the cause of P's belonging to S?—as the intuitionist does. I argued that the question asks whether an attribute P belongs to its subject S demonstrably. The objection is that this ignores the possibility that P might turn out to belong to S essentially. By answering 'no' to question (1'), as I have interpreted it, the inquirer lumps together two very different kinds of indemonstrable attribute: those that belong by chance and those that belong essentially.

The explanationist parts ways from the intuitionist on the question of how best to leverage this objection into a proper account of Stage 2 (the stage after the existence of the subject-kind has been established). The explanationist agrees with the intuitionist that at Stage 2 the inquirer pursues question (1'). For the explanationist, the correct account of (1') should not have the inquirer ignore the possibility that P belongs to S essentially (this is the problem with my view). But we also should not expect her to be able to discover in every case whether P belongs demonstrably or essentially (this is the problem with intuitionism). Discovering which attributes are demonstrable and which are essential comes later, as a result of the hard work of causal inquiry. What we can expect the inquirer to do at Stage 2 is discover that P belongs to S by necessity and thus not by chance.⁷ From this she can infer that P is either a demonstrable or an essential attribute of S—but normally at this stage she will not know which of these two kinds of attribute it is. So, whereas for the intuitionist question (1') admits of four possible answers, for the explanationist it admits of three:

- (a) P does not belong to S (no middle term).
- (b) P belongs to S by chance (no middle term).
- (c) P belongs to S by necessity (no middle term or middle term).

On this reading the inquirer at Stage 2 does not seek whether the proposition 'P belongs to S' is demonstrable, as she does on the formulation of (1') I presented.

⁶ See Charles 2000, Kosman 1973, Lennox 2001a: 161–2 and 2001b.

⁷ In what follows, what I call the 'necessary attributes' of a subject are the attributes that belong always or for the most, even though those that belong only for the most part are not necessary strictly speaking. See Chapter 2§3 n29.

Rather, she seeks whether the proposition meets a necessary but not a sufficient condition for being demonstrable, namely, holding by necessity. (It is not sufficient because if *P* is part of *S*'s essence then *P* belongs to *S* by necessity but not demonstrably.)

The explanationist's account of Stage 2 points toward a different picture of the order of inquiry. At Stage 2 the inquirer's question is whether *P* belongs to *S* by necessity. This question is neutral between two ways of belonging—demonstrably and essentially—and recognizes the inquirer's epistemic limitations at this early stage in her search. First she collects all or most of *S*'s necessary attributes, and only then, at Stage 3, does she sort out which are demonstrable and which essential. She does so by determining which can be explained and which do the explaining, until she reaches attributes that are explanatorily basic. That is, at Stage 3 she seeks the causes of the attributes she collected at Stage 2, and she seeks them among those same attributes.⁸ Over time she discovers that some attributes have causes but are not causes of other attributes, some have causes and are causes of other attributes, and the rest are causes but are not caused by any others—it is these, she discovers, that form *S*'s essence. For example, the inquirer knows that the subject-kind *broad-leafed plant* exists and that plants of this sort shed their leaves, and she seeks to explain why. She seeks the cause among broad-leafed plant's other necessary attributes, which she has collected. When she finds the cause—the coagulation of sap at the stem of the leaf—she knows that leaf-shedding is not part of the essence of broad-leafed plant. She is now one step closer to knowing at least part of what the essence is: it may be the cause of leaf-shedding (coagulation of sap), or what causes that, or what causes that, and so on. Or, to use a different example, she knows that the subject-kind *human being* exists and that human beings are rational and she seeks the cause of this. She finds that there is none; rather, being rational explains other attributes of human beings but is not explained by any of them, and so she concludes that rationality is part of the human essence.

The key to this picture of inquiry is this: by seeking the causes of a subject-kind's necessary attributes the inquirer at the same time defines what that subject is. In other words, she answers questions (2') and (4') at the same stage of inquiry (Stage 3), in a single complex search, one that depends on her prior knowledge of all or most of the subject-kind's necessary attributes. Thus the order of inquiry is: (3'), (1') (suitably amended), (2')/(4'). This gives us four stages covering both subject- and attribute-focused searches:

Explanationist Picture:

- At Stage 1, the inquirer seeks whether a subject-kind *S* exists, in the sense that she seeks whether *S* has an essence.

⁸ If she does not find them there she will have to return to Stage 2 and collect more attributes.

- At Stage 2, she knows that S exists, in the sense that she knows that S has an essence, and she collects all or most of S's necessary attributes.
- At Stage 3, she knows all or most of S's necessary attributes, and she seeks to identify which are demonstrable and which are essential, and she does so by seeking their causes.
- At Stage 4, she knows both what S's essence is and the causes of all or most of its demonstrable attributes—she has achieved complete scientific knowledge of S.

This is an attractive picture of Aristotle's account of inquiry. Like the Intuitionist Picture, it makes inquiry holistic. The inquirer does not seek facts about S in isolation from one another. Her goal is complete scientific knowledge of the whole subject-kind, a goal she pursues by collecting the facts at one stage and seeking their causes, including S's essence, at another. Unlike the Intuitionist Picture, however, the Explanationist Picture brings together in a compelling way our practices of explaining and defining.⁹ The inquirer defines a subject-kind by seeking the causes of its necessary attributes. She seeks its essence amongst the attributes she already knows, and she does so by determining which among them are explanatorily basic. On this view, seeking the essence is not mainly a matter of finding new facts or information. Rather, it is a matter of organizing one's knowledge, of turning the collection of facts one has accumulated (at Stage 2) into a systematic body of knowledge, a science, or part of one (at Stage 3). Put differently, the process of seeking the essence of S is the same as the process of seeking the demonstrations of S's necessary, non-essential attributes (its in itself accidents). For in working out what can be demonstrated from what, the inquirer discovers what cannot be demonstrated from anything: the essence.

In one form or another the Explanationist Picture has become a (perhaps the) dominant interpretation of Aristotle's account of scientific inquiry. I now want to argue against it. While I agree with the explanationist's rejection of intuitionism, I believe the texts support a third view of the order of inquiry: the Socratic Picture.

3. The Socratic Picture

According to the Explanationist Picture, when the inquirer seeks to answer (1') she seeks whether an attribute belongs to its subject by necessity (always or for the most part), without regard for whether it belongs demonstrably or essentially. However, this interpretation does not fit well with what Aristotle says in *APo* 2.2. He states clearly that in seeking whether P belongs to S the inquirer seeks whether there is a *cause* of its belonging, and he is also clear that the cause, if it exists, is the *middle term*.

⁹ See Charles 2000 for a fully developed account along these lines.

I quote from the relevant passage (first presented in the previous chapter), italicizing the crucial bits:

T14 (a) When we seek the fact that or whether something is without qualification, we are seeking *whether or not there is a middle term* for it; and when, having come to know either the fact that or whether it is either partially or without qualification, we seek in turn the reason why or what it is, we are then seeking *what the middle term is*. . . . (c) It turns out, therefore, that in all our searches we seek *either if there is middle term or what the middle is*. *For the middle term is the cause, and this is what is sought in all these cases.* (89b37–90a1, 90a5–7)

Any middle term that is the cause of an attribute's belonging to its subject must be the middle term in a demonstration. Therefore, if the inquirer seeks whether there is a middle term that explains why P belongs to S, which is what Aristotle says she does, then she seeks whether 'P belongs to S' is demonstrable. In addition, if the inquirer discovers and thus knows that 'P belongs to S' is demonstrable, then she knows that P is not part of S's essence. For if P is a demonstrable attribute of S, then P is not an essential attribute of S.

This is the first key move in the Socratic Picture: by answering (1') in the affirmative, the inquirer discovers not only that P is a demonstrable attribute of S but also that is *not* an essential one. The explanationist resists this move because it smacks of intuitionism. If by answering (1') the inquirer discovers what is *not* in S's essence (but is still a necessary attribute of it), then this opens the door to the view that by answering (1'), in intuitionist fashion, she discovers what *is* in S's essence. To avoid intuitionism the explanationist limits what the inquirer discovers as a result of answering (1'): she discovers only that P belongs to S by necessity, not that it belongs demonstrably or that it belongs essentially.

I want to suggest, however, that there is a middle ground between the two positions, one that makes better sense of Aristotle's claims in *APo* 2.2. The question is, how can the inquirer discover that P belongs to S demonstrably and thus not essentially? The intuitionist has a ready answer: by exercising her faculty of intuitive discovery. Recoiling from this, the explanationist denies that she can make the discovery in question. The defender of the middle ground asserts that she can make the discovery, and make it intuition-free, *if* she already knows what S's essence is. That is, having prior knowledge of S's essence is a sufficient condition for being able to discover what S's demonstrable attributes are. For Aristotle's view is that P is a demonstrable attribute of S if and only if P belongs to S (i) by necessity but (ii) not essentially. If the inquirer knows what S's essence is, she has a means of discovering which attributes meet both conditions. For if she knows that S's essence is, say, GD_1D_2 , then, when she discovers (as a result of empirical inquiry) that P belongs to S by necessity, she at the same time discovers that P is not part of S's essence, for P is not G, D_1 , or D_2 . Since she knows that P belongs to S (i) by necessity but (ii) not essentially, she knows (or is in an excellent position to infer) that P belongs to

S demonstrably—that is, she answers question (1') in the affirmative.¹⁰ On the Socratic Picture, then, question (1') admits of three possible answers:

- (a) P does not belong to S (no middle term).
- (b) P belongs to S by chance (no middle term).
- (c') P belongs to S by necessity (middle term).

In this way my account can answer the objection I raised above. My interpretation of (1') does not lump together chance and essential attributes of S. Rather, the inquirer uses (1') as a way of identifying S's demonstrable attributes and filtering out its chance attributes, and she can do so because she already knows its essential ones.

The view I have just proposed provides a non-intuitionist account of how the inquirer answers (1'). But in doing so it makes better sense of Aristotle's claims in *APo* 2.2 than the Explanationist Picture does. For Aristotle's view is clear: in seeking whether P belongs to S, the inquirer seeks whether there is a cause (middle term) of P's belonging to S—and this is just to seek whether P is a demonstrable attribute of S. Unlike the Explanationist Picture, the view I have proposed embraces what Aristotle's claim implies—namely, that in discovering which attributes are demonstrable the inquirer discovers which are non-essential—but it does so without succumbing to intuitionism. One advantage of this reading is that it explains why Aristotle does not mention essential attributes in his account of (1'): he assumes that they are discovered prior to it. For this reason I call this the Socratic Picture of the order of inquiry: like Socrates, Aristotle thinks that we should first seek what a thing's essence is and then seek its other attributes.

A few points of clarification are in order here. First, I have argued that prior knowledge of S's essence is a sufficient condition for being able to discover its demonstrable attributes as such. To make the relevant discoveries, however, one must of course conduct the relevant (empirical) inquiries: one must seek whether in fact P belongs to S by necessity (i.e., always or the most part). My claim is that if one discovers that P does so belong, and if one knows what S's essence is, then one discovers that there is a cause of P's belonging to S, just as Aristotle claims in *APo* 2.2. Second, I have not claimed that having prior knowledge of S's essence is in every case a necessary condition for being able to discover S's demonstrable attributes as such, only that it is a sufficient one. Perhaps in some cases one can discover that an attribute belongs demonstrably to a subject without knowing the subject's essence. Take lunar eclipse. If one determines that the moon is eclipsed always or for the most part and thus not by chance, then perhaps one can infer that eclipse is a non-essential, demonstrable attribute of the moon without knowing what the moon's

¹⁰ My account assumes that if P belongs to S by necessity but not essentially, then P belongs to S demonstrably. I accept that what we might call 'meta-attributes', such as being self-identical, are counter-examples (they are necessary but neither essential nor demonstrable). However, I see no evidence that Aristotle is concerned with these in the *APo*.

essence is. For being eclipsed is not the right sort of thing to feature in the moon's essence; it is something that happens to the moon, not (part of) what makes the moon the very thing that it is.¹¹ The same applies to thunder, which occurs in the clouds—another prominent example in *APo* 2.

The difficulty that the Socratic Picture is designed to address is that the non-essentiality of other demonstrable attributes is not nearly as clear as it is in the case of eclipse and thunder. Take leaf-shedding, which belongs to all and only broad-leaved plants. Aristotle thinks that it is a demonstrable attribute of its subject, not part of its essence. I submit that this would be difficult (perhaps impossible) to know about leaf-shedding without prior knowledge of what the essence of broad-leaved plant is. Suppose the inquirer discovers that broad-leaved plants shed their leaves before she knows their essence. It might seem to her that broad-leaved plants should be defined partly in terms of their deciduousness. Or, less conclusively, she might wonder whether this is so, and thus fail to conclude that their deciduousness is demonstrable. Or take 2R, which belongs to triangle. 'Rectilinear figure whose interior angles are equal to two right angles' might appear to an inquirer at an early stage in her search as a plausible candidate for triangle's essence. In these cases, prior knowledge of the subject's essence does seem necessary for discovering that the attribute is demonstrable.

Suppose Aristotle had some principled way of distinguishing eclipse and thunder on the one hand from leaf-shedding and 2R on the other—some criterion by which to determine which demonstrable attributes wear their non-essentiality on their sleeve, so to speak, and which do not. In that case one could argue that we can inquire profitably about some demonstrable attributes of a subject-kind without prior knowledge of its essence, namely, about those attributes that, though necessary, are obviously non-essential. However, Aristotle does not attempt to distinguish the two types of demonstrable attribute in any principled way, and for good reason. The extent to which it is obvious that a demonstrable attribute is non-essential will often and largely depend on facts about the inquirer, not on facts about the attribute itself. In particular, it will depend on what is better known to the inquirer at her stage of intellectual development. However, different things are better known to different people (and to the same person at different times), so that different demonstrable attributes will seem more or less obviously non-essential to different people (and to the same person at different times). The distinction between the two types of demonstrable attribute—obviously and non-obviously non-essential—is not inscribed in the order of nature; it is a byproduct of the order of learning. Because Aristotle wants to present a general account of inquiry that covers the full range of subject-kinds and attributes, it is natural that he would treat all demonstrable attributes in the same way: to inquire profitably about them, it helps a great deal (and in some cases it is necessary) to know in the first place the relevant subject-kind's essence.

¹¹ I am grateful to Hailey Huget for raising this issue.

A third point of clarification. I have argued that knowing what S's essence is is sufficient, and sometimes even necessary, for being able to discover S's demonstrable attributes as such. This is compatible with the view that before we discover S's essence we have low-level knowledge of some of S's attributes, both demonstrable and essential ones, though not *as such*. Indeed, it is reasonable to think that in the proper order of inquiry we begin with low-level knowledge of some of S's attributes, which we then use to aid our search for its essence. (See Chapter 12§§10–12.) The principal claim of the Socratic Picture is if the inquirer has prior knowledge of S's essence, she is able to acquire the more demanding form of knowledge of S's attributes introduced in *APo* 2.2—namely, knowledge that P is a demonstrable attribute of S (i.e., knowledge that P belongs to S by necessity but not essentially).

Finally, I have argued that in the proper order of inquiry, we first discover S's essence and then what its demonstrable attributes are. Consider an objection. Suppose that S's essence is a cause of its demonstrable attributes, a view Aristotle seems committed to in *APo* 1. It would seem to follow that if we know what S's essence is, then, whenever we discover that P is a demonstrable attribute of S, we discover at the same time what P's cause is, namely, S's essence. The problem is that although Aristotle thinks that there are cases in which we make the two discoveries at the same time (that there is a cause and what it is), these are the exception, not the rule.

To defend the Socratic Picture I need to show that it is possible to know what S's essence is, know that S is demonstrably P, and not know the cause of S's being P, all at the same time. There are at least two things to say here. First, I argued in Chapter 3§6 that although all of S's demonstrable attributes belong because of S's essence (i.e., all are in itself accidents), most of these belong also because of the attribute's essence (i.e., most are also in itself₂ attributes). In most cases, then, after discovering that S is demonstrably P, the inquirer will have to seek P's essence. Since in these cases P belongs to S directly because of P's essence and indirectly because of S's, the inquirer can know that S is demonstrably P and what S's essence is and not know the complete explanation of why S is P. In fact, the link between P and S's essence may be quite distant, spanning several syllogistic steps, and requiring a good deal of causal inquiry to bridge it. Second, even if P is explained directly by S's essence, the inquirer might not grasp this right away. For although the connection between S and its essence (i.e., the minor premise) is clear, the connection between P and S's essence (i.e., the major premise) might not be.

So far I have argued that in Aristotle's view before we answer (1')—is there a cause of P's belonging to S?—we should first answer (4')—what is S's essence? If this account of the order of inquiry is right (and I believe that it is), it follows that we do not answer questions (2') and (4') in a single, complex stage of inquiry, as we do on the Explanationist Picture. The order is more straightforward: first we answer subject-questions, then attribute-questions—(3'), (4'), (1'), (2'). This gives us five stages in total:

Socratic Picture:

- At Stage 1, the inquirer seeks whether a subject-kind S exists, in the sense that she seeks whether S has an essence (cause).
- At Stage 2, she knows that S exists, in the sense that she knows that S has an essence, and she seeks what S's essence is.
- At Stage 3, she knows what S's essence is, and she seeks whether P belongs to S by seeking whether there is a cause that explains why P belongs to S.
- At Stage 4, she knows that P belongs to S, in the sense that she knows that there is a cause that explains why P belongs to S, and she seeks what the cause is.
- At Stage 5, she knows both what S's essence is and why P belongs to S.

As we saw in the previous chapter, for Aristotle, to seek (at Stage 4) what the cause is that explains why P belongs to S is (ideally) to seek what P is, its essence. Thus Aristotle thinks that we define demonstrable attributes by means of demonstration and explanation. However, it does not follow that we define the subjects of demonstrable attributes in this way. I argue in Chapter 12 that the evidence in *APo* 2 suggests that we define S (at Stage 2) in non-explanationist fashion by means of division (if S is a subordinate subject-kind) or induction (if S is a primary). Seeking why P belongs to S (i.e., what P is) is different from seeking what S is. Demonstrable attributes and their subjects are different kinds of thing for which different methods of inquiry (demonstration and division/induction, respectively) are appropriate.¹²

Above I noted that one of the advantages of both the Intuitionist and Explanationist Pictures is that they make inquiry holistic. It may seem that my account falls short in this regard, but I believe it does not. Rather, the Socratic Picture contains all the elements of a grand theory of inquiry, one that explains how we acquire knowledge of a science as a whole, including noetic knowledge of its definitional first principles.

In Chapter 6§4, I gave a brief sketch of how this works. We can now think of it in terms of the stages of inquiry. At Stage 2, the inquirer acquires non-noetic knowledge of the essence and definition of a subject-kind S by means of division or induction. We can infer from the passages I discuss in the next section that at Stage 3 the inquirer then gathers together all or most of S's demonstrable attributes. (Again, on my view she is able to do this because she can discern which attributes *are* demonstrable, given that she knows

¹² In this way I arrive, by a different route, at an account similar to Ferejohn's (1991). Ferejohn argues that prior to demonstration there is a pre-syllogistic 'framing' stage in science in which we use division to establish the science's primary and immediate premises. (For a similar view, see Lennox 1987: 97–9.) However, I am even more optimistic than Ferejohn is about the usefulness of division (and Ferejohn is already more optimistic than most commentators). For I believe that division is the way we discover essential attributes of a subordinate subject-kind (species) in the first place (see Chapter 12), whereas Ferejohn thinks that in division we establish primary and immediate premises by using essential attributes we had previously discovered by non-divisional means (1991: 23–4; see also Modrak 2001: 93–4). Henry (2011b) argues that in the *Phaedrus* and other dialogues Plato proposes collection and division as a method of obtaining, at an early point in an inquiry, an object's definition, which one needs in order to investigate it further. This is remarkably close to the view I argue Aristotle adopts in the *APo*.

what S's essential attributes are.) Then at Stage 4 she seeks the causes of these demonstrable attributes. In doing so she moves from (i) the non-noetic knowledge of S's essence she acquired (by division or induction) at Stage 2 to (ii) noetic knowledge of it. That is, at Stage 4 she acquires *nous* of S's essence, and she does by explaining S's demonstrable attributes from it.¹³ The result, at Stage 5, is knowledge of the whole science of S.

4. Three Methodological Passages

I now want to argue that in three important methodological passages Aristotle presents the outlines of the Socratic Picture.

I begin with a passage from *De Anima*:

T18 (a) It seems that not only is knowing the essence (*to ti esti gnōnai*) useful for apprehending the causes (*tas aítias*) of the [demonstrable] attributes (*tōn sumbebēkotōn*) of substances (just as in mathematics [knowing] what straight and curved are, or what line and surface are, is [useful] for discerning how many right [angles] the angles of a triangle are equal to), but also conversely, [knowing] the [demonstrable] attributes contributes a great part (*sumballetai mega meros*) to our knowledge of the essence (*pros to eidenai to ti estin*). (b) For whenever we are able to give an account in conformity to our experience of all or most of the [demonstrable] attributes, at that time we will be able to speak best about the substance. (c) For in every demonstration the essence is a principle (*archē*), so that whichever definitions do not [enable us] to come to know (*gnōrizein*) the [demonstrable] attributes, and do not even make it easy [for us] to form a guess about them, it's clear that all [these definitions] are stated in a dialectical and empty manner.¹⁴ (*DA* 1.1, 402b16–403a2)

Aristotle makes two principal claims (I reverse the order in which they appear in the text):

- (i) Knowing the demonstrable attributes of a substance (subject-kind) S 'contributes a great part to our knowledge of [S's] essence.'¹⁵

¹³ See Kosman 1973: 380–92. Seeing how S's essence explains its demonstrable attributes is how we acquire *nous*. However, knowing that S's essence explains its demonstrable attributes is not what *nous*, once acquired, consists in. Rather, this is what demonstrative scientific knowledge consists in. (See Chapters 4§1, 4§6, and 6§4.) It seems to me that Kosman sometimes overlooks this distinction.

¹⁴ ἔοικε δ' οὐ μόνον τὸ τί ἐστι γινῶναι χρήσιμον εἶναι πρὸς τὸ θεωρῆσαι τὰς αἰτίας τῶν συμβεβηκότων ταῖς οὐσίαις (ὥσπερ ἐν τοῖς μαθήμασι τί τὸ εὐθὺ καὶ τὸ καμπύλον, ἢ τί γραμμὴ καὶ ἐπίπεδον, πρὸς τὸ κατιδεῖν πόσαις ὀρθαῖς αἱ τοῦ τριγώνου γωνίαι ἴσαι), ἀλλὰ καὶ ἀνάπαλιν τὰ συμβεβηκότα συμβάλλεται μέγα μέρος πρὸς τὸ εἰδέναι τὸ τί ἐστιν· ἐπειδὴν γὰρ ἔχουμεν ἀποδιδόναι κατὰ τὴν φαντασίαν περὶ τῶν συμβεβηκότων, ἢ πάντων ἢ τῶν πλείστων, τότε καὶ περὶ τῆς οὐσίας ἔξομεν λέγειν κάλλιστα· πάσης γὰρ ἀποδείξεως ἀρχὴ τὸ τί ἐστίν, ὥστε καθ' ὅσους τῶν ὀρισμῶν μὴ συμβαίνει τὰ συμβεβηκότα γνωρίζειν, ἀλλὰ μὴδ' εἰκάσαι περὶ αὐτῶν εὐμαρές, δῆλον ὅτι διαλεκτικῶς εἴρηται καὶ κενῶς ἅπαντες.

¹⁵ I assume that the mathematical examples in T18a (straight, curved, line, surface) are substance-like entities. 'Straight' and 'curved' are more difficult to take this way, but perhaps they are shorthand for 'straight line' and 'curved line'. See *APo* 2.13, 96b18 (in T19a, below).

- (ii) Knowing S's essence 'is useful for apprehending the causes of [S's] demonstrable attributes'.

It might seem that (i) and (ii) occur at temporally distinct stages: first we collect S's attributes, from which we work out its essence (i.e., (i)); and once we know its essence, we then turn back and explain its non-essential but necessary attributes (i.e., (ii)). (This is roughly the Explanationist Picture.) In contrast, I want to argue that careful attention to the passage, including Aristotle's choice of terms, reveals that (i) and (ii) represent different aspects of one and the same activity, which takes place at Stage 4.

In presenting (i) Aristotle uses the term *ta sumbebēkota* for the attributes the knowledge of which contributes to knowledge of the essence. This is Aristotle's standard term for accident. However, it here has the special significance of the in itself accidents of a subject-kind—that is, the demonstrable attributes that belong to a subject-kind S (at least partly) because of S's essence.¹⁶ Aristotle could have used a different term, *ta huparchonta* ('the things that belong'), which is neutral between demonstrable and essential attributes. (See T20 below.) His use of *ta sumbebēkota* suggests that his claim is that knowing a subject's demonstrable attributes *as such* contributes to our knowledge of its essence. As he goes on to explain in the next sentence ('For (*gar*)...', T18b), the point at which we have reached the highest cognition of something's essence is the point at which we can use it to explain its demonstrable attributes. The idea, I suggest, is not that we first know the demonstrable attributes as such and then discover the essence. (As I argued in the previous section, it is difficult to see how we could identify a thing's demonstrable attributes as such without already knowing its essence.) Knowing the demonstrable attributes makes its contribution in a different way. Once we know both the attributes and the essence, we use the essence to explain the attributes. And doing so contributes to our knowledge of the essence, knowledge we *already* have. In other words, when Aristotle, in presenting (i), talks of knowing the attributes, he means knowing them *as explained* by the subject's essence. Again, this is why he explains (i) in T18b ('For...') by saying that we have the highest knowledge of a thing's essence when we can explain its demonstrable attributes from it.¹⁷ It is when we explain the attributes from the essence that our knowing them contributes to our knowing the essence.

If I am right that the phrase 'knowing the attributes' in (i) means 'knowing them as explained by the essence', what does Aristotle mean by saying that this knowledge 'contributes a great part to our knowledge of the essence' (*sumballetai mega meros*

¹⁶ 'At least partly' because the attribute's essence may also be part of the explanation. See Chapter 3§4.

¹⁷ Being able to explain S's demonstrable attributes from its essence is a *sign* that one has the highest knowledge of its essence, namely, *nous*. It is not what having *nous* of S's essence consists in. Rather, it is what having demonstrative scientific knowledge of S's essence consists in.

pros)? In Aristotle's Greek, 'x contributes to (*sumballetai pros to eidenai to ti estin*) y' is a stock expression usually meaning 'x contributes to y's being or coming into being'—that is, it means 'x is a cause of y'.¹⁸ To say that x contributes 'a great part' to y is to say that x is a (or the) principal causal factor in y's being or coming into being.¹⁹ So knowing the attributes helps bring about some kind of knowledge of the essence. What kind of knowledge? It is not responsible for our *initial* acquisition of knowledge of the essence. For if (as I have argued) we know the attributes by knowing them as explained by the essence, then the initial acquisition must have already taken place. Rather, knowing the attributes (as explained by the essence) is responsible for our acquisition of *noetic* knowledge of the essence—it is the means by which we cultivate the knowledge we already have. *Nous* of the essence is something that grows and develops in us over time. So this is the way in which knowledge of the demonstrable attributes 'contributes a great part to our knowledge of the essence': by explaining them from S's essence we move from non-noetic knowledge of it to *nous*. We also move to demonstrative scientific knowledge of the demonstrable attributes themselves. For having *nous* of S's essence is necessary for having demonstrative scientific knowledge of its demonstrable attributes.

So, for purposes of acquiring noetic knowledge of the essence, it helps a great deal to know the demonstrable attributes as explained by it. This is claim (i). On the other hand, for purposes of apprehending the causes of those attributes, it helps a great deal to know the essence. For the essence, Aristotle says in T18c, is the principle (*archē*) from which they are explained. This is claim (ii). These claims do not describe two distinct activities, one following the other. They describe two distinct results of one activity, which takes place at Stage 4: by explaining a subject-kind's demonstrable attributes from its essence, we apprehend the attributes' causes *and* transform our pre-existing knowledge of the essence into *nous*. This is why Aristotle says specifically that knowing the essence allows us to apprehend the *causes* of the demonstrable attributes. For once we know a subject-kind's essence we know the explanatory middle term in the (Model 1) demonstrations of them. And by apprehending the essence as the cause, we achieve *nous* of it.

If I am right that (i) and (ii) describe different results of the same activity, then the passage supports the Socratic Picture. For Aristotle is saying that we seek and discover the causes of S's demonstrable attributes only after we discover its essence. And this is the Socratic Picture: define S (Stage 2); collect its demonstrable attributes (Stage 3); then explain them from the essence (Stage 4).²⁰

¹⁸ See, e.g., NE 4.3, 1124a21, 7.14, 1154a23. The expression is used frequently in this way in the biological works: e.g., PA 2.17, 660b25–6, 3.1, 661b14–15, 3.6, 669a22, GA 1.17, 721b3, 1.21, 730a26, 1.22, 730b9, 3.11, 763b5, 4.1, 765a29, 4.4, 771b19.

¹⁹ Aristotle uses the expression in this way in DA 1.1 (402a5–6), just a few lines above T18.

²⁰ Some demonstrable attributes are explained directly from the subject's essence (Model 1 demonstrations), others indirectly via their own essences (Model 2 demonstrations). See Chapter 3§4.

It is important to note that on my interpretation the inquirer at Stage 4 does not come to know via demonstration new and previously unknown attributes of a subject. Demonstration is not a machine for syllogistically producing new facts from known premises. Rather, she comes to understand via demonstration the explanatory connections between the indemonstrable essence she discovered at Stage 2 and the demonstrable attributes she discovered at Stage 3.²¹ More specifically, she comes to understand the essence *as* the cause of the subject's having the demonstrable attributes that it does—whether the essence is the proximate cause, in which case the relevant attribute follows directly from it, or the ultimate cause, in which case the attribute follows indirectly via a series of syllogistic steps depicted in the demonstrative chain. The inquirer fills in the gaps—large or small, as the case may be—between a subject's essence and its other attributes by constructing demonstrative chains. In so doing she transforms her knowledge into an organized science and achieves *nous* of the essence. Therefore, explaining S's demonstrable attributes, constructing demonstrations, organizing the science of S, and acquiring *nous* of its essence are all aspects of the same process (which occurs at Stage 4). Unlike in the Explanationist Picture, however, this is not the process by which we first discover what S's essence is. Rather, it is a process that presupposes that we have already discovered it.

I have suggested that Aristotle distinguishes between (a) first discovering the essence of a subject-kind and (b) acquiring *nous* of it.²² We acquire *nous* of an essence by demonstrating (i.e., explaining) from it. In this way there is a close connection between definition and explanation. However, we do not define a subject-kind *by* explaining its demonstrable attributes, as we do in the Explanationist Picture. Rather, explanation (and thus demonstration) is the way we transform our non-noetic knowledge of a subject-kind's definition, which we previously discovered by different means. This fits well with what Aristotle says in T18c. The inquirer has a candidate definition of S, tests it against S's demonstrable attributes, finds that it fails to explain them, and concludes that the definition is 'dialectical and empty'. The order of inquiry is clear: she has the candidate definition before she attempts to explain from it. In sum, while we get to know S's essence and its demonstrable attributes at different stages (2 and 3, respectively), we acquire noetic knowledge of the essence and demonstrative scientific knowledge of the causes of the attributes at the same stage: 4.

If we explain a subject-kind's demonstrable attributes by using our prior knowledge of its essence, then how do we discover its essence in the first place? As I have already mentioned, in the *APo* Aristotle's answer is division and induction. At Stage 2,

²¹ This bears a close resemblance to learning by demonstration. (See Chapters 2 and 4.) However, the two types of learning are not identical. For learning by demonstration presupposes noetic knowledge of first principles, whereas the learning I describe here is the means by which we acquire it. (See Chapter 5.)

²² See also Chapter 6§§3–4.

we discover S's essence by division (if it is a subordinate subject-kind) or induction (if it is a primary) and at Stage 4 we acquire *nous* of it by demonstration. There is evidence for my view in an important but difficult passage in *APo* 2.13, the second methodological text I want to examine:

- T19** (a) It is necessary, whenever one is working on any whole, to divide the genus into the primary indivisible species, for example, number into three and two, then to try to obtain in this way [i.e., by division] the definitions of them (for example, straight line, circle, right angle). (b) And after this, having taken hold of what the essence of the genus is, for example, whether it is among the quantities or qualities, [it is necessary] to study the peculiar attributes (*ta idia pathē*) through the common primaries. (c) For the attributes of the things composed from the indivisibles will be clear from the definitions [of the indivisibles], because of the fact that the definition and the simple are a principle of everything, and the attributes belong in themselves to the simples alone and through them to others.²³ (96b15–25)

I discuss this passage in more detail in Chapter 12§1. For now I want to point out a few ways in which it provides support for the Socratic Picture. Aristotle identifies a number of stages: divide a genus into its indivisible species; then, obtain the definitions of those species by means of the method of division; then, having defined the genus and the species, study their 'peculiar attributes' (i.e., their in itself accidents). The final stage is crucial to my interpretation. Aristotle means, I take it, that we should explain the in itself accidents by constructing demonstrations, using the genus' or the species' essence as the middle term. This is exactly the order of learning I have suggested is implicit in Aristotle's account in *APo* 2.2: first we discover the essence of a subject-kind, then we explain its other attributes from it. Aristotle's account is very condensed, but we can fill it in by adding that in between these two stages we have to discover which are the attributes we then go on to explain. In addition, in my (admittedly speculative) view, explaining these attributes is how we move from non-noetic to noetic knowledge of the essence. In this way the Socratic Picture contains a significant explanationist element: although first discovering the essence of a subject-kind does not involve explanation, acquiring *nous* of it does. Put differently, although division and induction (used at Stage 2) are not informed by explanatory considerations, Aristotle places an explanatory check on their results (at Stage 4). (Recall too that we discover the essences of demonstrable attributes by demonstration at Stage 4 (see Chapter 10), which is another significant explanationist element in the Socratic Picture.)

²³ *Χρή δέ, ὅταν ὅλον τι πραγματεύηται τις, διελεῖν τὸ γένος εἰς τὰ ἅτομα τῷ εἶδει τὰ πρῶτα, οἷον ἀριθμὸν εἰς τριάδα καὶ δυνάδα, εἴθ' οὕτως ἐκείνων ὁρισμοὺς πειρᾶσθαι λαμβάνειν, οἷον εὐθείας γραμμῆς καὶ κύκλου, καὶ ὀρθῆς γωνίας, μετὰ δὲ τοῦτο λαβόντα τί τὸ γένος, οἷον πότερον τῶν ποσῶν ἢ τῶν ποιῶν, τὰ ἴδια πάθη θεωρεῖν διὰ τῶν κοινῶν πρῶτων. τοῖς γὰρ συντιθεμένοις ἐκ τῶν ἀτόμων τὰ συμβαίνοντα ἐκ τῶν ὁρισμῶν ἔσται δῆλα, διὰ τὸ ἀρχὴν εἶναι πάντων τὸν ὁρισμὸν καὶ τὸ ἀπλοῦν καὶ τοῖς ἀπλοῖς καθ' αὐτὰ ὑπάρχειν τὰ συμβαίνοντα μόνοις, τοῖς δ' ἄλλοις κατ' ἐκείνα.*

The final methodological passage I want to examine is from the *Prior Analytics*:

T20 (a) Most [principles] are proper to each [science]. That is why it is characteristic of experience to provide the principles concerning each thing. I mean, for example, that astronomical experience [provides the principles] of astronomical science; for once the phenomena were sufficiently grasped, in this way the demonstrations of astronomy were discovered. Similarly with any other craft or science. As a result, if the attributes (*ta huparchonta*) of each thing are apprehended, at that point it falls to us to exhibit readily the demonstrations (*tas apodeixeis hetoimōs emphanizein*). (b) For if none of the true attributes (*huparchontōn*) of the objects had been omitted from the collection of facts (*historian*), then, that about which there is demonstration, we will be able to discover this [demonstration] and demonstrate it, and, that about which there is by nature no demonstration, [we will be able] to make this clear.²⁴ (*APr* 1.30, 46a17–27)

Aristotle's claim that we first get to know the facts to be explained and then their explanations fits well with the picture of the order of inquiry I have defended. My claim is that at Stage 3 the inquirer discovers the facts to be explained and at Stage 4 she explains them—and that prior to both stages she discovers the relevant subject-kind's essence. T20b makes it clear that inquiry at Stages 3 and 4 is holistic: the inquirer collects all or most of the facts and then constructs the demonstrations. The reason is that for Aristotle a science is a network of inter-connected truths, such that a complete understanding of the explanation of any one fact requires seeing its place within the broader network in which it belongs.

In the last part of the passage Aristotle says that the activity of constructing demonstrations will make clear those facts that do not admit of demonstration. On the Explanationist Picture, Aristotle means that we discover at the same stage (i) the causes of the demonstrable attributes of the subject-kind S and (ii) S's essence. However, I have argued that this interpretation does not fit well with *APo* 2.2, *De Anima* 1.1, or *APo* 2.13. According to the Socratic Picture, by the time we construct the demonstrations of the attributes of S, we already know what S's essence is. By constructing the demonstrations we make the essence clear, in the sense that we clarify its role as the essence, as S's explanatorily basic feature, that which explains its other necessary attributes. That is, what the process of constructing the demonstrations reveals to the inquirer is not so much *that* the definitions are indemonstrable principles but *how*. Organizing her knowledge into a demonstrative science makes clear to the

²⁴ ὅτι δὲ καθ' ἐκάστην αἱ πλείεσται. διὸ τὰς μὲν ἀρχὰς τὰς περὶ ἑκάστον ἐμπειρίας ἐστὶ παραδοῦναι, λέγω δ' οἷον τὴν ἀστρολογικὴν μὲν ἐμπειρίαν τῆς ἀστρολογικῆς ἐπιστήμης (ληφθέντων γὰρ ἱκανῶς τῶν φαινομένων οὕτως εὗρεθῆσαν αἱ ἀστρολογικαὶ ἀποδείξεις), ὁμοίως δὲ καὶ περὶ ἄλλην ὅποιον οὖν ἔχει τέχνην τε καὶ ἐπιστήμην· ὥστ' ἐὰν ληφθῇ τὰ ὑπάρχοντα περὶ ἑκάστον, ἡμέτερον ἤδη τὰς ἀποδείξεις ἐτοίμως ἐμφανίζειν. εἰ γὰρ μηδὲν κατὰ τὴν ἱστορίαν παραλειφθείη τῶν ἀληθῶς ὑπαρχόντων τοῖς πράγμασι, ἔξομεν περὶ ἅπαντος οὐ μὲν ἐστὶν ἀπόδειξις, ταύτην εὐρεῖν καὶ ἀποδεικνύειν, οὐ δὲ μὴ πέφυκεν ἀπόδειξις, τοῦτο ποιεῖν φανερόν.

inquirer the exact role that the definitional principles play in explaining the phenomena and in not being explained by them. The key here is that the inquirer already knows which facts are the *explananda* and which are the indemonstrable principles; what she does not understand are all the explanatory connections among them. The process of organizing a science into demonstrations fills in these gaps in just the way I described above in discussing the *De Anima* passage, and so (I suggest) the inquirer of the *Prior Analytics* passage acquires *nous* of definitional first principles in the same way.

It's worth looking closely at T20b with these points in mind:

- T20 (b)** For if none of the true attributes (*huparchontōn*) of the objects had been omitted from the collection of facts (*historian*), then, that about which there is demonstration, we will be able to discover this [demonstration] and demonstrate it, and, that about which there is by nature no demonstration, [we will be able] to make this clear. (46a24–7)

Aristotle writes carefully. He does not say that once all the facts are in we can discover which of them are *demonstrable*, as we would expect him to say if the Explanationist Picture were right. Rather, he is careful to say that once the facts are in we can discover their *demonstrations* (i.e., their causes). This suggests that at the prior, *historia* stage the facts are already divided into the demonstrable and the essential. For if they are so divided, the inquirer can then 'readily exhibit the demonstrations', as Aristotle says just above. She does not need to do the extra work of determining which facts need demonstrating; her task is limited to finding the causes of the facts whose demonstrability is already known. In this regard Aristotle's terms are well chosen: at the *historia* stage we have a collection of the objects' 'attributes' (*ta huparchonta*), a term that can signify both essential attributes and demonstrable ones. My suggestion is that at the *historia* stage the inquirer knows the demonstrable and essential attributes *as such*. At the next stage she seeks the relevant demonstrations, and in so doing makes clear that the subject-kind's essential attributes are explanatorily basic.

A case can be made that Aristotle puts the method outlined in *APr* 1.30 to work in his biological writings. I here offer only a few remarks in this direction. The *History of Animals* is a collection of unexplained facts about the ways of life, activities, character traits, and parts of animals. The *Parts* and *Generation of Animals* provide the explanations of some of these facts (in doing so they also present the facts explained). Arguably, when Aristotle presents the explanations of parts of animals in *Parts of Animals* 2–4, he does so with the relevant animal essences in the background. Not all of his explanations appeal to essential attributes of the relevant animal kinds (many appeal to the essences of the parts themselves or to both), but his procedure seems to presuppose that those essences have already been established. That is, Aristotle does not present, in explanationist fashion, the facts to be explained and then their explanations with the aim of making clear what the previously unknown essences of the relevant animal kinds are. Rather, he is able to present the facts to be explained and their explanations in large part because he already knows what the animal essences are (and assumes that his audience knows them too). There is an important

reason for this: Aristotle believes that you do not understand the reason why animals of kind K have part P unless you understand the role P plays in the proper functioning of the Ks; and to know the proper functioning of the Ks is to know their form and essence. Now it is important to note that this is a claim about the order of presentation in the *Parts of Animals*, which is not necessarily the same as the order of inquiry and discovery. Just because Aristotle presents his findings in a certain order does not mean he made them in that order (or thinks others should make them in that order).²⁵ Still, the similarity is striking: Aristotle's outline of the stages of inquiry in the *Analytics* seems neatly reflected in the presentation of his research in *Parts of Animals* 2–4.²⁶

5. Better Known By Nature and To Us: Explanation, Conviction, and *Nous*

I have argued that in Aristotle's account of the order of inquiry—the Socratic Picture—we first acquire (at Stage 2) non-noetic knowledge of the definition of a subject-kind S by means of division or induction, and we then acquire (at Stage 4) *nous* of it by demonstrating from it S's in itself accidents. A number of texts in the *APo* and elsewhere indicate Aristotle's reasons for adopting this two-step account.

As we saw in Chapter 4§6, the premises of a demonstration must be better known than the conclusion. In *APo* 1.2 (71b33–72a5), Aristotle distinguishes two senses in which something is better known: 'by nature' (or 'without qualification') and 'to us'. What is better known to us is closer to perception and what is better known by nature is further from it. Since sensible particulars are closer to perception, they are better known to us; since universal truths are further from it, they are better known by nature. In *APo* 1.2, then, the two senses of 'better known' are opposed. However, in other passages Aristotle uses 'better known to us' in a more flexible manner to signify whatever we find convincing (*pisteuein*),²⁷ where 'we' covers every knowing person, from students at the earliest stages of their learning to scientists at the most developed stages of expertise. In this more flexible sense, what is better known to us and by nature need not be opposed. Indeed, the epistemic condition of the expert scientist, and the goal of intellectual learning, is for these to be identical, for the better known by nature to be better known and more convincing to

²⁵ See Lennox (2011: 35 n11) who raises pertinent questions on this issue.

²⁶ The connection between the *Analytics* and the biological works is richly discussed in, e.g., Charles 2000, Detel 1997, Gotthelf 2012, Gotthelf and Lennox 1987, Henry 2011a, Lennox 2001b, 2004, 2011, and Leunissen 2010.

²⁷ See *APo* 1.2, 72a25–b4. For the connection between 'better known' and 'more convincing', see also *APr* 2.16, 64b32–3: 'for demonstration is from things that are more convincing and prior' (ἡ γὰρ ἀπόδειξις ἐκ πιστοτέρων τε καὶ προτέρων ἐστίν). Here 'more convincing' (*pistotērōn*) stands in for 'better known' (*gnōrimōterōn*) in *APo* 1.2, 71b21 (in T10). Also note 'better known...and more convincing' (*γνωριμώτερον...καὶ πιστότερον*) at *APo* 1.25, 86b27 and the triumvirate 'prior and better known...and more convincing' (*προτέρα καὶ γνωριμώτερα...καὶ πιστότερα*) at 86b29–30. *NE* 7.3, 1146b24–31 is also relevant. There is a helpful discussion of some of these issues in Burnyeat 1981: 127–8.

us.²⁸ When Aristotle says that the premises of a demonstration must be better known than the conclusion, he means better known in both ways: by nature and to the scientist.²⁹ That is, the premises of a demonstration must occupy a higher position in the order of nature than the conclusion and the scientist who is demonstrating from them must find them more convincing than the conclusion.³⁰

Now it is not the case that a fact is better known by nature because a scientist finds it more convincing; a scientist finds a fact more convincing because it is better known by nature.³¹ For Aristotle, if z is the cause of y , then z is better known by nature than y .³² Furthermore, if z is the cause of y and nothing else is the cause of z , then not only is z better known by nature than y , z is best known of all— z is a first principle (in the relevant science).³³ So the first principles of demonstration, especially definitions, are not only better known by nature than the conclusions of which they are the explanations, they are the best known facts of all. What makes them best known by nature is that (a) they explain other things and (b) they are not explained by anything else. As Aristotle says in *Metaphysics* 1.2 (982b2–4): ‘the primaries and the causes are best known, for the other things are known because of and from these, but they are not [known] because of any of the things subordinate to them.’³⁴ Since a scientist finds what is best known by nature most convincing, the first, explanatorily basic principles in a science are the most convincing of all—convincingness tracks explanatory power. For Aristotle, to have non-demonstrative scientific knowledge (*nous*) of the first principles requires being more convinced of them than of anything else in the science.³⁵ The first principles command the highest degree of conviction because they explain other things and are not explained by them. Therefore, acquiring *nous* of the first principles requires apprehending them as explanatory of other things and as not explained by them.³⁶ That is, it requires using them to demonstrate the in itself accidents of subject-kinds. However, once we have become completely convinced and acquired *nous* of a definition of the form ‘ S is_{def} E ’ (where E is the complete essence of the subject-kind S), our noetic knowledge does not consist in knowing E as the cause of S ’s in itself accidents (this is demonstrative scientific knowledge). Rather, it consists in knowing E as the cause of S itself, as that which makes S the very thing that it is. Apprehending definitions as explanatory of other things is how we become completely convinced of them; it is not how we know them noetically once we are completely convinced of them.³⁷

²⁸ See *Met* 7.3, 1029b3–8 (T21, just below) and *Top* 6.4, 141b3–142a15. See also Mansion 1979: 161, McKirahan 1992: 31, 232–3, and Schiapparelli 2011.

²⁹ See again *APo* 1.2, 72a25–b4.

³⁰ See *NE* 6.3, 1139a22–4.

³¹ See Irwin 1988: 123.

³² See *APo* 1.2, 71b31, *DA* 2.2, 413a11–16. See also *Cat* 12, 14b10–23, and Mansion 1979: 167.

³³ See *Met* 1.2, 982b2–4, quoted just below.

³⁴ μάλιστα δ’ ἐπιστητὰ τὰ πρῶτα καὶ τὰ αἴτια (διὰ γὰρ ταῦτα καὶ ἐκ τούτων τὰλλα γνωρίζεται ἀλλ’ οὐ ταῦτα διὰ τῶν ὑποκειμένων).

³⁵ See *APo* 1.2, 72a25–b4.

³⁶ See again Kosman 1973: 380–92 (especially 388–90); see also Charles 2000: 270–2.

³⁷ For an interesting discussion of some of the issues I address in this paragraph, see Goldin 2013: 206–13.

With these points in mind, consider the following passage from the *Metaphysics*:

- T21 learning (*mathēsis*) proceeds for all in this way—through that which is less known by nature to that which is better known; and just as in conduct our work is to start from what is good for each and make what is good in itself good for each, so it is our work to start from what is better known to oneself and make what is known by nature known to oneself.³⁸ (7.3, 1029b3–8)³⁹

Aristotle characterizes learning in two different, though related, ways. (1) Learning proceeds through (*dia*) what is better known to us to (*eis*) what is better known by nature. (2) Learning consists in making (*poiēsai*) what is better known by nature better known to us. This twofold characterization is significant, for it suggests that there is a temporal distinction between (a) initially coming to know what is better known by nature and (b) making it better known and more convincing to us.⁴⁰ I have suggested that we initially come to know what is best known by nature—the definitions of subject-kinds—through division and induction; and I have argued that the way in which we make what is best known by nature best known and most convincing to us is by demonstrating from these definitions the kinds' in itself accidents.⁴¹

6. An Objection

My interpretation assumes that at Stage 2 the inquirer is able to determine, by using the methods of division and induction, what the essential attributes of a subject-kind S are. This implies that at Stage 2 she can already identify which attributes are essential and which are not. But how can she do this, if she does not already know what the essence is? That is, the Socratic Picture seem to succumb to a problem it is designed to solve. For I argued that Aristotle's account of question (1') in *APo* 2.2 makes sense if we assume that the inquirer, in seeking at Stage 3 whether P is a demonstrable attribute of S, already knows what S's essence is. If she discovers that P belongs to S by necessity, she can infer that P is a demonstrable attribute of S because she knows that it is necessary but not essential, and she knows that it is not essential because she knows what is essential. But how does she grasp at Stage 2 what is essential to S? Surely not by relying on prior knowledge of what is non-essential! So then does she somehow intuit what S's essential attributes are? If so, the Socratic Picture collapses into the Intuitionist Picture I have sought to reject.

³⁸ ἡ γὰρ μάθησις οὕτω γίνεται πᾶσι διὰ τῶν ἡττον γνωρίμων φύσει εἰς τὰ γνώριμα μᾶλλον· καὶ τοῦτο ἔργον ἐστίν, ὥσπερ ἐν ταῖς πράξεσι τὸ ποιῆσαι ἐκ τῶν ἐκάστω ἀγαθῶν τὰ ὅλως ἀγαθὰ ἐκάστω ἀγαθὰ, οὕτως ἐκ τῶν αὐτῶ γνωριμωτέρων τὰ τῇ φύσει γνώριμα αὐτῶ γνώριμα.

³⁹ Ross's translation in Barnes 1984, altered slightly.

⁴⁰ The basic insight here is Platonic: it is one thing to be dragged out of the cave, it is quite another to become accustomed to seeing what is out there (*Republic* 7, 515e6–516c3).

⁴¹ The connection between learning and conviction is also stressed by De Gandt 1975–6.

My response to this objection is in Chapter 12, where I argue that in *APo* 2.13 Aristotle presents a number of rules for the proper use of the methods of division and induction, rules that include empirically grounded procedures for selecting essential attributes of the subject-kind being defined without relying on any faculty of intuition.

9

Cause, Essence, and Definition

I have argued for the following claims, among others:

- i. In *APo* 2, Aristotle distinguishes between two types of essence: causally complex essences of the form ‘A–C because of B’ (or ‘B–C’) and causally simple essences composed of genus and differentia(e) (or something analogous). (Chapter 7)
- ii. Causally complex essences apply to demonstrable attributes (e.g., 2R, eclipse, thunder) and causally simple essences apply to subject-kinds (e.g., unit, triangle, moon, human being). (Chapter 7)
- iii. In the Socratic Picture of the order of inquiry, to which Aristotle is committed, we first establish that a subject-kind S exists (Stage 1) and then we seek its (causally simple) essence (Stage 2). We then collect S’s demonstrable attributes and seek their causes (Stages 3–4), which form part of their (causally complex) essences. (Chapter 8)
- iv. In explaining S’s demonstrable attributes at Stage 4, we move from non-noetic knowledge of S’s essence (acquired at Stage 2) to noetic knowledge of it. (Chapter 6§4 and 8§§4–5)

I have also claimed (but not argued) that:

- v. We discover causally complex essences (at Stage 4) by demonstration and causally simple essences (at Stage 2) by division and induction. (Chapter 8§§ 3–4).

In Chapters 9–12, I focus on iii, iv, and v. In this chapter, I examine a distinction Aristotle makes in *APo* 2.8–9 between two types of cause: the cause that is ‘the same’ and the cause that is ‘different’. I argue that this distinction tracks the distinction between subject-kinds and demonstrable attributes and the distinction between causally simple and complex essences. Examining the two types of cause should further clarify some of the ontological commitments that lie behind Aristotle’s account. It will also give us an opportunity to examine his theory of definition in *APo* 2.10, which is important for understanding his account of inquiry. In Chapter 10, I turn to Aristotle’s account in *APo* 2.8 of how we discover by demonstration the causally complex essences of demonstrable attributes (Stages 3–4). In Chapter 11, I discuss his explanation of how we discover at Stage 1 the existence of

subject-kinds. In Chapter 12, I examine his discussion in *APo* 2.13 of how we discover (at Stage 2) by division or induction the causally simple essences of subject-kinds. After the account of inquiry in *APo* 2.1–2, Aristotle raises several puzzles about definition in 2.3–7. (See Chapter 10§1.) The main puzzles are then solved in 2.8 and 2.13. In 2.9–10, Aristotle summarizes some of the results of 2.1–8 and looks ahead to 2.13. I discuss 2.9–10 before 2.8 and 2.13 because they conveniently summarize key aspects of the account of learning in those chapters.

As I remarked in the Introduction, Aristotle's order of presentation in *APo* 2 is the reverse of the order of discovery: he discusses Stages 3–4 (in 2.8) before Stage 2 (in 2.13). This is true of the *APo* as a whole. Throughout the text he moves backwards through the different stages of learning, discussing the type of learning by which we acquire the knowledge needed for the type of learning previously discussed. For example, Aristotle first discusses learning by demonstration and then learning by definition—for learning by demonstration requires prior knowledge of definitions. Within his account of learning by definition, he first discusses learning causally complex essences (in 2.8) and then causally simple ones (in 2.13)—for learning the (causally complex) essence of a demonstrable attribute is aided by first knowing the (causally simple) essence of its subject. And within his account of learning causally simple essences, he first discusses learning the essences of subordinate subject-kinds (species) and then the essences of primaries (genera)—for knowing the essence of the genus is required for learning the essences of its species.

1. Causes that are the Same vs. Causes that are Different

The distinction between the two types of cause appears four times in the *APo*.¹ My aim is to answer two main questions: (1) What sort of thing has a cause of each type? (2) What does it mean for a cause to be the same or different?

Aristotle introduces one half of the distinction in *APo* 1.31. The chapter defends the claim that 'you cannot know anything scientifically through perception' (87b28).² For example, even if we were standing on the moon during an eclipse, we could not perceive its cause (the earth screening) as such (87b39–88a1). Rather, to achieve scientific knowledge we must grasp the relevant demonstration, whose premises and conclusion are universal propositions. Aristotle then states:

T22 Universals are valuable because they make the cause clear. Hence universal [demonstrations] are more valuable than perception and thought with regard to things whose cause is different. Concerning the primaries, there is a different account.³ (88a5–8)

¹ *APo* 1.31, 88a5–8 (T22), 2.8, 93a5–6 (in T23), 93b20 (in T29), 2.9, 93b21–8 (T24).

² Οὐδὲ δι' αἰσθήσεως ἐστὶν ἐπίστασθαι.

³ τὸ δὲ καθόλου τίμιον, ὅτι δηλοῖ τὸ αἴτιον· ὥστε περὶ τῶν τοιούτων ἡ καθόλου τιμωτέρα τῶν αἰσθήσεων καὶ τῆς νοήσεως, ὅσων ἕτερον τὸ αἴτιον· περὶ δὲ τῶν πρώτων ἄλλος λόγος.

Aristotle characterizes attributes, such as eclipse, for which universal demonstrations are more valuable, as things whose causes are ‘different’, and he contrasts them with ‘primaries’, which, he indicates, are indemonstrable. He makes the same alignment in *APo* 2.9 (see section 3), where he adds that in the case of primaries the cause is ‘not different’ (93b21). The upshot is that if an attribute is demonstrable, its cause is different, and if a thing is primary and indemonstrable, its cause is the same.⁴ So, staying with one half of the distinction, all demonstrable attributes (e.g., eclipse, 2R) have causes that are different. The end of 2.8 (93b15–20, T29) suggests an additional claim. Aristotle says that we get to know by demonstration the essences of things whose causes are different. However, it is only demonstrable attributes whose essences we learn by demonstration. Therefore, it is only demonstrable attributes whose causes are different.

Indemonstrable primaries have causes that are the same. Are these the only entities with such causes, or are there others? A passage early in 2.8 in which the two causes are mentioned gives us a clue:

T23 Since, as we said, knowing what a thing is and knowing the cause of whether it is⁵ are the same—and the reason is that there is a cause,⁶ and this is either the same or different, and if different, [what a thing is] is either demonstrable or indemonstrable—it follows that if [the cause] is different and it is possible to demonstrate [what a thing is], it is necessary for the cause to be the middle term and for [the what it is] to be proven in the first figure; for that which is being proven is universal and affirmative.⁷ (93a3–9)

I return to this passage in Chapter 10§2. For now, note that Aristotle mentions the distinction between the two types of cause as though it is already familiar. We just saw him introduce one half of the distinction in *APo* 1.31, but he says nothing about it and he does not mention it again until T23. On the other hand, the main

⁴ This fits well with a passage in *APr* 2.16 (64b34–6) where Aristotle contrasts ‘those things that are by nature such as to be known through themselves’ (τὰ μὲν δι’ αὐτῶν πέφυκε γνωρίζεσθαι) with ‘those things [that are by nature such as to be known] through other things’ (τὰ δὲ δι’ ἄλλων). He adds: ‘the first principles [are by nature such as to be known] through themselves, and things under the first principles [are by nature such as to be known] through other things’ (αἱ μὲν γὰρ ἀρχαὶ δι’ αὐτῶν, τὰ δ’ ὑπὸ τὰς ἀρχὰς δι’ ἄλλων). First principles, which are primaries, are known through (or because of: *dia*) themselves because their causes are (in *APo*-speak) ‘the same’; the things ‘under first principles’—namely, demonstrable attributes—are known through other things because their causes are ‘different’. (See also *APo* 1.15, 79a33–6.) I discuss in section 2 what it means for a cause to be the same or different.

⁵ τὸ αἴτιον τοῦ εἶ ἔστι. Some manuscripts have ‘the cause of what something is’ (τὸ αἴτιον τοῦ τί ἔστι). Chiba (2012: 188–9) argues in favour of this reading; Pellegrin (2010: 132) argues against it. A good reason to reject this reading is that the phrase ‘the cause of what something is’ makes little sense: what something is—i.e., the essence—is or contains the cause, but it does not have one.

⁶ I follow the usual translation of 93a5–6, although I think the passage makes better sense if were move Ross’s brackets. For a different translation based on a different punctuation of the Greek see Barnes 1993: 56, with his commentary on 217.

⁷ ἐπεὶ δ’ ἐστίν, ὡς ἔφαμεν, ταῦτόν τὸ εἰδέναι τί ἔστι καὶ τὸ εἰδέναι τὸ αἴτιον τοῦ εἶ ἔστι (λόγος δὲ τούτου, ὅτι ἔστι τι τὸ αἴτιον, καὶ τοῦτο ἢ τὸ αὐτὸ ἢ τὸ ἄλλο, καὶ ἢ ἄλλο, ἢ ἀποδεικτὸν ἢ ἀναπόδεικτον)—εἰ τοίνυν ἐστὶν ἄλλο καὶ ἐνδέχεται ἀποδείξαι, ἀνάγκη μέσον εἶναι τὸ αἴτιον καὶ ἐν τῷ σχήματι τῷ πρώτῳ δείκνυσθαι· καθόλου τε γὰρ καὶ κατηγορικὸν τὸ δεικνύμενον.

ontological distinction with which we are familiar at this point in the *APo* is that between demonstrable attributes and subject-kinds. So perhaps Aristotle expects us to grasp that the two distinctions line up. We have already seen that anything whose cause is different is a demonstrable attribute. My suggestion, which I now want to defend, is that anything whose cause is the same is a subject-kind. There are two types of subject-kind: primaries (e.g., unit, point), whose existence is indemonstrable, and subordinates (e.g., triangle, human being), whose existence is demonstrable. It is uncontroversial that primary subject-kinds have causes that are the same. However, there is good reason to think that subordinates do too. Since, according to *APo* 2.8, only demonstrable attributes have causes that are different, and since (as I shall argue in Chapter 11§2) subordinate subject-kinds are not demonstrable attributes, then, assuming that the distinction between the two types of cause is exhaustive, it follows that subordinate subject-kinds have causes that are the same.

2. Cause and Essence

Subject-kinds have causes that are the same and demonstrable attributes have causes that are different. The same as and different from what? As we shall see below, the two other passages in the *APo* in which Aristotle mentions the distinction strongly suggest that the cause is the same as or different from the *essence* of the thing of which it is the cause. The cause of a subject-kind *S* is the same as the essence of *S*; the cause of a demonstrable attribute *P* is different from the essence of *P*.⁸ I shall first explain what this means and then turn to the texts.

As we know from *APo* 2.2, the cause of a subject-kind, such as human being, is identical to its essence. If we are asked ‘what is the essence of human being?’ we say (let’s suppose) ‘being a two-footed tame animal’. If asked ‘what is the cause of human being?’ we give the same answer. So when Aristotle indicates that the cause of human being is the same, it is reasonable to think that he means that it is the same as the essence of human being. For the cause just is the essence stated in the definition.

The cause of a demonstrable attribute such as eclipse, by contrast, is not identical to its essence. For the essence includes both the cause and the subject to which the attribute belongs (along with a description of the attribute in more familiar terms (i.e., an *A* term), if one is available; see Chapter 7§§8–9). The essence of eclipse is ‘loss of light from the moon because of screening of the sun by the earth’ and the cause is ‘screening of the sun by the earth’. In *APo* 2.2, Aristotle says that what eclipse is and why it is are the same (90a14–15, in T15). ‘What is eclipse?’ and ‘why is

⁸ For a different view, see Deslaurliers (2007: 81–111) who argues that the distinction is between formal causes, which are the same, and efficient causes, which are different. (In Chapter 7§6, I argued that in the *APo* Aristotle treats the efficient cause of eclipse, thunder, etc. as part of the formal cause.) However, I agree with Deslaurliers that the cause of human being (and every other subject-kind) is the same. For a different view on this last question, see Charles 2000: 274–5. I discuss Charles’s view below.

eclipse?’ are questions the complete answers to which generally contain all and only the same elements. (See Chapter 7§§6–10.) Aristotle also says that the cause of eclipse is the middle term in the demonstration of eclipse. However, the middle term is not the complete answer to the ‘what?’ or ‘why?’ question—it is only part of the answer. So the cause of eclipse (screening by the earth) is different from the essence of eclipse, not because the cause and the essence are separate entities, but because the essence includes both the cause and other elements in addition to it.

Because eclipse is a demonstrable attribute that can be defined, in stating its essence we must mention the subject to which it belongs (the moon), in addition to the cause of its belonging. (That is, because eclipse is an in itself₂ demonstrable attribute of the moon, in stating its essence we must mention the moon.) Eclipse is essentially a phenomenon brought about by the screening of the sun by the earth, but it is not only that—it is also essentially a phenomenon that affects the moon. So the fact that the cause of eclipse is different from the essence of eclipse follows directly from eclipse’s status as an in itself₂ demonstrable attribute of a subject. (In this way, the cause of 2R is also different. For the essence of 2R includes both its cause and the subject to which it belongs: triangle.) On the other hand, human being is not an attribute of any subject. There is nothing more to say about what human being is essentially—no subject to mention—apart from what we state when we state its cause (essence), two-footed tame animal. So the fact that the cause of human being is the same as the essence of human being follows directly from human being’s status as a subject-kind. The distinction between the two types of cause, on my interpretation, follows from Aristotle’s principal ontological commitments in the *APo*.

3. The Two Types of Cause in *APo* 2.9

I have argued that all and only subject-kinds have causes that are the same and all and only demonstrable attributes have causes that are different. I have also started to argue that when Aristotle characterizes a cause as ‘the same’, he means the same as the essence of the subject-kind of which it is the cause, and that when he characterizes a cause as ‘different’, he means different from the essence of the demonstrable attribute of which it is the cause. Two passages in *APo* 2 provide strong evidence for this interpretation.⁹ The first is at the end of *APo* 2.8 where Aristotle says that ‘without demonstration it is not possible to get to know the what it is [i.e., the essence] (*to ti estin*), from which the cause is different (*hou estin aition allo*)’ (93b18–19, in T29).¹⁰ In section 1, I argued that this passage shows that it is only demonstrable attributes that

⁹ The two passages only provide evidence for my reading of ‘different’. However, I think it is reasonable to infer from this reading my reading of ‘the same’. For if, as these passages indicate, the cause that is different is different from the essence, it stands to reason that the cause that is the same is the same as the essence.

¹⁰ οὐτ’ ἀνευ ἀποδείξεως ἔστι γινῶναι τὸ τί ἐστίν, οὐ ἔστιν αἴτιον ἄλλο.

have essences that we get to know by demonstration. As we can now see, it also shows that demonstrable attributes have causes that are different from their essences.

The second passage, *APo* 2.9, is also the last and main text in which Aristotle draws the distinction between the two types of cause:

- T24 (a) Of some things there is something different [that is] the cause, of other things there is not. (b) The result is that it's clear that also among what things are [i.e., the essences] (*tōn ti esti*), some things (*ta men*) are immediates and principles, those things of which it is necessary to hypothesize that they are and what they are or make them clear in some other way. (This is the very thing that arithmetic does: for in fact it hypothesizes what unit is and that it exists.) (c) On the other hand, in the case of things (*tōn d'*) that have a middle term and of which there is some cause different from the essence (*heteron aition tēs ousias*), it is possible to make [what it is] clear through demonstration, as we said, but there is no demonstrating what it is.¹¹ (93b21–8)

The passage has a chiasmic structure. Aristotle begins with the now familiar distinction between (i) things whose causes are different and (ii) things whose causes are the same. T24b discusses (ii); T24c discusses (i). In T24c, Aristotle mentions 'things that have a middle term and of which there is some cause different from the essence (*heteron aition tēs ousias*)'. Things that have a middle term are demonstrable attributes. If, as it is reasonable to think, *ousia* here means 'essence' and depends for its genitive case on 'different' (*heteron*),¹² then T24c indicates that demonstrable attributes have causes that are different from their essences.¹³

¹¹ Ἔστι δὲ τῶν μὲν ἕτερόν τι αἴτιον, τῶν δ' οὐκ ἔστιν. ὥστε δῆλον ὅτι καὶ τῶν τί ἐστι τὰ μὲν ἅμεσα καὶ ἀρχαί εἰσιν, ἃ καὶ εἶναι καὶ τί ἐστὶν ὑποθέσθαι δεῖ ἢ ἄλλον τρόπον φανερά ποιῆσαι (ἄπερ ὁ ἀριθμητικὸς ποιεῖ· καὶ γὰρ τί ἐστὶ τὴν μονάδα ὑποτίθεται, καὶ ὅτι ἔστιν)· τῶν δ' ἐχόντων μέσον, καὶ ὧν ἐστὶ τι ἕτερον αἴτιον τῆς οὐσίας, ἔστι δι' ἀποδείξεως, ὥσπερ εἴπομεν, δηλῶσαι, μὴ τὸ τί ἐστὶν ἀποδεικνύντας.

¹² I am grateful to Chad Bochan for helpful discussion of this passage and 93b18–19.

¹³ David Charles (1991: 236–8; see also 2000: 274–5 and Chiba 2012: 193) argues that *ousia* in T24c means 'substance' and depends for its genitive case on 'cause'. On this reading, the crucial bit might be translated as follows: 'in the case of things that have a middle term and of which there is something different [that is] the cause of the substance'. If Charles is right, then this passage cannot be taken as evidence for my view that when Aristotle characterizes the cause of *x* as the same or different, he means the same as or different from *x*'s essence. More importantly, if Charles is right, then this passage is evidence that substances (what I have been calling 'subject-kinds': human being, god, moon) have causes that are different and hence they have essences that are in some way demonstrable, whereas I have argued that substances (subject-kinds) have causes that are the same and essences that are in no way demonstrable. On Charles's interpretation, Aristotle's use of the term *ousia* shows that he is expanding the class of entities whose causes are different and whose essences are (in some way) demonstrable to include substances, in addition to demonstrable attributes, which are the focus of *APo* 2.8. (Charles (1991: 236–8 and 2000: 274–5) states that *APo* 2.9 only gestures at this conception of substance. He argues that it gets developed in the *Metaphysics*, especially in 7.17 and 8.) However, contra Charles, if *ousia* in T24c means 'substance', then Aristotle is in fact limiting the class to substances and thereby excluding attributes. For he gives two conditions the joint satisfaction of which is necessary for having a demonstrable essence: it must have a middle term and the cause of the substance must be different. However, for demonstrable attributes there is no 'cause of the substance'. The result is that only substances have demonstrable essences. This is wrong: Aristotle's examples (in *APo* 2.1–2 and 8) are all demonstrable attributes (e.g., eclipse, thunder, harmony,

In T24b–c, Aristotle distinguishes between different things that have essences.¹⁴ Some of the things that have essences (*ta men*) are immediates and principles and others (*tōn de*) have a middle term. It turns out that this distinction between things that have essences implies a distinction between the essences themselves: T24b indicates that the essences of immediate things (whose causes are the same) are in no way demonstrable (we hypothesize the essence or make it clear ‘in some other way’); and T24c states that the essences of things with a middle term (things whose causes are different) are in some way demonstrable (as he explains in *APo* 2.8; see Chapter 10).

In sum, T24 makes three sets of distinctions that line up in the following way:

A	B
Things whose causes are the same.	Things whose causes are different.
Immediates and principles (primaries).	Things that have a middle term.
Things whose essences are in no way demonstrable.	Things whose essences are in some way demonstrable.

The interpretation I have defended is that everything in column A is a subject-kind and everything in column B is a demonstrable attribute.¹⁵ (In addition, I have argued that column A also includes subordinate subject-kinds.) T24 also provides evidence for my view that when Aristotle characterizes a cause as the same or different, he means the same as or different from the essence of the thing of which it is the cause.

4. How Essences are Discovered

Aristotle makes two methodological claims *APo* 2.9. In T24c, he says that we discover by demonstration the essences of things whose causes are different, a claim he argues for in *APo* 2.8, as we shall see in the next chapter. In T24b, he says that in the case of things whose causes are the same either we hypothesize the essence or we ‘make it clear in some other way’. Whatever this other way is, it differs both from hypothesis (asserting the essence without proof) and from demonstration (and in general syllogistic proof). So for one type of essence, there is a way of making it clear that goes beyond assertion without

2R). In addition, it is worth noting that *ousia* in *APo* 2 means ‘essence’ far more frequently than it means ‘substance’: see 2.3, 90b30–1, 2.4, 91b9, 2.6, 92a6, 2.7, 92a34, 92b13, b14 (in T41), 2.13, 96a34 (in T44), 96b12. Another possibility (suggested to me by Ben Morison and opted for by Ross (1949: 633) in his paraphrase) is that *ousia* in T24c means ‘being’. However, *ousia* in the *APo* so often means ‘essence’ and so rarely (if ever) means ‘being’ that I am hesitant to accept it.

¹⁴ Here I follow Charles (2000: 274–5 n2) who in commenting on T24 rightly points out that it is things with essences (e.g., unit), not the essences of things, whose existence and essence are hypothesized (T24b). Similarly, it is things with essences (e.g., eclipse) that have a middle term and whose cause is different (T24c). Therefore, the main distinction in T24b–c is between two different types of things that have essences. Barnes’s translation obscures this.

¹⁵ For a broadly similar view, see Goldin 1996: 126–36 and Ross 1949: 78, 633.

proof but differs from the demonstrative method of 2.8. In Chapter 12§12, I argue that the method of discovering the essences of primary subject-kinds is induction. In addition, the method of discovering the essences of subordinate subject-kinds is division, which also differs from assertion without proof and the demonstrative method of 2.8. Aristotle discusses both methods (induction and division) in *APo* 2.13.¹⁶

If my interpretation is right, we can now add to our two columns:

A	B
Things whose causes are the same	Things whose causes are different.
Primary and subordinate subject-kinds.	Things that have a middle term—i.e., demonstrable attributes.
Things whose essences are in no way demonstrable.	Things whose essences are in some way demonstrable.
Essences discovered by induction or division.	Essences discovered by demonstration.
Causally simple essences.	Causally complex essences.
E.g., human, moon, god, soul, unit.	E.g., eclipse, harmony, thunder, ice, 2R.

5. *APo* 2.10: Definition

There is evidence for the main outlines of my interpretation in Aristotle's discussion of the different types of definition in *APo* 2.10. His account confirms that there are two main types of definable entity (subject-kinds and demonstrable attributes) and that each type of definable entity has a distinct type of essence and definition. His remarks also provide some insight into his account of inquiry in *APo* 2.8, which I discuss in the next chapter.

Aristotle begins by defining definition (*horismos*) as an 'account of what something is' (*logos tou ti esti*) (93b29). He then proceeds to discuss the different types of definition. Near the end of the chapter he summarizes his account:

T25 One type of definition, then, is an indemonstrable account of what something is; another is a syllogism of what something is, differing in aspect from a demonstration; a third is a conclusion of the demonstration of what something is.¹⁷ (94a11–14; see also *APo* 1.8, 75b30–2)

Aristotle says that immediate entities (i.e., the primary subject-kinds mentioned in *APo* 2.9) have definitions of the first type: 'The definition of the immediates is an indemonstrable positing of the what it is' (94a9–10).¹⁸ However, he need not be

¹⁶ For a similar view, see Ross (1949: 633), who also takes the phrase 'make it clear in some other way' (T24b, 93b23–4) to refer to *APo* 2.13.

¹⁷ "Ἔστιν ἄρα ὁρισμὸς εἰς μὲν λόγος τοῦ τί ἐστιν ἀναπόδεικτος, εἰς δὲ συλλογισμὸς τοῦ τί ἐστι, πτώσει διαφέρων τῆς ἀποδείξεως, τρίτος δὲ τῆς τοῦ τί ἐστιν ἀποδείξεως συμπέρασμα.

¹⁸ ὁ δὲ τῶν ἀμέσων ὁρισμὸς θέσις ἐστὶ τοῦ τί ἐστιν ἀναπόδεικτος.

saying that only primaries have definitions of this type; subordinate subject-kinds may have them too. The reason is that all subject-kinds have causally simple essences, the different parts of which do not stand to each other in any complex causal relation. The essences are of the form 'GD₁ ... D_n', and the resulting definitional propositions are of the form 'S is_{def} GD₁ ... D_n' where 'G' signifies either a genus or, in the case of primaries such as unit, a genus-like entity, such as one of the categories of being, and each 'D' signifies a differentia of that genus or genus-like entity.¹⁹ E.g.,

Unit is_{def} indivisible quantity²⁰

Human being is_{def} two-footed tame animal

I shall call these 'non-demonstrative definitions'.

It is significant that Aristotle calls this type of definition 'an indemonstrable positing of the essence'. He does not mean that we simply intuit these definitions without prior inquiry or assert them without prior argument. (In fact, in *APo* 2.13, Aristotle introduces a complex set of rules for their discovery, which I discuss in Chapter 12§§2–9.) Nor does he simply mean that in these cases the connection between the *definiendum* and the *definiens* is indemonstrable, for this is true of every type of definition. Rather, he means that if we take the terms in the *definiens*, apart from the *definiendum*, there is no way to arrange them in such a way as to form a demonstration. This is why I have called the essences stated in such definitions 'causally simple'.

The second type of definition mentioned in T25 is 'a syllogism of what something is, differing in aspect from a demonstration'. I shall call these 'demonstrative definitions'. Aristotle also describes them as 'an account (*logos*) that shows why something exists'²¹ (93b39) and 'a sort of demonstration of the what it is, differing in arrangement from a demonstration' (94a1–2; see also *APo* 1.8, 75b31–2).²² These are definitions in which the essence is of the form 'A–C because of B' (or just 'B–C'). The definition itself—that is, the *definiens*—is not a demonstration, nor can it be demonstrated to belong to the *definiendum*. But the *definiens* is 'a sort of demonstration of the essence' because the terms in it can be arranged in the form of a demonstration that makes clear the causal relation among the items they signify:

Definition: Thunder is_{def} (A) noise in (C) the clouds because of (B) fire extinguishing

Demonstration: Noise belongs to all fire extinguishing
 Fire extinguishing belongs to all clouds
 Noise belongs to all clouds

¹⁹ I say that the categories of being, such as quantity, are 'genus-like' because I take it that a genus defines the subject-matter of a science and that there is no science (in the *APo* sense) of any of the categories of being.

²⁰ See *APo* 1.2, 72a22–3. ²¹ λόγος ὁ δηλῶν διὰ τί ἔστιν.

²² οἷον ἀποδείξῃς τοῦ τί ἔστι, τῇ θέσει διαφέρων τῆς ἀποδείξεως.

In short, demonstrative definitions are of causally complex essences, and the type of entity defined in this way is a demonstrable attribute.²³ (I discuss demonstrative definitions in more detail in Chapter 7§§6–10.)

The third type of definition ('a conclusion of the demonstration of what something is') is closely connected to the second (i.e., demonstrative definition). Aristotle says: 'A definition of thunder is noise in the clouds; and this is the conclusion of the demonstration of the what it is' (94a7–9).²⁴ Scholars have debated whether the relevant conclusion is (1) 'noise belongs to the clouds' or (2) 'noise in the clouds belongs to thunder'. In my view the correct option is (1):²⁵ the 'conclusion' is the one in the demonstration presented just above. Two considerations favour this view.

First, in *APo* 2, Aristotle's terms for 'definition' (*horos* and *horismos*) usually signify the *definiens* and not the whole proposition in which the *definiens* is predicated of the *definiendum*. This suggests that T25 identifies three types of *definiens*, in which case 'noise in the clouds' and not 'thunder is noise in the clouds' is the conclusion of the demonstration Aristotle has in mind.

Second, Aristotle calls the third type of definition 'the conclusion of the demonstration of the what it is' (94a8–9). The relevant demonstration makes clear what thunder is by displaying the causal relation among the parts of its essence. The relevant causal relation is that fire extinguishing causes there to be a certain type of noise (the type with which thunder is identified) in the clouds. However, if the conclusion is 'noise in the clouds belongs to thunder', then the causal relation displayed in the demonstration is that being an extinguishing of fire causes thunder to be a noise in the clouds. This fails to make clear the relevant causal relation—indeed, I do not think it makes clear any causal relation at all. Thunder just is a noise in the clouds; there is no reason why it is. The question of scientific interest is: why is there thunder (i.e., a certain type of noise) in the clouds? Of course 'noise in the clouds' is not the complete definition of thunder. It is only part of it, the A and C terms. For this reason, definitions of the third type are limited to demonstrable attributes. For definitions of this type are parts of demonstrative definitions, and only demonstrable attributes have such definitions. Nonetheless, since the definition 'noise in the clouds' identifies part of the essence of thunder, it seems to satisfy the requirement for definition Aristotle lays down at the start of *APo* 2.10: it is an account of what something is.

²³ How demonstrative definitions are related to definitions by genus and differentia(e) (i.e., non-demonstrative definitions) is a classic problem of Aristotelian exegesis. (See, e.g., LeBlond 1975.) My solution is that each type of definition applies to a distinct type of object. Aristotle does not indicate how definitions by genus and differentia(e) are to be transformed into demonstrative ones and vice versa because (at least in the *APo*) he thinks they cannot be. And since they apply to different types of object, they need not be. For a similar view, according to which substances are defined by genus and differentia(e) and attributes are defined in a different way by what I call 'demonstrative definitions', see Ross 1949: 78, 633 and Goldin 1996: 12, 126–41.

²⁴ ἐστὶν ὁρος βροντῆς ψόφος ἐν νέφεσιν τοῦτο δ' ἐστὶ τῆς τοῦ τί ἐστιν ἀποδείξεως συμπέρασμα.

²⁵ For a similar interpretation of 94a7–8, see Charles 2000: 199 n5; for a different view, see Ackrill 1981: 360.

6. Nominal Accounts in *APo* 2.10

Since Aristotle says that definition is of essence, he seems to think that all definitions properly speaking are real definitions, definitions that state the real essences of real things. *APo* 2.10 also mentions ‘an account of what a name or some other name-like expression signifies’ (93b30–1, in T33).²⁶ I shall call these ‘nominal accounts’.²⁷ A nominal account states the ordinary meaning of a term. Examples include ‘thunder, a certain noise in the clouds’ and ‘eclipse, a certain loss of light’.²⁸ In the next chapter, I argue that nominal accounts of this sort play an important role in inquiry. In this section, I examine their place in Aristotle’s theory of definition.

Scholars have debated whether nominal accounts are a genuine and distinct type of definition. If they are, Aristotle recognizes four types of definition in total. In favour of an affirmative answer is the fact that he introduces them immediately after stating what a definition is. He also refers to them as definitions later in *APo* 2.10 (93b38–94a1). In favour of a negative answer is the fact that they do not appear in Aristotle’s list of types of definition at the end of the chapter (94a11–15, T25).²⁹ There is another issue. Aristotle says that (a) definition is of essence, (b) non-existent entities do not have essences, and (c) non-existent entities have nominal accounts.³⁰ There seem to be two possibilities. Either nominal accounts are not definitions, in which case there are three types of definition. Or nominal accounts are definitions, in which case there are four types and, contra (a), not all definitions are of essence. If nominal accounts are definitions and not all definitions are of essence, then Aristotle risks making the concept of definition ambiguous. On the other hand, if nominal accounts are not definitions then it is odd that he introduces them as a type of definition (93b29–31, in T33).³¹ (Below I suggest a solution to this difficulty.)

However, my main interest here is not in whether nominal accounts are genuine definitions but in the relationship between nominal accounts and definitions of the third type: the conclusion of the demonstration of the essence. One possibility is that

²⁶ λόγος τοῦ τί σημαίνει τὸ ὄνομα ἢ λόγος ἕτερος ὀνοματώδης.

²⁷ They are sometimes called ‘nominal definitions’. However, this label is potentially misleading: calling them ‘definitions’ prejudices the question of whether accounts of what names signify are genuine definitions (i.e., essence-stating accounts). I take up this question just below.

²⁸ *APo* 2.8, 93a22–3 (in T32). In both examples, the nominal account mentions (what turns out to be) part of the essence. This is true of only (and perhaps all) nominal accounts of existent things. This is not true of nominal accounts of non-existent things, for they do not have essences. In this way, there is significant continuity between the nominal account of an existent thing (e.g., eclipse: loss of light) and its complete scientific definition (loss of light from the moon because of the screening of the sun by the earth). In Chapter 10§§5–8, I argue that the inquirer can use the nominal account of eclipse to launch a search for its existence and (complete) essence. This view is developed in detail by Charles 2000. See also DeMoss and Devereux 1988.

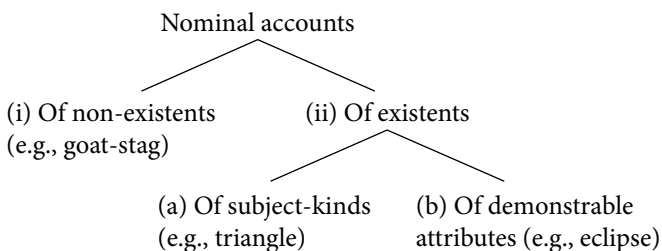
²⁹ They are also missing from the parallel passage in *APo* 1.8 (75b30–2).

³⁰ See *APo* 2.7, 92b5–8, 92b28–32.

³¹ There are useful discussions of these issues in Bolton 1976, Charles 2000: 26–33, DeMoss and Devereux 1988, Deslauriers 2007: 68–78, and Ross 1949: 634–6.

all nominal accounts are definitions of this type.³² (If they are, then all nominal accounts are genuine definitions.) In *APo* 2.8 (93a22–4, in T32), Aristotle gives a list of what are plausibly thought to be nominal accounts, which include (as I noted above) ‘thunder, a certain noise in the clouds’ and ‘eclipse, a certain loss of light’. These are conclusions of demonstrations of essence.³³ However, one problem with the view that all nominal accounts are definitions of the third type is that the latter apply only to existent entities (for there are demonstrations only of existent entities), whereas some nominal accounts are of non-existent entities (e.g., goat-stag). Another problem is that Aristotle says that there is a nominal account of triangle (93b30–2, in T33). But the essence of triangle is causally simple and its definition is non-demonstrative, and so there is no demonstration whose conclusion states its nominal account.³⁴ (The same holds true, I have argued, for human being, which appears on the list in 2.8, at 93a23–4 (in T32).) Therefore, not all nominal accounts are definitions of the third type.

But then are all definitions of the third type (i.e., conclusions of demonstrations of essence) nominal accounts? I suggest that they are.³⁵ In that case, there are two main sub-groups of nominal accounts: (i) nominal accounts of non-existent entities and (ii) nominal accounts of existent entities. (ii) then further divides into (a) nominal accounts of subject-kinds (e.g., triangle, human being) and (b) nominal accounts of demonstrable attributes (e.g., eclipse, thunder). All definitions of the third type (i.e., conclusions of demonstrations of essence) are in group (ii) (b). In addition, it may be that all nominal accounts in (ii) (b) are definitions of the third type.



One advantage of this interpretation is that it solves the difficulty I mentioned above: no nominal account in group (i) is a genuine definition, but all those in group (ii) are.

I have suggested that all and only definitions of the third type (i.e., conclusions of demonstrations of essence) are nominal accounts of demonstrable attributes (i.e.,

³² For this view, see Bolton 1976: 523, 525, Ross 1949: 634–5.

³³ In the first case we would need to add ‘a loss of light from the moon’.

³⁴ See DeMoss and Devereux 1988: 136–7.

³⁵ I take it that in the case of demonstrable attributes for which there is no *explanandum*-fixing A term, such as leaf-shedding, the conclusion of the demonstration of essence is not a definition and thus not a nominal account of the attribute. For in these cases the demonstration of essence is identical to the demonstration of the attribute, and, for example, ‘leaf-shedding belongs to all broad-leaved plants’ or ‘leaf-shedding in broad-leaved plants’ is not a definition or nominal account of leaf-shedding. See Chapter 7 §§8–10.

group (ii) (b)). Nevertheless, our knowledge of nominal accounts and our knowledge of definitions of the third type differ in the following way. Suppose 'loss of light from the moon' is the nominal account of eclipse. Eclipse exists and is a demonstrable attribute, so 'loss of light from the moon' is the conclusion of the demonstration of eclipse's essence. This demonstration also proves that eclipse exists. If one knows this as the conclusion, then one knows that eclipse exists.³⁶ However, if one knows this merely as the nominal account, as what 'eclipse' signifies, and not as the conclusion, it does not follow that one knows that eclipse exists. One can know the nominal account of eclipse without knowing that eclipse exists, even though the nominal account has the same content as the conclusion of the existence-proving demonstration of eclipse's essence. For one can know the nominal account of eclipse before one discovers that eclipse exists and thus before one discovers the demonstration. Indeed, as we shall see in the next chapter, knowing the nominal account aids one's search for whether eclipse exists and for the demonstration.

Conclusion

With Aristotle's account of the different types of definition in view, we can complete our two columns, which summarize the distinctions made in *APo* 2.9–10:

A	B
Things whose causes are the same.	Things whose causes are different.
Primary and subordinate subject-kinds.	Things that have a middle term—i.e., demonstrable attributes.
Things whose essences are in no way demonstrable.	Things whose essences are in some way demonstrable.
Essences discovered by induction or division.	Essences discovered by demonstration.
Causally simple essences.	Causally complex essences.
E.g., human, moon, god, soul, unit.	E.g., eclipse, harmony, thunder, ice, 2R.
Non-demonstrative definitions.	Demonstrative definitions.
Nominal accounts.	Conclusions of demonstrations of essence.

³⁶ See Chapter 10 §§7–8. The conclusion of the demonstration is that loss of light (i.e., eclipse) belongs to the moon. Therefore, the demonstration proves that eclipse exists. If one knows the nominal account as the conclusion of the demonstration, one knows the demonstration (or at least that there is one), and hence one knows that eclipse exists.

10

Discovering Causally Complex Essences

APo 2.8

APo 2.8 is one of the most important and difficult chapters in the *APo*. It is important because it explains how one searches for and discovers one type of essence (the causally complex type). It is difficult because, as with much of the *APo*, parts of the text border on unintelligible and the structure and philosophical significance of the chapter as a whole are hard to discern. My goal is to show that Aristotle's account of inquiry in *APo* 2.8 is both intelligible and philosophically interesting, and I shall do so by arguing that the chapter is best understood as responding to an instance of Meno's Paradox, one that arises out of Aristotle's account of inquiry in *APo* 2.2. (see Chapter 7§4.) Other commentators have detected signs of Meno's Paradox in *APo* 2.1–2 and 8.¹ However, they have tended to miss two important points. First, the puzzle concerns the possibility of inquiring whether something exists (and not, as is often supposed, what something is).² Second, in *APo* 2.8 Aristotle offers two solutions to the puzzle—two routes to knowledge that something exists.

I begin by reviewing some of the central puzzles of the aporetic chapters that fall between *APo* 2.2 and 8. I then turn to 2.8, arguing that both the puzzles of 2.3–7 and Meno's Paradox provide useful background for understanding Aristotle's account.

1. The Puzzles of *APo* 2.3–7

APo 2.8 begins:

T26 But let us inquire again into which of these things is said rightly and which not rightly, and into what definition is, and whether there is in some way demonstration and definition of the what it is (*tou ti esti*) or not at all.³ (93a1–3)

¹ See Ackrill 1981: 364–7, Bayer 1995: 246, Bolton 1976: 516, Charles 2000: 76, Goldin 1996: 113, Gómez-Lobo 1981: 36.

² Charles (2000: 76) briefly mentions the existence version of the puzzle.

³ Πάλιν δὲ σκεπτέον τί τούτων λέγεται καλῶς καὶ τί οὐ καλῶς, καὶ τί ἐστὶν ὁ ὁρισμὸς, καὶ τοῦ τί ἐστὶν ἄρα πῶς ἐστὶν ἀπόδειξις καὶ ὁρισμὸς ἢ οὐδαμῶς.

Aristotle refers back to *APo* 2.3–7, where he raises a number of puzzles concerning the relationship among demonstration, definition, and essence. It will be useful to review some of these.

At the end of T26, Aristotle states the central question of 2.3–7: can there be both demonstration and definition of the ‘what it is’ (essence) of a thing? Throughout the *APo* Aristotle assumes that definition is of the essence. He says so at the start of 2.10 (93b29) and the claim is a crucial premise in many of the arguments in 2.3–7. The principal question, then, is whether there can be demonstration of essence—or, put differently, whether there can be demonstration of the same thing of which there is definition. Aristotle’s arguments in these chapters are complex, but we can discern four major obstacles to an affirmative answer. I shall turn to these in a moment.

First, however, it is worth noting the sceptical conclusion Aristotle reaches in *APo* 2.7. The chapter ends:

T27 From these things it seems that (a) definition and syllogism are not the same, and that (b) there is not syllogism and definition of the same thing; in addition, [it seems] that (c) definition neither demonstrates nor proves anything, and that (d) it is not possible to get to know the what it is either by definition or by demonstration.⁴ (92b35–8)

In a moment I shall try to explain how Aristotle arrives at the conclusions stated in T27a–c. In d, he says that we cannot get to know an essence either by definition or by demonstration. Since essences cannot be demonstrated, as a–b imply, we cannot get to know them by that means. Nor can we get to know them by definition, if we assume that getting to know an essence requires grasping a proof of it and we accept Aristotle’s arguments that definitions do not prove anything, as c states. Earlier in *APo* 2.7, he argues that we cannot get to know essences by induction (92a37–b1). For induction, like demonstration, ‘does not prove what a thing is, but rather that it is or is not’⁵ (i.e., that it is or is not something) (92a38–b1). In sum, the three canonical routes by which we acquire knowledge—demonstration, definition, and induction—are incapable of leading us to knowledge of essence. Or so the puzzles of *APo* 2.3–7 would have us believe.

In the remaining chapters of *APo* 2, Aristotle rehabilitates demonstration, definition, and induction as routes to knowledge of essence: by demonstration we learn the causally complex essences of demonstrable attributes (2.8); and by definition we learn the causally simple essences of primary and subordinate subject-kinds, where ‘definition’ includes the methods of induction and division outlined in *APo* 2.13 (see Chapter 12). Induction is also the way we learn the preliminary accounts required for

⁴ Ἐκ μὲν τοίνυν τούτων οὕτε ὁρισμὸς καὶ συλλογισμὸς φαίνεται ταὐτὸν ὄν, οὕτε ταυτοῦ συλλογισμὸς καὶ ὁρισμὸς· πρὸς δὲ τούτοις, ὅτι οὕτε ὁ ὁρισμὸς οὐδὲν οὕτε ἀποδείκνυσιν οὕτε δείκνυσιν, οὕτε τὸ τί ἐστίν οὐθ’ ὁρισμῶ οὐτ’ ἀποδείξει ἔστι γινῶναι.

⁵ οὐ γὰρ τί ἐστι δείκνυσιν, ἀλλ’ ὅτι ἡ ἔστιν ἡ οὐκ ἔστιν.

seeking essences of both types (2.19; see Chapter 13).⁶ Stated in terms of Aristotle's theory of definition in 2.10 (see Chapter 9§§5–6), by demonstration we learn demonstrative definitions, by division we learn some non-demonstrative definitions, and by induction we learn other non-demonstrative definitions and some nominal accounts.

Returning now to the question of whether there can be demonstration of essence, the first obstacle to an affirmative answer is Aristotle's previously stated claim that definitions, in so far as they are principles of demonstration, are indemonstrable.⁷ (Otherwise there would be an infinite regress of demonstrations or they would proceed in a circle, and either way demonstrative scientific knowledge would be impossible.⁸) The claim that definitions are indemonstrable principles needs to be stated precisely. Suppose that AB is the essence of *x*. The claim is that there can be no demonstration whose conclusion is 'AB belongs to *x*', or 'A belongs to *x*', or 'B belongs to *x*'—the connection between a thing and its essence or any part thereof cannot be demonstrated.

The second obstacle to there being demonstration of essence is the assumption that definition and demonstration are different. This is the principal premise in the arguments of *APo* 2.3 and 7. Consider a subordinate subject-kind, such as human being, whose existence is demonstrable. A definition is a statement of what something is, whereas a demonstration is a proof that something is (either that a subordinate subject-kind exists or that a subject-kind has some attribute). But what human being is and that human being (the natural kind) exists are different. Therefore, since definition is of what something is (the essence), demonstration cannot be. As Aristotle puts it in 2.7: 'If one is to prove what [something] is and that it exists, how will one prove [these] by the same argument? For definition and demonstration [each] make one thing clear; but what a human being is and that human being exists are different' (92b8–11).⁹

Furthermore, a demonstration that an attribute P belongs to a subject S standardly assumes as the middle term what S or P is (the essence).¹⁰ But if demonstrations assume what things are, they cannot also prove what they are. As Aristotle argues in *APo* 2.4 and 6, any such demonstration would beg the question. This is the third obstacle to there being demonstration of essence. Suppose one offered the following as a demonstration of the essence of human being:

Two-footed animal belongs to all B

B belongs to all human being

Two-footed animal belongs to all human being

⁶ On my reading, division and induction are sufficient for acquiring non-noetic knowledge of definitions, and necessary for acquiring *nous* of definitions, but not sufficient for acquiring *nous*. See Chapters 6§4, 8§§4–5, 12§1, 12§3, and 12§12.

⁷ See, e.g., *APo* 2.3, 90b24–7.

⁸ See *APo* 1.3.

⁹ ἀλλὰ μὴν εἰ δείξει τί ἐστι καὶ ὅτι ἔστι, πῶς τῷ αὐτῷ λόγῳ δείξει; ὁ τε γὰρ ὁρισμὸς ἐν τι δηλοῖ καὶ ἡ ἀπόδειξις· τὸ δὲ τί ἐστὶν ἀνθρώπου καὶ τὸ εἶναι ἀνθρώπου ἄλλο.

¹⁰ See Chapter 3§4 on the two models of demonstration in the *APo*.

What is B? Either it is the essence of human being or it is not. If B is the essence, then the syllogism, in so far as it aims to be a demonstration of the essence, begs the question, for it assumes what human being is: B. If B is not the essence, then the syllogism fails to demonstrate that two-footed animal is the essence of human being. For in any such demonstration, the middle term would have to belong essentially to the subject.¹¹ (Nevertheless, this is a valid syllogism.) Or consider another example:

Loss of light from the moon belongs to all screening of the sun by the earth
Screening of the sun by the earth belongs to all eclipse
 Loss of light from the moon belongs to all eclipse

Is screening of the sun by the earth the essence of eclipse or not? If it is, then the syllogism, in so far as it aims to be a demonstration of the essence, begs the question. If it is not, it fails to demonstrate that loss of light from the moon is eclipse's essence. (Nevertheless, this is a valid syllogism; in *APo* 2.8 Aristotle calls it 'the general syllogism' of the essence (93a15, T28b below).)

The fourth and final obstacle to there being demonstration of essence follows from the third. The question-begging syllogisms face an additional problem: they seem to conflict with Aristotle's requirement that an essence must be a unity. Eclipse, in Aristotle's view, is a unity. Since the essence of eclipse makes it the very thing that it is, eclipse is a unity only if its essence is. The (failed) demonstration of eclipse's essence, however, makes it seem as if its essence is two things, not one: loss of light from the moon and screening by the earth. If its essence is two different things, it seems that eclipse will be so as well.

Taken together, the central arguments of *APo* 2.3–7 clarify Aristotle's main task in 2.8. He argues that in one sense there can be, and in another sense there cannot be, demonstration of essence. To do this he must show that there can be a demonstration that (a) does not violate the indemonstrability of the connection between a thing *x* and its essence (or any part thereof), (b) proves that *x* exists, (c) assumes as the middle term what *x* is, and (d) still somehow amounts to a non-question begging demonstration of what *x* is (*x*'s essence), a demonstration that (e) makes clear (or at least does not violate) the unity of the essence. How he accomplishes this is the subject of the present chapter.

2. The Argument of *APo* 2.8, 93a3–15

The opening lines of *APo* 2.8 (T26) refer back to the puzzles of 2.3–7. Aristotle then continues:

T28 (a) Since, as we said, knowing what a thing is (*ti esti*)¹² and knowing the cause of whether it is are the same—and the reason is that there is a cause, and this is either the same or different, and if different, [what a thing is] is

¹¹ See *APo* 2.4, 91a15–32.

¹² I take it that in this passage and throughout *APo* 2.8 Aristotle uses 'what it is' (*ti esti*) and 'essence' (*to ti ên einai*) inter-changeably.

either demonstrable or indemonstrable—it follows that if [the cause] is different and it is possible to demonstrate [what a thing is], it is necessary for the cause to be the middle term and for [the what it is] to be proven in the first figure; for that which is being proven is universal and affirmative.¹³

(b) Then one way [of demonstrating what a thing is] would be the one mentioned just now, proving the [what it is] though another what it is. For in the case of [demonstrations] of the what it is, the middle term must be what it is, and in the case of [demonstrations] of properties [it must be] a property. So that for the same object one will prove the one but not the other of the essences (*tōn to ēn einai*). Earlier it was said that this way [of proving] would not be a demonstration [of the what it is]. Rather, it is a general syllogism of the what it is.¹⁴ (93a3–15)

Aristotle begins by reminding us of his claim in *APo* 2.2 that knowing what something is (the essence) and knowing why it is (the cause) are the same. He means, I take it, that if one knows the essence, one knows the cause, and vice-versa. He then offers an explanation (*logos*) of this claim. The explanation involves three possibilities: (i) *x*'s cause is the same; (ii) *x*'s cause is different and *x*'s essence is demonstrable; and (iii) *x*'s cause is different and *x*'s essence is indemonstrable.¹⁵ He then spends the rest of the passage—in fact, the rest of *APo* 2.8—developing (ii).

Let's see how (ii) might support Aristotle's opening claim in T28 that knowing the essence and knowing the cause are the same. In developing (ii), Aristotle first claims that the cause would be the middle term in a first figure demonstration of the essence. On the interpretation I defended in the previous chapter, if the cause is different, then it is part of and not identical to the whole essence, which is of the form 'A–C because of B'—for example, in the case of eclipse: (A) loss of light from (C) the moon because of (B) screening of the sun by the earth. So if the cause (B) is different, there is another part of the essence: A–C. When Aristotle says that the essence would be proven in the first figure, he means that the A and C terms would appear in the conclusion of a first figure demonstration whose middle term is the cause, B. Now if something is demonstrable, then knowing it in an unqualified way requires knowing its demonstration. So if the essence is demonstrable, then knowing it in an

¹³ T28a appears as T23 in Chapter 9§1.

¹⁴ ἔπει δ' ἐστίν, ὡς ἔφαμεν, ταυτὸν τὸ εἶδέναι τί ἐστι καὶ τὸ εἶδέναι τὸ αἷτιον τοῦ εἶ ἐστι (λόγος δὲ τούτου, ὅτι ἐστι τι τὸ αἷτιον, καὶ τοῦτο ἢ τὸ αὐτὸ ἢ ἄλλο, καὶ ἢ ἄλλο, ἢ ἀποδεικτὸν ἢ ἀναπόδεικτον)—εἰ τοίνυν ἐστὶν ἄλλο καὶ ἐνδέχεται ἀποδείξαι, ἀνάγκη μέσον εἶναι τὸ αἷτιον καὶ ἐν τῷ σχήματι τῷ πρώτῳ δεικνύσθαι· καθόλου τε γὰρ καὶ κατηγορικὸν τὸ δεικνύμενον. εἰς μὲν δὴ τρόπος ἂν εἴη ὁ νῦν ἐξητασμένος, τὸ δι' ἄλλου του τί ἐστι δεικνύσθαι. τῶν τε γὰρ τί ἐστὶν ἀνάγκη τὸ μέσον εἶναι τί ἐστι, καὶ τῶν ἰδίων ἴδιον. ὥστε τὸ μὲν δείξει, τὸ δ' οὐ δείξει τῶν τί ἦν εἶναι τῷ αὐτῷ πράγματι. Οὗτος μὲν οὖν ὁ τρόπος ὅτι οὐκ ἂν εἴη ἀπόδειξις, εἴρηται πρότερον· ἀλλ' ἔστι λογικὸς συλλογισμὸς τοῦ τί ἐστίν.

¹⁵ Some commentators (e.g., Barnes in his translation) think that it is 'the cause' that is either demonstrable or indemonstrable. This is a defensible reading, but in the context of the passage as a whole 'the essence' (i.e., 'the what it is') makes better sense. After all, the demonstrability of essence was the central concern of *APo* 2.3–7 and remains so in 2.8.

unqualified way requires knowing the relevant demonstration, whatever it might be. In addition, perhaps Aristotle thinks that knowing the cause in an unqualified way requires knowing it as the middle term in the demonstration of the essence. In that case, it seems, knowing the essence and knowing the cause are the same: if we know the first, we know the second, and vice versa. In this way, (ii) supports T28's opening claim.

So far Aristotle's account in T28 is at a very abstract level. He is reflecting on his claim that knowing what something is and knowing why it is are the same, and he connects this thought with the issue of the demonstrability of essence. In T28b, he considers and dismisses one view of what the demonstration of the essence might be. As we have just seen, the cause is the demonstration's middle term and the A and C terms appear in the conclusion. For example:

Loss of light from the moon belongs to all screening of the sun by the earth
Screening of the sun by the earth belongs to all eclipse
 Loss of light from the moon belongs to all eclipse

As we saw above, the problem with this syllogism, in so far as it aims to be a demonstration of eclipse's essence, is that it begs the question, assuming in the middle term what it is supposed to prove: namely, what eclipse is. Aristotle comments on it in T28b, saying that it proves 'the [what it is] though another what it is. For in the case of [demonstrations] of the what it is, the middle term must be what it is' (93a10–11). The syllogism proves in a deductively valid way that one part of the essence belongs to eclipse, but it does not prove that the other part belongs. As he says: 'for the same object one will prove the one but not the other of the essences' (93a12–13). Furthermore, the syllogism gives no reason for thinking that one part has any better claim to being the essence than the other, or that one part enjoys any causal priority over the other.¹⁶ For one can just as well prove that eclipse is a screening of the sun by the earth from its being a loss of light. Finally, as I argued in Chapter 9§5, it is doubtful that the syllogism makes clear any causal relation at all. For it is doubtful that there is any cause of the fact that eclipse is a loss of light from the moon. For these reasons, the syllogism fails to be a genuine demonstration of essence. Rather, Aristotle calls it 'a general syllogism of the essence' (93a15).

In this way, T28 reminds us of a central argument of the aporetic chapters (2.3–7), now cast in terms of the distinction between the two types of cause. When the cause is different, the essence of which it is part seems somehow demonstrable. And if the essence is demonstrable, then knowing it in an unqualified way requires knowing the relevant demonstration. But this demonstration cannot be the general syllogism of essence just discussed. So then what is it?

¹⁶ See Charles 2000: 199–200.

3. The Essence-Revealing Demonstration

We have already seen Aristotle's answer, as it appears in his account of definition in *APo* 2.10. In the case of demonstrable attributes (i.e., things whose causes are different), we can arrange the terms in the *definiens* in demonstrative form:

Definition: Eclipse is_{def} (A) loss of light from (C) the moon because of (B) screening of the sun by the earth

Demonstration: Loss of light belongs to all screening of the sun by the earth
Screening of the sun by the earth belongs to all moon
 Loss of light belongs to all moon¹⁷

In section 1, I identified five conditions the demonstration of essence would have to meet in order to overcome the puzzles of *APo* 2.3–7. This demonstration meets all of them.

First, it does not violate the indemonstrability of the connection between a thing and its essence (condition (a)). Unlike the 'general syllogism', it does not attempt to demonstrate that any part of eclipse's essence belongs to it.¹⁸ Rather, it demonstrates that (i.e., it proves that and shows why) a certain loss of light belongs to the moon. In this way, it also meets condition (b): it proves that eclipse exists. Since eclipse is a certain loss of light, to prove that the moon loses its light (in a certain way) just is to prove that it is eclipsed. We can substitute 'eclipse' for 'loss of light' without altering the explanatory content of the demonstration (though not without altering its definitional content; see Chapter 7§10).¹⁹

In addition, the demonstration's middle term identifies (part of) what eclipse is: screening of the sun by the earth. So condition (c) is met. For the middle term is the cause of eclipse, and the cause of any demonstrable attribute is part of its essence—indeed, it is the explanatorily basic part.

Furthermore, the syllogism amounts to a non-question begging demonstration of the essence (condition (d)). In the concluding passage of *APo* 2.8, Aristotle makes the strong claim that demonstration is necessary for getting to know the essences of demonstrable attributes:

T29 So then it has been stated how the what it is is gotten hold of and becomes known. The result is that there is neither syllogism nor demonstration of the what it is, but it is made clear through syllogism and demonstration. So that without demonstration it is not possible to get to know the what it is, from

¹⁷ See *APo* 2.8, 93a30–1 (in T34, below), 93b7–12 (T30, below), 2.10, 94a1–10.

¹⁸ For a different account of the connection between the 'general syllogism' and the essence-revealing demonstration, see Mansion 1976: 183–9. For an account similar to my own, see Landor 1985.

¹⁹ For this account to work, we need to take 'loss of light' as shorthand for 'such-and-such kind of loss of light'—that is, the specific sort of loss of light that occurs when an eclipse occurs.

which the cause is different, but there is no demonstration of it, just as we also said in discussing the puzzles.²⁰ (93b15–20)

Aristotle draws on the distinction between what a demonstration proves and what it reveals. (See Chapter 2§3.) What a demonstration proves is the fact stated in the conclusion. What it reveals is the causal relation among the items signified by the syllogism's three terms. When Aristotle says that there is no demonstration of the essence, he means that there is no demonstration whose conclusion is a proposition in which the *definiens*, or any part thereof, is predicated of the *definiendum*. Any such syllogism, as we have seen, at least violates the indemonstrability condition and may also beg the question. When Aristotle says that we get to know the essence *through* demonstration, he means that there is a demonstration whose three terms can be arranged in such a way that the complete essence, including the causal relation among its parts, is made clear. This is the key feature of the essence-revealing demonstration above. Its three terms are all that is required for an exhaustive causal analysis of eclipse: the subject (the moon, C), the attribute that belongs to it (loss of light, A), and the cause (screening of the sun by the earth, B). In this way, the demonstration contains all the definitional information relevant to eclipse, arranged so as to make clear its causal structure. As a result, from the demonstration as a whole we can 'read off', as Barnes says, the complete essence.²¹

Finally, since the demonstration makes clear the causal relation among the parts of the essence, it also makes clear its unity (condition (e)). It is not the case that eclipse is two things: loss of light from the moon and screening of the sun by the earth. Rather, it is one thing: loss of light from the moon *caused by* screening of the sun by the earth. The demonstration reveals the intrinsic connection among the parts of the essence. It also reveals the intrinsic connection between the object and its essence. Since eclipse is a certain loss of light, one that affects the moon, and since there is an intrinsic connection between loss of light from the moon and screening of the sun by the earth, there is an intrinsic connection between eclipse and its essence.

In Chapter 7§9, I argued that some causally complex essences contain three parts (an attribute, the subject to which it belongs, and the cause of its belonging: A–C because of B) and others contain two (the cause and the subject: B–C). Harmony, for example, is defined as (B) a numerical ratio holding between (C) high and low notes, and leaf-shedding as (B) coagulation of sap in (C) broad-leaved plants. For explanatory purposes, there is no difference between these essences and those that contain an A term. For this reason, Aristotle's account of demonstrating essence in APO 2.8–10 applies just as well in these cases.

²⁰ Ὡς μὲν τοίνυν λαμβάνεται τὸ τί ἐστὶ καὶ γίνεται γνώριμον, εἴρηται, ὥστε συλλογισμὸς μὲν τοῦ τί ἐστὶν οὐ γίνεται οὐδ' ἀπόδειξις, δῆλον μέντοι διὰ συλλογισμοῦ καὶ δι' ἀποδείξεως· ὥστ' οὐτ' ἄνευ ἀποδείξεως ἐστὶ γνώαι τὸ τί ἐστὶν, οὐ ἐστὶν αἴτιον ἄλλο, οὐτ' ἐστὶν ἀπόδειξις αὐτοῦ, ὥσπερ καὶ ἐν τοῖς διαπορήμασιν εἵπομεν.

²¹ Barnes 1993: 219.

We can see evidence for this in the passage in *APo* 2.8 in which Aristotle sets out an essence-revealing demonstration:

- T30** What is thunder? An extinguishing of fire in a cloud. Why is there thunder? Because the fire in the cloud is being extinguished. Cloud C, thunder A, extinguishing of fire B. So B fire being extinguished belongs to C cloud, and A noise belongs to B; and B is the account (*logos*) of A, the first extreme term.²² (93b7–12)

Aristotle first sets out the terms for the following demonstration:

- (A) Thunder belongs to all (B) fire extinguishing²³
(B) Fire extinguishing belongs to all (C) clouds
 (A) Thunder belongs to all (C) clouds²⁴

He then switches the value of the A term:

- (A) Noise belongs to all (B) fire extinguishing
(B) Fire extinguishing belongs to all (C) clouds
 (A) Noise belongs to all (C) clouds

For explanatory purposes ‘thunder’ and ‘noise’ are interchangeable. To demonstrate that there is thunder in the clouds just is to demonstrate that there is a certain type of noise in them, and vice versa. From the second demonstration we can read off the complete essence of thunder. However, the first demonstration is also valuable, because it indicates that if no A term is available or used (such as with harmony, leaf-shedding, and 2R), we can read off the complete essence of the attribute from the demonstration in which it is proven to belong to its subject. For example, the demonstration of leaf-shedding

- (A) Leaf-shedding belongs to all (B) coagulation of sap
(B) Coagulation of sap belongs to all (C) broad-leafed plants
 (A) Leaf-shedding belongs to all (C) broad-leafed plants

proves that and explains why broad-leafed plants shed their leaves, and in so doing it reveals what leaf-shedding is: coagulation of sap in broad-leafed plants (B–C). As we saw in *APo* 2.2 (see Chapter 7§2), to explain why P belongs to S is to define what P is.²⁵

²² τί ἐστι βροντή; πῦρ δὲ ἀπόσβεσις ἐν νέφει. διὰ τί βροντᾷ; διὰ τὸ ἀποσβέννυσθαι τὸ πῦρ ἐν τῷ νέφει. νέφος Γ, βροντή Α, ἀπόσβεσις πῦρ δὲ Β. τῷ δὲ Γ τῷ νέφει ὑπάρχει τὸ Β (ἀποσβέννυται γὰρ ἐν αὐτῷ τὸ πῦρ), τούτῳ δὲ τὸ Α, ψόφος· καὶ ἔστι γε λόγος τὸ Β τοῦ Α τοῦ πρώτου ἄκρου.

²³ Since not all cases of fire extinguishing cause thunder, for this demonstration to work the middle term will have to be enhanced.

²⁴ We should understand the conclusion and minor premise to be stating that all clouds are susceptible to having thunder and fire extinguishing in them.

²⁵ As I noted in Chapter 3§4, for every subject-kind S, there are a certain number of demonstrable attributes that belong only because of S's essence and not because of their own (i.e., there are a certain

4. Inquiry, Discovery, and Prior Knowledge

So far I have discussed the main puzzles from *APo* 2.3–7 Aristotle aims to solve in *APo* 2.8 and the essence-revealing demonstration that solves them. I now turn to Aristotle's (difficult to understand and variously interpreted) account of how an inquirer discovers a demonstration of this sort.

In Chapter 8§3, I argued that in *APo* 2 Aristotle is committed to the Socratic Picture of the order of inquiry:

- At Stage 1, the inquirer seeks whether a subject-kind *S* exists, in the sense that she seeks whether *S* has an essence (cause).
- At Stage 2, she knows that *S* exists, in the sense that she knows that *S* has an essence, and she seeks what *S*'s essence is.
- At Stage 3, she knows what *S*'s essence is, and she seeks whether *P* belongs to *S* by seeking whether there is a cause that explains why *P* belongs to *S*.
- At Stage 4, she knows that *P* belongs to *S*, in the sense that she knows that there is a cause that explains why *P* belongs to *S*, and she seeks what the cause is.
- At Stage 5, she knows both what *S*'s essence is and why *P* belongs to *S*.

As we have seen, at the end of *APo* 2.8 (93b15–20, T29), Aristotle says that the essence-revealing demonstration is the means by which the inquirer learns the essence of a demonstrable attribute. Discovering a demonstration of this sort effects the move from Stages 4 to 5. However, as I argued in my discussion of Meno's Paradox in Chapter 7§4, Aristotle needs to explain how we can move from Stages 3 to 4. In my view, much of *APo* 2.8 is spent explaining exactly this. So while the chapter's official task is to show how to get to Stage 5 (thus solving the main puzzles of *APo* 2.3–7), I shall argue that Aristotle spends much of the chapter showing how to get to Stage 4 (thus solving an instance of Meno's Paradox).²⁶ It will turn out that he gives two different routes to Stage 4, and so two different solutions to Meno's Paradox.

In the next two passages in *APo* 2.8 I shall examine (T31–32), Aristotle discusses the prior knowledge we rely on when we move through the stages of inquiry. After raising the problem of demonstration of essence (T26 and T28 above), he makes a fresh start:

- T31** (a) Let us state in what way it is possible [to demonstrate the essence], speaking again from the beginning. (b) For just as we seek the reason why once we grasp the fact that, but sometimes [the reason why and the fact that] become clear at the same time, but it is not possible to come to know

number of in itself accidents that are not in itself₂ demonstrable attributes). In these cases, to explain why *P* belongs to *S* is not to define what *P* is. (Perhaps in these cases *P* does not have an essence.)

²⁶ As I mentioned above, commentators usually miss this. See Bolton (1987: 130–46) whose account of inquiry in *APo* 2 does not, as far as I can tell, explain how the inquirer learns in the first place that the object exists. (See also Bolton 1976: 521–4, 535.) My interpretation comes closest to Charles 2000: 23–77 and DeMoss and Devereux 1988.

the reason why before [grasping] the fact that, (c) it is clear that in the same way too [it is not possible to come to know] the essence without [grasping] that [the object] exists; for it is impossible to know what a thing is when we do not know whether [it] exists.²⁷ (93a15–20)

Aristotle reminds us of the four different objects of inquiry in *APo* 2.1–2 and of the order in which we (should ideally) seek them. (See Chapters 6–7.) In T31b, he indicates that there are certain unusual cases in which we learn simultaneously that and why *x* is. In b–c, he makes or implies four additional claims, in the following order ('b1' signifies the first claim in T31b, and so on):

- b1: If we know that *x* is, we seek why it is.
- b2: If we know why *x* is, we know that it is.
- c1: If we come to know (i.e., discover) what *x* is, we have prior knowledge that it is.
- c2: If we know what *x* is, we know that it is.

b2 and c2 make knowing that *x* is a necessary condition for knowing why and what it is. b1 makes having prior knowledge that *x* is a sufficient condition for seeking why it is. In the next passage I discuss, Aristotle makes it a necessary condition. c1 makes having prior knowledge that *x* is a necessary condition for discovering what it is. However, this does not seem consistent with his claim about simultaneous discovery. Presumably, since why *x* is and what it is (cause and essence) are the same, if we can discover simultaneously that and why *x* is, we can discover simultaneously that and what *x* is. In that case, having prior knowledge that *x* is is not a necessary condition for *discovering* what it is. Perhaps, then, we should take c1 to mean: if we discover what *x* is, we either already know or at the same time discover that it is. If this is right, then none of these four claims makes having prior knowledge that *x* is a necessary condition for discovering why or what it is. Indeed, given the possibility of simultaneous discovery, Aristotle must deny that having prior knowledge that *x* is is necessary for discovering why or what it is.

In the passage that immediately follows T31, Aristotle makes having prior knowledge that *x* is a necessary condition for *seeking* what it is:

- T32** (a) But sometimes we grasp accidentally whether [an object] exists, and sometimes [we grasp whether it exists] when we grasp something of the object itself, for example, thunder, that it is a certain noise in the clouds, and eclipse, that it is a certain loss of light, and human being, that it is a certain kind of animal, and soul, that it moves itself. (b) And so whenever we know accidentally that [the object] exists, it is necessarily the case that we are in no position to [seek] what it is; for we do not know that it exists; but seeking

²⁷ ὃν δὲ τρόπον ἐνδέχεται, λέγωμεν, εἰπόντες πάλιν ἐξ ἀρχῆς. ὥσπερ γὰρ τὸ διότι ζητοῦμεν ἔχοντες τὸ ὅτι, ἐνίοτε δὲ καὶ ἅμα δῆλα γίνεται, ἀλλ' οὐτὶ πρότερόν γε τὸ διότι δυνατὸν γνωρίσαι τοῦ ὅτι, δῆλον ὅτι ὁμοίως καὶ τὸ τί ἦν εἶναι οὐκ ἄνευ τοῦ ὅτι ἔστιν· ἀδύνατον γὰρ εἰδέναι τί ἐστίν, ἀγνοοῦντας εἰ ἔστιν.

what it is when we do not grasp that it exists is seeking nothing. (c) But whenever we grasp something [of the object itself], [seeking what it is] is easier. (d) The result is that as we grasp that it exists, so too we are in a position [to seek] what it is.²⁸ (93a21–9)

In T32a, Aristotle distinguishes between grasping (*echein*) ‘accidentally’ that *x* exists and grasping that *x* exists by grasping ‘something of the object itself’. In b, he says that if one knows accidentally that *x* exists, one cannot (is ‘in no position to’) seek what it is. It seems to follow that knowing non-accidentally that *x* exists is necessary for seeking what it is. According to c, if one knows that *x* exists by grasping something of *x* itself, one can seek what it is. Just below I argue that knowing that *x* exists by grasping something of *x* itself is one of two ways of knowing non-accidentally that *x* exists. So knowing non-accidentally that *x* exists by grasping something of *x* itself is sufficient for seeking what it is. In d, Aristotle draws his conclusion: the manner in which we grasp that *x* exists determines our cognitive position vis-à-vis our search for its essence.²⁹

T31 implies that knowing (non-accidentally) that *x* exists is not necessary for *discovering* why or what it is. T32 implies that knowing non-accidentally that *x* exists is necessary for *seeking* what it is. The two claims are consistent if we can discover what *x* is without seeking what it is. Aristotle may think that in some cases we just happen upon what *x* is without a prior search. He may also think that in those unusual cases in which we discover simultaneously that and what *x* is, we discover what *x* is without a prior search for what it is (but perhaps as a result of a prior search for whether *x* is). Either way, Aristotle seems committed to the possibility of accidental discovery—discovery not brought about by a deliberate search for that which one discovers (in this case, what *x* is). However, Aristotle does not explore this any further in APO 2.8. He focuses instead on discovery brought about by inquiry.

T32b states that if one knows accidentally that *x* exists, one cannot seek what it is. What does it mean to know accidentally that *x* exists? The idea seems to be that we know that *x* exists only in virtue of knowing that *x* has some accidental attribute, one that belongs to it neither always nor for the most part.³⁰ Two types of attribute are excluded from this sense of ‘accidental’: essential attributes and demonstrable ones. Therefore, if we know that *x* exists in virtue of knowing that one of its essential or demonstrable attributes belongs to it, we know non-accidentally that *x* exists. Non-accidental knowledge that *x* exists is necessary for seeking what it is. It also seems

²⁸ τὸ δ' εἰ ἔστιν ὅτε μὲν κατὰ συμβεβηκὸς ἔχομεν, ὅτε δ' ἔχοντές τι αὐτοῦ τοῦ πράγματος, οἷον βροντήν, ὅτι ψόφος τις νεφῶν, καὶ ἔκλειψιν, ὅτι στέρησίς τις φωτός, καὶ ἄνθρωπον, ὅτι ζῶόν τι, καὶ ψυχὴν, ὅτι αὐτὸ αὐτὸ κινεῖν. ὅσα μὲν οὖν κατὰ συμβεβηκὸς οἶδαμεν ὅτι ἔστιν, ἀναγκαῖον μηδαμῶς ἔχειν πρὸς τὸ τί ἔστιν· οὐδὲ γὰρ ὅτι ἔστιν ἴσμεν· τὸ δὲ ζητεῖν τί ἔστι μὴ ἔχοντας ὅτι ἔστι, μηδὲν ζητεῖν ἔστιν. καθ' ὅσων δ' ἔχομεν τι, ῥᾶν. ὥστε ὡς ἔχομεν ὅτι ἔστιν, οὕτως ἔχομεν καὶ πρὸς τὸ τί ἔστιν.

²⁹ For an interesting discussion of this difficult last sentence see Bolton 1987: 132 n26. See also Goldin 1996: 112 and Mansion 1976: 53.

³⁰ See Met 5.30, 1025a4–30. See also Barnes 1993: 219, Bayer 1995: 247, Pellegrin 2010: 135–6, and Ross 1949: 630.

sufficient. Since there are two forms of non-accidental knowledge that *x* exists, there are two forms of prior knowledge on the basis of which we can seek *x*'s essence: knowledge of one of its essential attributes and knowledge of one its demonstrable attributes. In what follows, I shall argue that in *APo* 2.8 this is exactly the view Aristotle adopts.

In T32a and c, Aristotle discusses one way of seeking and learning *x*'s essence. Sometimes we know that, for example, eclipse exists when we grasp something of eclipse itself, for example, that it is a certain loss of light.³¹ By 'grasping something of the object itself' Aristotle means grasping part of its essence.³² This is clear from his examples in T32a (and from 93a29, T34a below): loss of light is part of eclipse's essence, noise in the clouds is part of thunder's, and so on. Since one knows part of eclipse's essence, one knows non-accidentally that eclipse exists. Hence one can seek and discover the rest of its essence—namely, the cause. However, since there is another way of knowing non-accidentally that eclipse exists (namely, via one of its demonstrable attributes), grasping part of the essence ('something of the object itself') is sufficient but not necessary for seeking the essence. This is what Aristotle means when he says in T32c that grasping something of the object itself makes seeking the essence 'easier': our grasp aids our search but is not necessary for it.

5. Knowing Part of the Essence

So far Aristotle's account in *APo* 2.8 is focused on how we seek and discover essences, and he does not distinguish between seeking the essence of a subject-kind (at Stage 2) and that of a demonstrable attribute (at Stage 4). In the passage that immediately follows T32 (T34, below), he explains how we seek and discover that a demonstrable attribute exists (at Stage 3) and what its cause and essence is (at Stage 4), and he does so in a way that avoids Meno's Paradox. (In Chapters 11–12, I discuss how we seek the existence and essence of subject-kinds at Stages 1 and 2, respectively.) His principal move is the claim he makes in T32 and T34 that one can know part of a demonstrable attribute's essence without knowing the whole essence. To see this, we need to interpret his claim broadly. I want to suggest that it covers two cases.

In the first case, which Aristotle has in mind in T32, knowing part of a demonstrable attribute's (P's) essence consists in (a) identifying P with another attribute A, where A turns out to be part of P's essence, and (b) knowing that A belongs by necessity to P's subject, S. For example, the inquirer knows part of eclipse's essence when she identifies eclipse with a certain loss of light (which turns out to be part of eclipse's essence) and knows that the moon by necessity loses its light in this way.

³¹ This is a common but not uncontroversial interpretation. For discussion, see Ackrill 1981: 371–3.

³² See Philoponus(?) in *An Post* 367.29–368.6. This commentary's author is unknown but it 'is appended to some (but not all) manuscripts of Philoponus's commentary on the first book of *An. Post.*, and was published as the second part of that commentary in the Berlin edition of the ancient commentaries on Aristotle, edited by M. Wallies.' (Goldin 2009: 1) For further discussion of the commentary's authorship, see Goldin 2009: 1–4.

(She is not required to know at this stage that ‘loss of light’ is part of eclipse’s essence, nor is it likely that she will be able to do so.) In this case, I argue below in section 7, the inquirer has non-accidental knowledge that eclipse exists in the way required at Stage 4—namely, as an *explanandum*, as something to be demonstrated and explained. For she identifies eclipse with a phenomenon she knows admits of explanation: the moon’s loss of light. She can now seek why and what eclipse is and reach Stage 5.

In the second case, which Aristotle has in mind in T34, knowing part of the essence consists in knowing that if P exists, then it exists as A (where A turns out to be part of P’s essence).³³ For example, the inquirer knows part of eclipse’s essence when she knows that if eclipse exists, then it exists as a certain loss of light. (For reasons I discuss in section 7, it is important that she identifies eclipse with a loss of light and does not merely predicate ‘loss of light’ of ‘eclipse’ as one of eclipse’s attributes. The phrase ‘exists as’ is meant to capture this.) In this case, the inquirer is at Stage 3: she does not know whether eclipse is an *explanandum*. She does, however, have a preliminary account of eclipse.³⁴ She knows eclipse, without knowing that it exists, by identifying it with what is (unbeknownst to her) part of its essence. In section 7, I argue that the inquirer can use this account to launch a search for eclipse’s existence, in the way required at Stage 3, without falling prey to Meno’s Paradox.

6. Knowing Part of *x*’s Essence without Knowing that *x* Exists

But first: I have just argued that there are two ways of knowing part of a demonstrable attribute’s essence (‘something of the thing itself,’ T32a):³⁵ in the first, one knows that the attribute exists (i.e., belongs to its subject); in the second, one does not. Some commentators deny that it is possible to know part of an object’s essence without knowing that the object exists. They believe that if, for example, A is part of P’s essence, one cannot know in any way that P is A without knowing that P exists.³⁶ I shall now defend my interpretation against this view.³⁷ It is important that I do so, for on my reading the inquirer’s ability to know part of P’s essence without knowing that P exists is the key to solving Meno’s Paradox.

First, in T32a, Aristotle only says that sometimes we know (non-accidentally) that an object exists by knowing part of its essence. This is compatible with the claim that at other times we know (what turns out to be) part of the essence without knowing that the object exists. Furthermore, in the passage that immediately follows T32 (93a29–37, T34 below), Aristotle explicitly addresses the issue of how the inquirer

³³ See Charles 2000: 35, 40.

³⁴ See Charles 2000: 23–56, DeMoss and Devereux 1988: 134–5.

³⁵ ‘The thing’ in ‘something of the thing itself’ (T32a) is either a demonstrable attribute or a subject-kind. In this chapter, I focus on the implications of T32 for inquiry about demonstrable attributes. In Chapters 11–12, I focus on the implications of T32 for inquiry about subject-kinds.

³⁶ Bolton 1976 and 1987 takes this view, as does Mansion 1976: 183–4 with n105.

³⁷ The defence that follows owes much to Charles 2000: 23–56 and DeMoss and Devereux 1988.

acquires non-accidental knowledge that objects such as eclipse exist. I shall argue that she can do so in two different ways: by inference from what is (unbeknownst to her) part of eclipse's essence or by inference from what is (unbeknownst to her) one of its demonstrable attributes. Since in the first case the inquirer learns that eclipse exists from prior knowledge of (what is unbeknownst to her) part of its essence, it seems obvious that there is a time at which she knows part of the essence without knowing that eclipse exists. Therefore, one can know (what turns out to be) part of an object's essence without knowing that the object exists.

A passage in APO 2.10 is another key piece of evidence for my claim.

T33 It is clear that one sort of [definition] will be an account of what a name or some other name-like expression signifies, for example what triangle signifies. This [e.g., triangle] is the very thing that, when we grasp that it is, we seek why it is; but it is difficult to grasp in this way [namely, why it is] things that we do not know to exist. The explanation of the difficulty was stated earlier, that we do not know whether or not [the object] exists, except accidentally.³⁸ (93b29–35)

This passage introduces nominal accounts. (See Chapter 9§6.) When you know that the thing signified by the term 'triangle' exists, you can go on to seek why it exists. But it is difficult to seek why triangle exists when you know only accidentally that it exists.³⁹ These are similar to the claims Aristotle makes in T32. However, the difference between the two passages is that 'an account of what the name signifies' now seems to take the place of 'something of the object itself' (in T32a).⁴⁰ This suggests that to know (what turns out to be) part of *x*'s essence is to know a nominal account of *x*.⁴¹ However, to know a nominal account of *x* is not necessarily to know part of *x*'s essence. For it is clear from APO 2.7 (92b5–8 and 92b28–32) that there can be nominal accounts of non-existent entities (e.g., goat-stag), which do not have essences. It follows that it is not a necessary condition for knowing a nominal account that one knows that the item signified by the relevant term exists.⁴² Since knowing part of *x*'s essence is equivalent to knowing a nominal account of *x*, we can know part of *x*'s essence without knowing that *x* exists.⁴³ Sometimes one knows that *x* exists by

³⁸ φανερόν ὅτι ὁ μὲν τις ἔσται λόγος τοῦ τί σημαίνει τὸ ὄνομα ἢ λόγος ἕτερος ὀνοματώδης, οἷον τί σημαίνει [τί ἐστι] τρίγωνον. ὅπερ ἔχοντες ὅτι ἔστι, ζητοῦμεν διὰ τί ἔστιν· χαλεπὸν δ' οὕτως ἐστὶ λαβεῖν ἂ μὴ ἴσμεν ὅτι ἔστιν. ἢ δ' αἰτία εἶρηται πρότερον τῆς χαλεπότητος, ὅτι οὐδ' εἰ ἔστιν ἢ μὴ ἴσμεν, ἀλλ' ἢ κατὰ συμβεβηκός.

³⁹ Aristotle first talks about not knowing that triangle exists (93b33) but then explains this in terms of knowing accidentally that it exists (b35). Note that Aristotle says it is 'difficult' to seek why triangle exists in this case, but he does not say it is impossible. However, T32b seems to claim that it is impossible.

⁴⁰ Aristotle does not say this, but I assume that in T33 he thinks that grasping what 'triangle' signifies (the nominal account) is what allows us to seek whether and why triangle is. This explains why he mentions inquiry immediately after introducing nominal accounts. (See DeMoss and Devereux 1988: 134–5.)

⁴¹ See Modrak 2010: 257.

⁴² This claim is disputed by Bolton 1976 and defended by Charles 2000 and DeMoss and Devereux 1988.

⁴³ For a similar interpretation of T33, see Sorabji 1981: 217 n30. See also the helpful discussion in Charles 2000: 34 n18. For two alternative interpretations, see Ackrill 1981: 375 and Barnes 1993: 223.

knowing part of its essence (T32); at other times one knows part of x 's essence without knowing that it exists.

7. First Route to Knowledge: Stages 3 to 4

I have suggested that knowing an account of the sort 'eclipse, if it exists, exists as a certain loss of light from the moon' allows the inquirer to seek at Stage 3 whether eclipse is an *explanandum*.⁴⁴ I call an account of this sort a 'preliminary account'.⁴⁵ A preliminary account of x identifies a non-accidental (essential or demonstrable) attribute of x , without identifying its complete essence, and thereby facilitates our search for whether and what x is. These are accounts one knows prior to seeking (at Stages 1 or 3) whether x exists.

There is significant overlap between preliminary and nominal accounts, but the two are not the same. First, a nominal account can but need not be grasped as a starting-point for inquiry. For it states what an ordinary speaker means when she uses the relevant term. Second, some but not all preliminary accounts are nominal accounts. There are three types of preliminary account. (i) Some preliminary accounts are nominal accounts of (what turn out to be) existent things. These identify (what turns out to be) part of the thing's essence. (ii) Other preliminary accounts are nominal accounts of (what turn out to be) non-existent things. (iii) Still other preliminary accounts are accounts that identify (what turns out to be) a demonstrable attribute of (what turns out to be) an existent thing. These do not seem to be nominal accounts.⁴⁶ All preliminary accounts are, in Charles's felicitous expression, 'springboards' for scientific inquiry.⁴⁷ Let's see how. (Here I consider only demonstrable attributes. In Chapters 11–12, I consider subject-kinds.)

In the passage that immediately follows T32, Aristotle presents in a highly compressed way the inquirer's move from Stages 3 to 4 and 4 to 5:

- T34** (a) Of the things of which we grasp something of the what it is, let it first be like this. (b) Eclipse A, moon C, screening by the earth B. (c) And so [to seek] whether [the moon] is eclipsed or not is to seek B, whether it is or not. This is no different from seeking whether an account of it exists; and if this does exist, then we say that that thing [i.e., eclipse] exists. (d) Or which [part] of the contradiction is there an account of: its having 2R or its not having [2R]? (e) Whenever we discover [that an account exists], we know at

⁴⁴ Above I indicated that the account is 'eclipse, if it exists, exists as a certain loss of light', and here I have added 'from the moon.' (Compare 'thunder, that it is a certain noise *in the clouds*', in T32a. The same passage has 'eclipse, a certain loss of light'.) I have omitted the step in which the inquirer identifies the subject to which eclipse, if it exists, belongs. Once she does this, she will include it in her account.

⁴⁵ DeMoss and Devereux 1988 also use this expression. In Chapter 13, I discuss Aristotle's explanation of how we acquire preliminary accounts.

⁴⁶ I infer this from the fact that Aristotle's only example of a preliminary account of this sort does not seem to be a nominal account: 'eclipse is the moon's inability to cast shadows on earth though full and unobstructed' (Apo 2.8, 93a37–8 (in T35b, below)). See Pellegrin 2010: 139–40.

⁴⁷ Charles 2000: 35–7. See also Fine 2014: 196–7.

the same time the fact that [eclipse exists] and the reason why, if [the syllogism] is through middle terms.⁴⁸ If not, [we know] the fact that but not the reason why.⁴⁹ (93a29–37)

T34a introduces the general topic of interest: cases in which the inquirer grasps ‘something of the what it is’. In b–e, Aristotle explains how the inquirer learns that and then why eclipse exists (i.e., belongs to the moon) (Stages 3–5), presumably starting from her grasp of ‘something of the what it is’. b sets out the demonstration that represents the inquirer’s knowledge, at Stage 5, that eclipse exists and why and what it is (its cause and essence). In c–e, Aristotle indicates how she reaches Stage 5. He first focuses, in c–d, on how she reaches Stage 4—how she seeks and learns that eclipse exists. In e, he contrasts two cases: in the first, the inquirer knows a syllogism proving that and explaining why eclipse exists (this is the demonstration in b, which represents her knowledge at Stage 5); in the second, she knows a syllogism proving that but not explaining why eclipse exists (this represents her knowledge at Stage 4). I shall now focus on the inquirer’s move from Stages 3 to 4; I’ll then turn to her move to Stage 5.

Grasping ‘something of the what it is’ in T34a seems to be equivalent to grasping ‘something of the thing itself’ in T32a. That is, Aristotle has in mind a preliminary account that identifies (what turns out to be) part of the thing’s essence. In fact, in the rest of T34 he seems to have in mind the specific preliminary account mentioned in T32a: eclipse, if it exists, exists as a loss of light from the moon.⁵⁰ T34c describes how the inquirer seeks whether eclipse exists, starting from her grasp of the preliminary account. Since she seeks whether it exists, she does not yet know that it does. So she is at Stage 3: she knows that the moon exists and what its essence is, and she wishes to seek whether it is eclipsed, and if it is, why it is. Aristotle’s claim in T34c is that for the inquirer to seek whether eclipse exists is for her to seek whether there exists a cause of eclipse (i.e., whether eclipse is an *explanandum*), a claim he also makes in APo 2.2 (T14). (See Chapter 7§§1–5.) She does not determine that eclipse exists by determining that a specific cause, which she already knows (e.g., screening by the earth), exists. If she did, she would learn simultaneously that eclipse exists and why. T34 seems to describe the standard way of learning that eclipse exists, where we first seek and learn that it exists and then seek and learn why. Discovering the two

⁴⁸ At 93a36 I follow the majority manuscript reading of *διὰ μέσων* (‘through middle terms’) rather than *δι’ αμέσων* (‘through immediates’), found in one manuscript and printed in Ross’s text. (See Barnes 1993: 219.)

⁴⁹ ὦν οὖν ἔχομέν τι τοῦ τί ἐστίν, ἔστω πρῶτον μὲν ὧδε· ἔκλειψις ἐφ’ οὗ τὸ Α, σελήνη ἐφ’ οὗ Γ, ἀντίφραξις γῆς ἐφ’ οὗ Β. τὸ μὲν οὖν πότερον ἐκλείπει ἢ οὐ, τὸ Β ζητεῖν ἔστιν, ἀρ’ ἔστιν ἢ οὐ. τοῦτο δ’ οὐδὲν διαφέρει ζητεῖν ἢ εἰ ἔστι λόγος αὐτοῦ· καὶ ἐὰν ᾗ τοῦτο, ἀκκεῖνός φαμεν εἶναι. ἢ ποτέρας τῆς ἀντιφάσεώς ἐστιν ὁ λόγος, πότερον τοῦ ἔχειν δύο ὁρθὰς ἢ τοῦ μὴ ἔχειν. ὅταν δ’ εὖρωμεν, ἅμα τὸ ὅτι καὶ τὸ διότι ἴσμεν, ἂν διὰ μέσων ᾗ· εἰ δὲ μή, τὸ ὅτι, τὸ διότι δ’ οὐ.

⁵⁰ Another possibility is that the preliminary account mentions ‘screening of the sun by the earth’ (T34b). (See Goldin 1996: 119.) There are a number of ways we might develop this. It is difficult to be certain how to interpret this puzzling passage.

simultaneously is the exception, not the rule.⁵¹ Rather, the inquirer determines that eclipse exists by determining that a cause (an ‘account’, a B term), she knows not what, exists.⁵² That is, she determines that eclipse exists by determining that it is an *explanandum*. The preliminary account mentioned in T32a and alluded to in T34a helps explain how.⁵³

The inquirer is able to launch her search because her preliminary account gives her a determinate target at which to aim: the moon losing its light in a certain way. Since she identifies eclipse with a certain familiar and observable loss of light, she learns that eclipse exists by observing instances of the moon undergoing a loss of light of that sort (and/or by gathering reliable testimony to that effect). When she has accumulated a sufficient body of evidence, she can construct the following syllogism:

Eclipse belongs to all loss of light (of such-and-such a kind)
Loss of light (of such-and-such a kind) belongs to all moon
 Eclipse belongs to all moon⁵⁴

This syllogism represents the knowledge the inquirer possesses at Stage 4 as a result of her inquiry at Stage 3. She obtains the major premise from her preliminary account. She discovers the minor premise by induction from observation (and/or testimony). The syllogism as a whole is a non-explanatory proof of the fact that eclipse exists (i.e., belongs to the moon). It is an example of one of the two sorts of syllogism Aristotle has in mind in T34e, where he distinguishes between two cases. In both cases, one has discovered that eclipse exists. In the first, one knows both that and why it exists, because one grasps a syllogism ‘through middle terms’—that is, through the cause.⁵⁵ In the second, one knows that it exists but not why, because one grasps a syllogism that is not ‘through middle terms’. This is a non-explanatory, existing-proving syllogism, such as the one above. The inquirer who grasps it does not know why the moon is eclipsed, but she does know in a non-accidental way that it is, for she knows that the moon is eclipsed in virtue of knowing one of eclipse’s non-accidental features (one that turns out to be part of its essence).

⁵¹ Aristotle mentions discovering simultaneously ‘the fact that’ and ‘the reason why’ in T31 (93a17–18). (See also APO 2.2, 90a25–30.) But the rest of T31 and T32 indicate that this is unusual. See also APO 2.1–2, with Chapters 6–7.

⁵² See Barnes 1993: 219.

⁵³ For a similar interpretation, see Goldin 1996: 119. However, Goldin takes the inquirer’s preliminary account to identify eclipse with ‘screening by the earth’ (T34b) not (as I have) ‘loss of light’ (T32a).

⁵⁴ Aristotle does not set out this syllogism in 2.8, though we shall see in section 12 that it is very similar to other existence-proving syllogisms that he does present in this chapter.

⁵⁵ Aristotle says ‘whenever we discover [that an account exists], we know at the same time the fact that [eclipse exists] and the reason why, if [the syllogism] is through middle terms’ (T34e, 93a35–6). I take it he means that *after* we discover that eclipse exists, we *later* know at the same time that it exists and why, if the syllogism we (later) apprehend states the cause. Aristotle, on this reading, is not describing a case of simultaneous discovery or learning. He is describing a case of simultaneous knowledge, where one knows at the same time that and why eclipse exists, but only after one first discovers that it exists. (He says ‘we know at the same time’ (*hama . . . ismen*), not ‘we discover at the same time’.)

The syllogism not only proves that the moon is eclipsed; it also establishes that eclipse is an *explanandum*. For the inquirer identifies eclipse with the moon losing its light in a certain way and it is this that requires explanation. She knows that this phenomenon does not occur by chance but happens ‘always or for the most part’ and thus by necessity.⁵⁶ The inquirer in this scenario begins at Stage 3, so she already knows the moon’s essence, and thus she knows that loss of light is not part of it. She can infer, then, that the moon’s loss of light has a cause (although she does not yet know what it is). (See Chapter 8§7.) And since the moon losing its light in a certain way just is its being eclipsed, she knows that eclipse has a cause. Therefore, she knows that eclipse exists in the way required at Stage 4: as an *explanandum*.

It is worth noting that in at least two of Aristotle’s examples of knowing part of the essence (thunder and eclipse), we know something that is familiar from (and available to us in) perceptual experience: a certain noise, a certain loss of light (T32a, 93a22–3). These examples suggest that a preliminary account facilitates inquiry by identifying the object with some other thing that is more familiar to the inquirer than the object itself. This is one of the ways in which a preliminary account provides the inquirer with a target at which to aim her search.

Above I noted that the inquirer’s preliminary account does not merely predicate ‘loss of light’ of ‘eclipse’ as one of eclipse’s attributes. Rather, it identifies eclipse as a loss of light. This distinction is important. The inquirer’s question is not whether eclipse is a loss of light; it is doubtful whether this question is interesting or even intelligible (at least in the context of science). (See Chapter 9§5.) Her question is whether eclipse—that is, a certain loss of light—affects the moon. Discovering that the moon loses its light (in the relevant way) is sufficient for discovering that the moon is eclipsed only if this identification has taken place. This is part of what Aristotle means when he speaks of grasping ‘something of the object itself’ (T32a, 93a22) and ‘something of the essence’ (T34a, 93a29). The inquirer identifies the object with (what turns out to be) part of its essence, and this identification structures and guides her subsequent search.

8. First Solution to Meno’s Paradox

In Chapter 7§5, I examined an instance of Meno’s Paradox that threatens to block the inquirer from seeking, in the way required at Stage 3, whether there is a cause of P’s belonging to S—that is, whether P exists as an *explanandum*. Aristotle thinks that we cannot know what P is (P’s essence) before we know that P belongs to S (T31). He also thinks that what P is and why it is (i.e., why it belongs to S) are the same.⁵⁷ Given these two claims, I argued, it seems that if we know what P is, we know why P is, in

⁵⁶ See Chapter 2§3 n29.

⁵⁷ APO 2.2, 90a14–15 (in T15).

which case we know that there is a cause of P, so we do not need to seek whether there is one (and perhaps cannot, if we cannot seek what we already know). But it also seems that if we do not know what P is, we cannot seek whether there is a cause of P, for we do not what to look for.

I also suggested that if we know an identifying description in the form of a preliminary account of P, we can seek, in the way required at Stage 3, whether there is a cause of P's belonging to S. There are four conditions the inquirer's Stage 3 knowledge must meet: (i) it must not involve knowledge that there is a cause of P's belonging to S; (ii) it must fall short of complete knowledge of P's essence; (iii) it must exceed complete ignorance of P; and (iv) it must aid her search for whether there is a cause of P's belonging to S.

In Aristotle's example in T34, the inquirer's Stage 3 knowledge—her grasp of the preliminary account 'eclipse, if it exists, exists as a certain loss of light from the moon'—meets all four conditions. Therefore, it allows her to move to Stage 4 in a way that avoids Meno's Paradox. First, it does not involve knowledge that eclipse exists as an *explanandum*. Second, it falls short of complete knowledge of eclipse's essence, for it consists in knowing (what turns out to be) only part of the essence. Third, it exceeds complete ignorance of eclipse. Finally, it allows her to search for whether eclipse has a cause by giving her a determinate target at which to aim. If she can establish that the moon loses its light in the distinctive way associated with eclipses, then she can establish that eclipse is a genuine *explanandum*, as she does in the syllogism above. Since, in this case, the inquirer's preliminary account is derived from the nominal account of eclipse, Aristotle's first solution to Meno's Paradox in *APo* 2.8 involves distinguishing between what 'eclipse' signifies (in ordinary language) and what eclipse is (its essence).⁵⁸ However, as we shall in the next section and in section 12, Aristotle has other solutions to this instance of Meno's Paradox, ones that do not rely on this distinction.

9. Inquiring without an A Term

In section 3, I claimed that Aristotle's account of inquiry and learning in *APo* 2.8 applies just as well to those demonstrable attributes for which there is no A term (such as harmony, leaf-shedding, and 2R) as it does to those for which there is one (such as eclipse, thunder, and ice). (The A term is what fixes the attribute to be defined as an *explanandum* and features in essences of the form 'A-C because of B'. See Chapter 7§8.) However, I have also argued that the inquirer discovers that a demonstrable attribute is an *explanandum* by relying on a preliminary account in which (what turns out to be) the A term plays a central role. She grasps that eclipse, if it exists, exists as a certain loss of light, or that thunder, if it exists, exists as a

⁵⁸ See Charles 2010b.

certain noise, and in both cases the feature with which she identifies the object turns out to be the A term in its complete essence. In fact, this identification is the key to solving Meno's Paradox. What is the inquirer to do, then, when no A term is available?

First, as we saw in Chapter 7§9, when Aristotle does not provide an A term for a demonstrable attribute, it does not mean that none exists. For example, he defines harmony in the *APo* as 'a numerical ratio between high and low notes' (B–C) but in the *Metaphysics* as 'a *blending* of high and low notes because of a numerical ratio' (A–C because of B).

Second, I shall argue below that some preliminary accounts do not mention (what turns out to be) the A term. In a preliminary account the object of inquiry is identified with a feature that is more familiar than the object itself. In this way, the account facilitates inquiry. In some cases, the other, more familiar feature is one of the object's demonstrable attributes. For example, suppose the inquirer identifies leaf-shedding with the presence of dead leaves around the base of a tree. She then uses this feature as the basis of her preliminary account. She does not define leaf-shedding in these terms at Stage 5, but her preliminary account helps guide her to leaf-shedding's cause and essence.

The last example will seem forced (although it is similar to one in *APo* 2.8, discussed below in section 12). For most inquirers, the presence of dead leaves at the base of a tree is no more familiar than the phenomenon of leaf-shedding itself. This tells us something important. As I argued in Chapter 7§9, it may be that some demonstrable attributes lack A terms because none are needed. For example, 'leaf-shedding' and 'interior angles equal to two right angles' ('2R') do not require (and do not seem amenable to) re-description in more familiar terms. Assuming one possesses the relevant concepts ('leaf', 'shedding', 'two', etc.), one can seek whether the attribute belongs always or for the most part to its subject (and thus whether there is a cause of its belonging). My suggestion, then, is that in some cases the route from Stages 3 to 4 is not blocked by Meno's Paradox at all. For in some cases the term for the attribute is already sufficiently descriptive to allow us to search for whether the attribute exists as an *explanandum*.

10. Discovering the Essence-Revealing Demonstration: Stages 4 to 5

I have argued that in T34 Aristotle explains how an inquirer at Stage 3 seeks and learns that a demonstrable attribute belongs to its subject. Let's now see how she moves from Stages 4 to 5—how she seeks and learns eclipse's cause and essence. Equipped with the Stage 4 existence-proving syllogism introduced above in section 7, she has a determinate target at which to aim her search: the cause of the moon losing its light—the middle (explanatory) term that links 'moon' and 'loss of light' in the

syllogism's minor premise.⁵⁹ Because she identifies eclipse with a certain loss of light, she has a reliable way of picking out instances of eclipse (and of assessing other people's testimony about them), and she can study these in search of the cause. If she is successful, she will discover that the cause is the earth screening the moon from the light of the sun. She will then be able to construct the following demonstration:

Loss of light belongs to all screening of the sun by the earth
Screening of the sun by the earth belongs to all moon
 Loss of light belongs to all moon⁶⁰

This is the essence-revealing demonstration I discussed in section 3. Aristotle says that discovering it is the means by which the inquirer gets to know the essence (93b15–20, T29)—not because the complete essence appears as the conclusion, but because it appears as the causal relation expressed over the syllogism as a whole. But notice what the conclusion is: loss of light belongs to the moon. This was the inquirer's preliminary account of eclipse at Stage 3; it was also the minor premise of her existence-proving syllogism at Stage 4. The fact that it is the conclusion of her demonstration at Stage 5 is exactly what we would expect given that it is the target *explanandum* in her search for the cause. The moon's loss of light is the *explanandum*; screening of the sun by the earth is the *explanans*. Together they constitute eclipse's complete essence, knowledge of which can be obtained, Aristotle says, only by grasping the demonstration that reveals it.

We can view the inquirer's progress through the stages of inquiry in terms of Aristotle's account of definition in *APo* 2.10. (See Chapter 9§§5–6.) At Stage 3, she knows a preliminary account of eclipse, which is also a nominal account. In addition, her account has the same content as (what turns to be at Stage 5) the conclusion of the demonstration of eclipse's essence, the third type of definition. The demonstration as a whole can be re-stated as a single proposition: 'eclipse is_{def} loss of light from the moon because of screening of the sun by the earth'—a demonstrative definition.

The demonstration above is not exactly the one set out in T34b, which is:

Eclipse belongs to all screening of the sun by the earth
Screening of the sun by the earth belongs to all moon
 Eclipse belongs to all moon

However, as I argued in Chapter 7§10, the explanatory content of these two demonstrations is the same: to explain why eclipse belongs to the moon is to explain why a certain loss of light belongs to it, and vice versa. In fact, as we saw in section 3, just a few lines below T34 Aristotle presents a demonstration in which 'thunder' and 'noise' (analogous to 'eclipse' and 'loss of light') are used interchangeably:

⁵⁹ See Goldin 1996: 122–5.

⁶⁰ See *APo* 2.8, 93b7–14 (T30). Aristotle's example in this passage is thunder.

- T30** What is thunder? An extinguishing of fire in a cloud. Why is there thunder? Because the fire in the cloud is being extinguished. Cloud C, thunder A, extinguishing of fire B. So B fire being extinguished belongs to C cloud, and A noise belongs to B; and B is the account (*logos*) of A, the first extreme term. (93b7–12)

This suggests that the demonstration in T34b, like the one in T30, is the essence-revealing demonstration that represents the inquirer's Stage 5 knowledge.

11. The Two Models of Demonstration in *APo* 2.8

T30 continues: 'And if there is in turn another middle term for this, it will be from the remaining accounts (*tōn logōn*)' (93b12–14).⁶¹ As elsewhere in *APo* 2.8, by 'middle term' Aristotle means 'cause'. The referent of 'this' seems to be the A term, 'thunder' ('noise'): 'if there is in turn another cause of thunder (noise)'. Aristotle is not saying that if we later discover that the cause we first found (e.g., fire extinguishing) is not the cause, we should select a different one to replace it.⁶² If this were his point, it would be an unfortunate and unwelcome distraction from his main claims in *APo* 2.8. Rather, I suggest he is saying that if we later discover that there is another cause in addition to the one we first found, this other cause will be found among 'the remaining accounts'. It seems plausible that these accounts (*logoi*) are definitions, including the definitions of subject-kinds: for example, the definition of cloud. If this is right, then Aristotle may be referring obliquely to the two models of demonstration I introduced in Chapter 3§4. The attribute (thunder, eclipse) belongs to its subject (clouds, moon) in the first place because of the attribute's essence (fire extinguishing, earth screening) (Model 2). However, the attribute also belongs ultimately because of the subject's essence. For the attribute's essence belongs to the subject (ultimately) because of the subject's essence (Model 1). In this way, Aristotle may also be gesturing at the Socratic Picture of the order of inquiry. The inquirer who learns the essence of thunder does so with prior knowledge of the relevant subject's (the clouds') essence. This is why she can select the additional cause of the attribute 'from the remaining accounts'.

12. Second Route to Knowledge, Second Solution to Meno's Paradox

The inquirer in T32 and T34 grasps a preliminary account that identifies eclipse with (what turns out to be) part of its essence (a certain loss of light from the moon). As we saw in section 7, in T34e Aristotle distinguishes between two cases. In the first, the inquirer knows both that and why eclipse exists (she is at Stage 5), for she knows

⁶¹ ἂν δὲ πάλιν τούτου ἄλλο μέσον ᾗ, ἐκ τῶν παραλοιπῶν ἔσται λόγῳ.

⁶² For this interpretation see Barnes 1993: 220–1.

the explanatory syllogism (set out in T34b). In the second, she knows that eclipse exists but not why (she is at Stage 4), for she knows a non-explanatory, existence-proving syllogism. I presented a syllogism of this sort in section 10, where the middle term is ‘loss of light’. Immediately after T34 Aristotle presents a second syllogism of this sort. In doing so, he introduces a new preliminary account and another way of solving Meno’s Paradox. I quote starting from the end of T34:

- T35 (a) But whenever we discover [that an account exists], we know at the same time the fact that [eclipse exists] and the reason why, if [the syllogism] is through middle terms. If not, [we know] the fact that but not the reason why. (b) Moon C, eclipse A, not being able to cast a shadow during a full moon even though there is nothing visible between us [and the moon] B. So then if B (not being able to cast a shadow even though there is nothing between us) belongs to C [moon], and A (being eclipsed) belongs to B, then it is clear that [the moon] is eclipsed, but it is not yet [clear] why, and we know that there is an eclipse, but we do not know what it is. (c) But when it is clear that A [eclipse] belongs to C [moon], [to seek] why it belongs is to seek what B is, whether screening, or a turning of the moon, or extinguishing. And this is the account of the other extreme term, for example, in these cases A [eclipse]; for eclipse is screening by the earth.⁶³ (93a35–b7)

In T35b, the inquirer learns that eclipse exists using the following preliminary account: eclipse, if it exists, exists as the full and unobstructed moon’s inability to cast shadows on earth. This account identifies eclipse not with (what turns out to be) part of the essence but with (what turns out to be) one of its demonstrable attributes. The inquirer seeks whether eclipse exists by seeking whether the moon is unable to cast shadows. Once she discovers this, she can form the syllogism Aristotle sets out in b:

Eclipse belongs to all inability to cast shadows on earth though full and unobstructed
Inability to cast shadows on earth though full and unobstructed belongs to all moon
 Eclipse belongs to all moon

The inquirer does not know why eclipse exists, but she does know non-accidentally that it does. For she knows that it exists in virtue of knowing one of its non-accidental features. Furthermore, she knows that eclipse exists as an *explanandum*, because she identifies it with a phenomenon that requires explanation. (So she is at Stage 4.) On the basis of empirical observation (and perhaps by gathering reliable testimony) she

⁶³ ὅταν δ' εὗρωμεν, ἅμα τὸ ὅτι καὶ τὸ διότι ἴσμεν, ἂν δι' ἀμέσων ᾗ· εἰ δὲ μή, τὸ ὅτι, τὸ διότι δ' οὐ. σελήνη Γ, ἔκλειψις Α, τὸ πανσελήνου σκιὰν μὴ δύνασθαι ποιεῖν μηδενὸς ἡμῶν μεταξὺ ὄντος φανεροῦ, ἐφ' οὗ Β. εἰ τοῖνυν τῷ Γ ὑπάρχει τὸ Β τὸ μὴ δύνασθαι ποιεῖν σκιὰν μηδενὸς μεταξὺ ἡμῶν ὄντος, τούτῳ δὲ τὸ Α τὸ ἐκλειπέναι, ὅτι μὲν ἐκλείπει δῆλον, διότι δ' οὐπω, καὶ ὅτι μὲν ἔστιν ἔκλειψις ἴσμεν, τί δ' ἔστιν οὐκ ἴσμεν. δήλου δ' ὄντος ὅτι τὸ Α τῷ Γ ὑπάρχει, ἀλλὰ διὰ τί ὑπάρχει, τὸ ζητεῖν τὸ Β τί ἐστι, πότερον ἀντίφραξις ἢ στροφή τῆς σελήνης ἢ ἀπόσβεσις. τοῦτο δ' ἐστὶν ὁ λόγος τοῦ ἐτέρου ἄκρου, οἷον ἐν τούτοις τοῦ Α· ἔστι γὰρ ἡ ἔκλειψις ἀντίφραξις ὑπὸ γῆς.

can infer that the full and unobstructed moon's inability to cast shadows occurs not by chance but 'always or for the most part' and stands in need of explanation—and thus so too does eclipse.

The second route to knowledge avoids in a new way the instance of Meno's Paradox I introduced in Chapter 7§4:

- (1) Prior to seeking whether there exists a cause of P's belonging to S, either one knows what P is or one does not.
- (2) If one knows what P is, one cannot seek whether it has a cause.
- (3) If one does not know what P is, one cannot seek whether it has a cause.
- (4) Therefore, one cannot seek whether there exists a cause of P's belonging to S.

Aristotle continues to deny the 'all or nothing' version of (1). It is not the case that prior to knowing whether eclipse exists there are only two possibilities: complete knowledge of its essence or complete ignorance of eclipse. One can grasp (what turns out to be) a demonstrable attribute of eclipse and seek whether eclipse exists (as an *explanandum*). However, on the innocuous reading of premise (1), Aristotle takes a different approach and focuses on what it means to 'know what eclipse is'. If 'knowing what P is' requires knowing at least part of its essence, then Aristotle denies (3). Prior knowledge of (what turns out to be) part of eclipse's essence is a sufficient condition for being able to search for whether it exists (as an *explanandum*), but it is not a necessary one. For the inquirer can grasp a preliminary account that identifies (what turns out to be) a demonstrable attribute of eclipse and allows her to search. On the other hand, if 'knowing what P is' does not require knowing any part of its essence, but only requires grasping an identifying description, then Aristotle denies (2). For one can grasp a preliminary account of P that identifies (what turns out to be) a demonstrable attribute of P, and one can in that way 'know what P is', without knowing whether P exists (as an *explanandum*). Furthermore, preliminary accounts of this sort allow the inquirer to search, as Aristotle explains in T35. Finally, while Aristotle's first solution to this instance of Meno's Paradox involves distinguishing between what 'eclipse' signifies (the nominal account) and what eclipse is (the essence), his second solution does not. For the second preliminary account is not derived from a nominal account: being unable to cast shadows (etc.) is not what 'eclipse' signifies in ordinary language.

T35c suggests that the inquirer proceeds through the stages of inquiry in similar fashion to the first route. Having established that eclipse exists (as an *explanandum*), she 'seeks what the B term [i.e., the cause] is' (93b4–5). (And to seek the cause, Aristotle reminds us, is to seek the definition.) In seeking the cause she takes the minor premise of her syllogism and searches for a middle term that identifies the cause of the moon's inability to cast shadows during an eclipse. We can expect her to discover that the proximate cause is that the moon has lost its light:

Inability to cast shadows (etc.) belongs to all loss of light

Loss of light belongs to all moon

Inability to cast shadows (etc.) belongs to all moon

The inquirer has made a decisive step toward learning the cause and essence of eclipse. She has identified another phenomenon (the moon's loss of light) that occurs during an eclipse and that explains the phenomenon with which she began her search. Since 'loss of light' is causally prior to 'inability to cast shadows' the inquirer may infer that it does a better job of expressing what the phenomenon of eclipse is and thus of fixing eclipse as an *explanandum*. She can now look again at her second premise and ask, 'why does the moon lose its light?' and again seek and discover the cause:

Loss of light belongs to all screening of the sun by the earth

Screening of the sun by the earth belongs to all moon

Loss of light belongs to all moon

This is the essence-revealing demonstration Aristotle presents in *APo* 2.8 and 10. The inquirer is at Stage 5. She should then seek to ground the explanation of eclipse in the moon's essence by seeking the cause of the fact that the moon is screened from the sun by the earth (the minor premise). That is, she should seek to ground her Model 2 demonstration in a Model 1 demonstration.

Conclusion

If my reading of *APo* 2.8 is along the right lines, then one of the principal philosophical lessons of the chapter is that the starting-point of inquiry plays a decisive role in determining its success. Aristotle is not naively optimistic about our ability to acquire scientific knowledge. Rather, he is fairly cautious: he thinks that inquiry can succeed, but only if it gets off to the right start. That Aristotle takes himself to have shown how one kind of successful inquiry proceeds, and how it does so by making use of syllogism and demonstration, is evident from his conclusion (already quoted above):

T29 So then it has been stated how the what it is is gotten hold of and becomes known. The result is that there is neither syllogism nor demonstration of the what it is, but it is made clear through syllogism and demonstration. So that without demonstration it is not possible to get to know the what it is, from which the cause is different, but there is no demonstration of it, just as we also said in discussing the puzzles. (93b15–20)

In Chapters 11–12, we shall see how a successful search (at Stages 1–2) for the existence and essence of a subject-kind proceeds.

Subject-Kinds and their Existence

In the Socratic Picture of the order of inquiry, in order to discover whether a putative attribute *P* belongs demonstrably to a subject-kind *S*, the inquirer should first seek whether *S* exists (Stage 1) and then what *S*'s essence is (Stage 2). My aim in this chapter and the next is to explain how the inquirer does this.

Aristotle distinguishes between two different types of subject-kind. First, there are the primary subject-kinds, whose existence is indemonstrable and whose essences are discovered by induction.¹ Aristotle calls these 'primaries' (*APo* 1.10, 76a32, in T37) and 'first principles' (2.9, 93b22, in T24). Second, there are the subordinate subject-kinds, whose existence is demonstrable and whose essences are discovered by division.² In Chapter 12, I turn to the inquirer's search for the essences of primary and subordinate subject-kinds. In the present chapter, I focus on her search for their existence. This will lead us to a discussion of the different ingredients that make up a science and to the role that demonstration plays in teaching a science to students.

I begin in sections 1 and 2 by discussing the distinctions between the two types of subject-kind and between subject-kinds in general and their demonstrable attributes. In section 3, I argue that Aristotle does not identify subordinate subject-kinds with the demonstrable attributes of primary subject-kinds, as some commentators have argued he does.³ The result is that there are five main ingredients in an Aristotelian science:

- 1) The primary subject-kind (such as unit or number in arithmetic, magnitude or point and line in geometry, animal in zoology).
- 2) The subordinate subject-kinds (such as three in arithmetic, triangle in geometry, human being in zoology).
- 3) The demonstrable attributes (in itself accidents) of primary and subordinate subject-kinds (such as eclipse in astronomy and 2R in geometry).
- 4) The essences of the primary and subordinate subject-kinds and of their demonstrable attributes, and the definitions that state these essences.
- 5) The common axioms (such as the principle of non-contradiction).

(Note that 1) and 2) give us two different kinds of subject (primary and subordinate) and 3) and 4) give us two different kinds of attribute (demonstrable and essential).) In sections 4–6, I turn to Aristotle's account in *APo* 1 of how we demonstrate, first,

¹ *APo* 2.13, 97b7–15, T49.

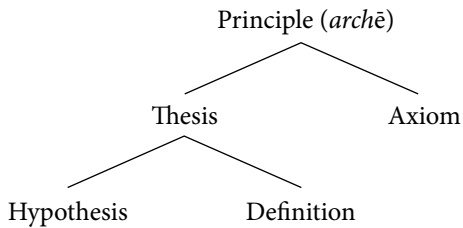
² 2.13, 96a24–97a22, T43–48.

³ See Goldin 2004 and Ross 1949: 539. My view comes closest to McKirahan 1992: 36–63.

that a subordinate subject-kind exists and, second, that an attribute belongs to it. The relevant passages, I argue, concern the procedures for using demonstration as a tool for teaching. I then offer, in sections 7–8, a highly speculative explanation of how the inquirer seeks and discovers that primary and subordinate subject-kinds exist.

1. Primary vs. Subordinate Subject-Kinds

One of my main claims in this chapter is that Aristotle distinguishes on the one hand between primary and subordinate subject-kinds and on the other between subject-kinds in general and their demonstrable attributes. Before examining the evidence for these distinctions, it will be useful to recall the kinds of first principle Aristotle discusses in *APo* 1.2 (72a14–24):⁴



Elsewhere Aristotle calls the axioms ‘common’ principles.⁵ They are common because they either govern scientific reasoning in all the sciences (such as the principle of non-contradiction) or are used as premises in demonstrations in more than one science but not in all of them (such as the principle that subtracting equals from equals leaves equals).⁶ Hypotheses and definitions, by contrast, are ‘proper’ principles:⁷ each one is a principle in just one science. For example, the definition of triangle serves as an indemonstrable, explanatory premise in geometry alone.⁸ As we have seen, definitions state the essences of the subject-kinds and attributes studied by the sciences. A hypothesis states that the primary subject-kind of a science (e.g., unit) exists.⁹ (For Aristotle, both the primary subject-kind itself and the proposition stating its existence are first principles.¹⁰ Similarly, both essences and the definitions that state them are first principles.)

Aristotle’s account in *APo* 1.2 does not distinguish between the primary subject-kind, whose existence is stated in a hypothesis, and subordinate-subject kinds, whose existence is established in a different way. However, the distinction appears elsewhere, including in the following passage from *APo* 1.1:

⁴ See Chapter 4§2. ⁵ *APo* 1.10, 76a37–b2.

⁶ See McKirahan 1992: 70. On the common principles in general McKirahan (1992: 68–79) is useful.

⁷ See again *APo* 1.10, 76a37–b2.

⁸ My discussion ignores the complications that arise from Aristotle’s account of the subordinate sciences, which he discusses in *APo* 1.7, 1.9, 76a4–15, and 1.13, 78b32–79a16.

⁹ *APo* 1.2, 72a18–24.

¹⁰ See *APo* 1.2, 72a14–24, where the proposition stating the existence of a primary (such as unit) is a first principle and 2.9, 93b22 (T24b) where the primary itself is called a first principle.

T36 There are two ways in which it is necessary to have prior knowledge (*proginōskein*): of some things we must already assume (*proupolambanein*) that they are, of others we must comprehend (*xunienai*) what the thing spoken about is, and of some things both. For example, of the fact that everything is either asserted or denied truly, [we must assume] that it is the case; of triangle, [we must comprehend] that it signifies this; and of unit we must both [comprehend] what it signifies and [assume] that it exists. For these things are not equally clear to us.¹¹ (71a11–17)

I return to this passage below, where I argue that it describes the prior knowledge that a student of a science must possess in order to be taught by demonstration. For now, note that Aristotle distinguishes between unit and triangle. He claims that prior to learning, one must know (*proginōskein*) (among other things) that unit exists, what ‘unit’ signifies, and what ‘triangle’ signifies. He does not say that one must know that triangle exists. The following passage explains why:

T37 I call principles in each kind those things of which it is not possible to prove that they exist. And so what the primaries and what the things from them (*ta ek toutōn*) signify is assumed (*lambanetai*), but that they exist must be assumed (*lambanein*) for the principles and proved for the others. For example, we must assume (*labein*) what unit or what straight and triangle [signify],¹² and that unit and magnitude exist; but we must prove the other things.¹³ (APo 1.10, 76a31–6)

The distinction between unit and triangle is clear. Unit is a primary whose existence is indemonstrable and assumed as a first principle (a hypothesis) in the relevant science (arithmetic). Triangle, on the other hand, is a non-primary whose existence is demonstrated in the relevant science (geometry).¹⁴ T37 explains why in T36 Aristotle

¹¹ διχῶς δ' ἀναγκαῖον προγινώσκειν· τὰ μὲν γάρ, ὅτι ἔστι, προϋπολαμβάνειν ἀναγκαῖον, τὰ δέ, τί τὸ λεγόμενόν ἐστι, ξυνιέναι δεῖ, τὰ δ' ἄμφω, οἷον ὅτι μὲν ἅπαν ἢ φῆσαι ἢ ἀποφῆσαι ἀληθές, ὅτι ἔστι, τὸ δὲ τρίγωνον, ὅτι τοδὶ σημαίνει, τὴν δὲ μονάδα ἄμφω, καὶ τί σημαίνει καὶ ὅτι ἔστιν· οὐ γὰρ ὁμοίως τούτων ἕκαστον δῆλον ἡμῖν.

¹² The phrase ‘we must assume what unit or what straight and triangle ...’ (76a34–5) must be filled in either with ‘are’ or ‘signify’. Barnes’s translation has ‘are’ but I have opted for ‘signify’, which occurs just three lines above (76a32). (Ross’s paraphrase also seems to supply ‘signify’ (1949: 538).) Also, note the close parallels between 76a32–5 and T36, which has what ‘unit’ and ‘triangle’ signify. In sections 4–6 below, I discuss what it is to assume what terms signify, according to these passages.

¹³ Λέγω δ' ἀρχὰς ἐν ἐκάστῳ γένει ταύτας ἃς ὅτι ἔστι μὴ ἐνδέχεται δεῖξαι. τί μὲν οὖν σημαίνει καὶ τὰ πρῶτα καὶ τὰ ἐκ τούτων, λαμβάνεται, ὅτι δ' ἔστι, τὰς μὲν ἀρχὰς ἀνάγκη λαμβάνειν, τὰ δ' ἄλλα δεικνύνα· οἷον τί μονάς ἢ τί τὸ εὐθὺ καὶ τρίγωνον, εἶναι δὲ τὴν μονάδα λαβεῖν καὶ μέγεθος, τὰ δ' ἕτερα δεικνύνα.

¹⁴ In T37, Aristotle distinguishes between unit and triangle by conjoining ‘the straight’ and ‘triangle’ with ‘and’ (*kai*) at 76a35 and disjoining them from unit with ‘or’ (*ē*) at a34–5. The straight and triangle are included in ‘the other things’ whose existence is demonstrated. Aristotle’s mention of ‘the straight’ poses a problem for the interpretation I go on to defend, according to which T37 deals with subordinate subject-kinds and not demonstrable attributes of primaries, for in APo 1.4 Aristotle treats straight as an in itself₂ attribute of line (73a38–9). (See Chapter 3§1.) However, in APo 2.13 he treats straight line as a subject-kind (96b18, T19a). So perhaps ‘straight’ in T37 is shorthand for ‘straight line’. (In Chapter 8§4 n14, I make the same suggestion about ‘straight’ and ‘curved’ in DA 1.1, 402b19 (T18a).)

does not say that we must have prior knowledge that triangle exists: he is discussing the prior knowledge required for demonstrating that triangle exists. Putting T36 and T37 together, Aristotle's view is that, prior to demonstrating that triangle exists, one must 'assume' (*lambanein*) and thus 'already know' (*proginōskein*) that magnitude (or line) (the primary) exists, what 'magnitude' (or 'line') signifies, and what 'triangle' signifies.¹⁵ The demonstration is conducted on the basis of this prior knowledge in ways I try to explain below in section 5.

In T37, Aristotle calls unit and magnitude 'principles' and 'primaries'. Elsewhere he says that each science is concerned with one such primary and with the attributes that are demonstrated to belong to it. (See T38, T39, and T40 below.) Because each primary is the subject of attributes demonstrated in the relevant science, I have been calling it a 'primary subject-kind'. As we just saw, one of Aristotle's key claims in T37 is that the existence of primary subject-kinds is indemonstrable. In this way, primaries differ from other entities, such as triangle, whose existence is demonstrable. However, these resemble primaries in that they are the subjects of demonstrable attributes and their individual members are primary substances (or substance-like entities). I have been calling them 'subordinate subject-kinds'.

2. Subject-Kinds vs. Demonstrable Attributes

In T36 and T37, Aristotle distinguishes between primary and subordinate subject-kinds. In the next group of passages, he distinguishes between subject-kinds in general and their demonstrable attributes.

The first passage appears in *APo* 1.7:

T38 There are three things in demonstrations: one, what is being demonstrated, the conclusion (this is what belongs in itself to some kind); one, the axioms (axioms are the things from which [the demonstrations proceed]); third, the underlying kind whose attributes and in itself accidents demonstration makes clear.¹⁶ (75a39–b2)

Aristotle's use of 'axiom' here is problematic. In *APo* 1.2, the axioms are the common principles, many of which are not premises of demonstrations but general laws governing proper reasoning. In T38, he says that the axioms are 'that from which' demonstrations proceed. This makes it seem as though they are premises of demonstrations. If so, they must be proper principles, especially definitions, and thus not axioms in the 1.2 sense. Assuming that 'axiom' in T38 signifies the proper principles solves a difficulty

¹⁵ As I remarked in Chapter 1§5 n29, in the cases of 'assuming' Aristotle has in mind in T36 and T37, all the assumptions are true. So in these passages, to assume is to have true cognition—that is, knowledge. See also section 4.

¹⁶ τρία γάρ ἐστι τὰ ἐν ταῖς ἀποδείξεσιν, ἐν μὲν τὸ ἀποδεικνύμενον, τὸ συμπέρασμα (τοῦτο δ' ἐστὶ τὸ ὑπάρχον γένει τινὶ καθ' αὐτό), ἐν δὲ τὰ ἀξιώματα (ἀξιώματα δ' ἐστὶν ἐξ ὧν)· τρίτον τὸ γένος τὸ ὑποκείμενον, οὗ τὰ πάθη καὶ τὰ καθ' αὐτὰ συμβεβηκότα δηλοῖ ἡ ἀπόδειξις.

with this passage: we expect it to mention proper principles, such as definitions, among the ‘three things in demonstrations’, but it seems not to. However, the solution comes at some cost: the meaning of ‘axiom’ shifts between *APo* 1.2 and 1.7. Below (in section 4) I argue for a different way of interpreting the passage: ‘axiom’ signifies the common principles, as in 1.2, but other parts of the passage refer implicitly to definitions.

For our present purposes T38 is important because it distinguishes between the underlying kind (*to genos to hupokeimenon*) that supplies the minor term in a demonstration and the in itself accidents (*ta kath’ hauta sumbebēkota*) that supply the major terms.¹⁷ Aristotle’s use of the expression ‘underlying’ points to appropriate subjects of predication—namely, those natural kinds to which demonstrable attributes belong and whose members are primary substances (or substance-like entities). In *APo* 2.2 (90a12, in T17), he uses the same expression (‘underlying’) to describe the subjects of demonstrable attributes. This suggests that the underlying kind mentioned in T38 is the same as the object sought in the ‘if it is’ and ‘what it is’ questions of *APo* 2.1–2: a subject-kind. What is noteworthy is that in T38, as in 2.1–2, Aristotle does not distinguish between primary subject-kinds and subordinate ones. His claim is simply that to have a demonstration one needs (among other things) ‘an underlying kind’—an appropriate subject of predication. In this way, he leaves room for subject-kinds at different levels of generality and of different ontological statuses. According to T38, then, both unit and three, both line and triangle, both animal and human being, can serve as subjects of demonstration.

This is crucial for Aristotle’s theory of science. He does not think that ‘point’ or ‘line’ is the minor term in every demonstration in geometry. Although point or line is the subject-kind about which geometry is centrally concerned, there are other, subordinate subject-kinds (e.g., triangle) whose attributes geometers demonstrate. Similarly, ‘animal’ is not the minor term in every demonstration in zoology. Although animal is the subject-kind about which zoology is centrally concerned, there are other, subordinate subject-kinds (e.g., human being) whose attributes zoologists demonstrate. Indeed, because zoologists are centrally concerned with the subject-kind *animal*, they are concerned with the subordinate kinds that fall under it.

The following passage, from *APo* 1.10, also distinguishes between subject-kinds and their demonstrable attributes. The context is a discussion of the distinction between common and proper principles.

- T39** Proper too are the things that are assumed (*lambanetai*) to exist, concerning which the science studies the things that belong in itself—for example, units in arithmetic, and points and lines in geometry. They assume (*lambanousi*) that these things exist and that they are such-and-such. But the in itself attributes of these things, they assume (*lambanousin*) what each signifies, for example, arithmetic [assumes] what odd or even or quadrangle or cube

¹⁷ On in itself accidents, see Chapter 3.

[signifies], and geometry [assumes] what irrational or inflexion or verging [signifies], and they prove that they exist through the common things and from what has been demonstrated. Astronomy [proceeds] in the same way.¹⁸ (76b3–11)

Aristotle begins by mentioning the primary subject-kind, whose existence is assumed as a first principle in the relevant science. Unlike T36 and T37, T39 does not mention subordinate subject-kinds; and unlike T38, it does not use a generic expression (such as ‘the underlying kind’) for both types of subject-kind. However, what Aristotle says in T39 is consistent with the view that science and demonstration are also concerned with the subordinate subject-kinds that fall under the primary one and with their demonstrable attributes. He ignores this aspect of his account, perhaps because he does not want to distract from the main distinction he wishes to draw, which is between primary subject-kinds and the in itself accidents that belong to them.

3. Subordinate Subject-Kinds vs. Demonstrable Attributes

In T39, Aristotle says that in demonstrating that an attribute P belongs to its subject, we assume what ‘P’ signifies. This recalls his claim in T37 that in demonstrating that a subordinate subject-kind S exists, we assume what ‘S’ signifies. However, it does not follow that demonstrable attributes and subordinate subject-kinds are the same. In T37, Aristotle signals that triangle is a subordinate subject-kind by distinguishing between primary subject-kinds and ‘the things from (*ek*) them’. The phrase ‘from the primaries’ is key.¹⁹ It refers to subordinate subject-kinds, not demonstrable attributes, which are not ‘from’ or ‘out of’ (*ek*) the primaries but ‘belong to’ (*huparchein*) them.²⁰ In two passages Aristotle says that subordinate subject-kinds are ‘composed from (*ek*)’ primaries,²¹ language he never uses for demonstrable attributes. Rather, he calls them ‘the things that belong (*ta huparchonta*) in itself’ to a subject (T39, 76b4); he also calls them ‘the in itself accidents’ (*ta kath’ hauta sumbebēkota*) (T38, 75b1) and ‘the in itself attributes’ (*ta pathē kath’ hauta*) (T39, 76b6–7) of a subject.²² So Aristotle is careful to use different expressions for different kinds of thing. Furthermore, it is clear that he regards triangle, his main example of a subordinate subject-kind, as a subject and not an attribute. For he makes triangle the subject of in itself_f attributes,²³ and as I argued in Chapter 3§1, only genuine subject-kinds

¹⁸ “Ἔστι δ’ ἴδια μὲν καὶ ἃ λαμβάνεται εἶναι, περὶ ἃ ἡ ἐπιστήμη θεωρεῖ τὰ ὑπάρχοντα καθ’ αὐτά, οἷον μονάδας ἢ ἀριθμητικῇ, ἢ δὲ γεωμετρίας σημεῖα καὶ γραμμάς. ταῦτα γὰρ λαμβάνουσι τὸ εἶναι καὶ τοδὶ εἶναι. τὰ δὲ τούτων πάθη καθ’ αὐτά, τί μὲν σημαίνει ἕκαστον, λαμβάνουσιν, οἷον ἡ μὲν ἀριθμητικὴ τί περιττὸν ἢ ἄρτιον ἢ τετράγωνον ἢ κύβος, ἢ δὲ γεωμετρία τί τὸ ἄλογον ἢ τὸ κεκλάσθαι ἢ νεύειν, ὅτι δ’ ἔστι, δεικνύουσι διὰ τῶν κοινῶν καὶ ἐκ τῶν ἀποδεδειγμένων. καὶ ἡ ἀστρολογία ὡσαύτως.

¹⁹ In addition to T37 (76a33), see also APo 1.28, 87a38–9 (T40, below) and 2.13, 96b21 (T19c), discussed in Chapters 8§5 and 12§1.

²⁰ See T39 (76b4) and T38 (75a40–1, b1). See also T40.

²¹ See again T40 and T19c.

²² See also 87a38 (in T40), 76b13 (in T39b), and 96b20–4 (T19c), discussed in Chapters 8§5 and 12§1.

²³ APo 1.4, 73a34–7.

are subjects of in itself₁ attributes. He also makes triangle the subject of demonstrable attributes²⁴—indeed, one of his favourite examples of a conclusion of a demonstration is ‘2R belongs to all triangle’.

We can see the distinctions between primary and subordinate subject-kinds and between subject-kinds in general and their demonstrable attributes in the following passage:

T40 A single science is of a single kind (*genous*), whatever things are composed out of (*ek*... *sugkeitai*) the primaries and are parts or attributes of these things in themselves (*pathē toutōn kath’ hauta*).²⁵ (*APo* 1.28, 87a38–9)

Aristotle identifies four entities included in the ‘one kind’ studied by each science: (1) the primaries, (2) the things that are ‘composed from the primaries’, and (3) the things that are (a) parts or (b) attributes of ‘these things in themselves’. (1) and (2) give us the distinction between primary and subordinate subject-kinds; (2) and (3) give us the distinction between subordinate subject-kinds and attributes. ‘These things’ in (3) signifies the primary and subordinate subject-kinds together.²⁶ The parts (3a) that belong to them in themselves are their essential attributes;²⁷ the attributes (*pathē*) (3b) that belong to them in themselves are their demonstrable attributes (their in itself accidents). T40, therefore, gives us a nearly exhaustive list of the ingredients of a science: the two types of subject-kind (primary and subordinate) and the two types of attribute (essential and demonstrable). (It’s only missing the common axioms.)

Aristotle says that subordinate subject-kinds (species) are composed out of or from (*ek*) the primaries. In *APo* 2.13, he says that the essence of each species is ‘out of’ or ‘from’ (*ek*) two things: the genus and the differentia(e).²⁸ This suggests that the primary (i.e., the genus) is that out of which species are composed just in so far as the genus is part of the essence of each species. So the ‘composed out of’ relation is definitional. For example, the genus *animal* is that ‘out of’ or ‘from’ which each animal species is composed just in so far as it is part of the essence of each animal species.

Aristotle makes a crucial but easily overlooked distinction between demonstrable attributes and subordinate subject-kinds. Although both are demonstrable, they differ in at least three significant ways. First, subject-kinds are not demonstrable attributes of any subject. Second, subordinate subject-kinds are (definitionally)

²⁴ *APo* 1.4, 73b30–2.

²⁵ *Μία δ’ ἐπιστήμη ἐστὶν ἣ ἐνὸς γένους, ὅσα ἐκ τῶν πρώτων σύγκειται καὶ μέρη ἐστὶν ἢ πάθη τούτων καθ’ αὐτά.*

²⁶ Here I follow McKirahan 1992: 58.

²⁷ See *Met* 5.25, 1023b23–4, cited by Barnes 1993: 190: ‘the items in the account which makes a thing clear are also parts of the whole’ (Barnes’s translation) (τὰ ἐν τῷ λόγῳ τῷ δηλοῦντι ἕκαστον, καὶ ταῦτα μέρη τοῦ ὅλου).

²⁸ See *APo* 2.13, 96b32 (in T45), Chapter 12§6; see also 2.13, 96b6.

composed out of the primaries whereas demonstrable attributes belong to primaries (and other subject-kinds). Finally, subordinate subject-kinds, unlike demonstrable attributes, are natural kinds whose individual members are primary substances (or substance-like entities).

Aristotle distinguishes between subject-kinds and demonstrable attributes in another important passage, *APo* 2.9 (which I discussed in Chapter 9§3):

- T24** (a) Of some things there is something different [that is] the cause, of other things there is not. (b) The result is that it's clear that also among what things are [i.e., the essences] (*tōn ti esti*), some things (*ta men*) are immediates and principles, those things of which it is necessary to hypothesize that they are and what they are or make them clear in some other way. (This is the very thing that arithmetic does: for in fact it hypothesizes what unit is and that it exists.) (c) On the other hand, in the case of things (*tōn d'*) that have a middle term and of which there is some cause different from the essence, it is possible to make [what it is] clear through demonstration, as we said, but there is no demonstrating what it is. (93b21–8)

T24b discusses the now familiar case of unit, a primary subject-kind. Aristotle says that the cause of unit is the same and its essence is in no way demonstrable, and he contrasts it with the sort of entity whose cause is different and whose essence is in some way demonstrable. In this way, he contrasts unit with demonstrable attributes. (Hence T24 resembles T39, which makes the same distinction.) For, as I argued in Chapter 9, it is only demonstrable attributes whose causes are different. Therefore, *APo* 2.9 is consistent with, and in some ways confirms, the account I have presented so far.

To sum up: In *APo* 1, Aristotle identifies five main ingredients that make up a science. T36 and T37 give us (1) the primary subject-kind in each science, whose existence is assumed in what Aristotle (in *APo* 1.2) calls a 'hypothesis', which is also a proper principle. These passages also give us (2) subordinate subject-kinds, whose existence is demonstrated. T38 and T39 mention (3) the in-itself accidents that are demonstrated to belong to primary and subordinate subject-kinds. Finally, in *APo* 1.2, he identifies (4) definitions, which are among the proper principles of a science, and (5) common axioms.

4. Demonstrating Attributes: Teaching by Demonstration, Part 1

Let's return to Aristotle's remarks in T39 about how we demonstrate that attributes belong to their subjects. In the next section I shall use the interpretation I develop here to try to clarify Aristotle's account of how we demonstrate the existence of subordinate subject-kinds. Here again is the passage; I now also include the lines that immediately follow it:

- T39** (a) Proper too are the things that are assumed (*lambanetai*) to exist, concerning which the science studies the things that belong in itself—for example, units in arithmetic, and points and lines in geometry. They assume (*lambanousi*) that these things exist and that they are such-and-such. But the in itself attributes of these things, they assume (*lambanousin*) what each signifies, for example, arithmetic [assumes] what odd or even or quadrangle or cube [signifies], and geometry [assumes] what irrational or inflexion or verging [signifies], and they prove that they exist through the common things and from what has been demonstrated. Astronomy [proceeds] in the same way. (b) Every demonstrative science is concerned with three things: whatever it posits (*tithetai*) to exist (these things are the kind whose in itself attributes [the science] studies), and the things called common axioms, which are the primary things from which they demonstrate, and third the attributes, each of which one assumes (*lambanei*) what [it] signifies. . . . Nevertheless by nature there are these three things: that concerning which they prove and the things that they prove and the things from which [they prove].²⁹ (76b3–16, 21–2; see also *APr* 1.27, 43b1–3)

In T39a, Aristotle mentions five things that seem relevant to the demonstration that an attribute P belongs to a primary subject-kind S:³⁰ (i) that S exists, (ii) what S is, (iii) what ‘P’ signifies, (iv) the common axioms, and (v) demonstrated propositions. (T39b mentions (i), (iii), and (iv).) He says that common axioms and demonstrated propositions are that ‘from which’ P is demonstrated. These remarks are problematic. As I mentioned above, many (perhaps most) common axioms cannot serve as premises of demonstrations. In addition, although demonstrated propositions can serve as premises of some demonstrations, indemonstrable propositions are also required; otherwise there will be an infinite regress or demonstration will be circular. To fill in Aristotle’s account, we need to find among (i), (ii), and (iii) the proper principles, especially definitions, that serve as indemonstrable explanatory premises in demonstrations. I shall now argue that they are found in (ii) what S is and (iii) what ‘P’ signifies. According to T39, on my reading, when we demonstrate

²⁹ Ἔστι δ’ ἴδια μὲν καὶ ἃ λαμβάνεται εἶναι, περὶ ἃ ἡ ἐπιστήμη θεωρεῖ τὰ ὑπάρχοντα καθ’ αὐτά, ὅσον μονάδας ἢ ἀριθμητικῆς, ἢ δὲ γεωμετρίας σημεῖα καὶ γραμμὰς. ταῦτα γὰρ λαμβάνουσι τὸ εἶναι καὶ τοδὶ εἶναι. τὰ δὲ τούτων πάθη καθ’ αὐτά, τί μὲν σημαίνει ἕκαστον, λαμβάνουσιν, ὅσον ἡ μὲν ἀριθμητικὴ τί περιττὸν ἢ ἄρτιον ἢ τετράγωνον ἢ κύβος, ἡ δὲ γεωμετρία τί τὸ ἄλογον ἢ τὸ κεκλάσθαι ἢ νεύειν, ὅτι δ’ ἔστι, δεικνύουσι διὰ τε τῶν κοινῶν καὶ ἐκ τῶν ἀποδεδειγμένων. καὶ ἡ ἀστρολογία ὡσαύτως. πᾶσα γὰρ ἀποδευκτικὴ ἐπιστήμη περὶ τρία ἔστί, ὅσα τε εἶναι τίθεται (ταῦτα δ’ ἔστι τὸ γένος, οὐ τῶν καθ’ αὐτὰ παθημάτων ἐστὶ θεωρητικῆς), καὶ τὰ κοινὰ λεγόμενα ἀξιώματα, ἐξ ὧν πρῶτον ἀποδείκνυσιν, καὶ τρίτον τὰ πάθη, ὧν τί σημαίνει ἕκαστον λαμβάνει. . . . ἀλλ’ οὐδὲν ἤττων τῇ γε φύσει τρία ταῦτά ἐστι, περὶ ὅ τε δείκνυσιν καὶ ἃ δείκνυσιν καὶ ἐξ ὧν.

³⁰ In T39a, Aristotle talks of ‘proving’ that P belongs to S, not ‘demonstrating’ it, but he mentions demonstration in T39b. He also mentions it in T38. Merely proving that P belongs to S does not require an explanatory middle term; demonstrating does. My interpretation of T39 assumes that Aristotle has demonstration in mind, an assumption warranted by T38 and T39b. I make use of the distinction between demonstration and mere proof just below.

that P belongs to S, we use the essences of both S and P. I shall defend this reading by arguing that to assume what 'S' or 'P' signifies is to assume what S or P is (the essence).

In T39a, Aristotle says that we assume that a primary subject-kind such as unit exists 'and that it is such and such' (*einai todi*), by which he means what it is (the essence). In T24 (quoted in the previous section) too he says that we assume what unit is (the essence). In T36 and T37, he says that we assume what 'unit' signifies. All four passages address the same issue: the prior knowledge (*proginōskein*, T36) required for demonstrating either that a demonstrable attribute belongs to a primary subject-kind or that a subordinate subject-kind exists. So what is Aristotle's view? For purposes of demonstration, must we assume what unit is (as T39 and T24 say) or what 'unit' signifies (as T36 and T37 say)?

Assuming Aristotle has a coherent and consistent view across all the relevant passages, there are (at least) three possible readings. Suppose the proposition stating what unit is and the proposition stating what 'unit' signifies have different contents: the first proposition states the essence of unit; the second states its nominal account—that is, the ordinary meaning of the term 'unit'.³¹ On one interpretation, to demonstrate that P belongs to unit we must assume the nominal account of 'unit'. When Aristotle speaks of what unit is, this is a careless slip. On a second interpretation, we must assume the essence of unit. When he speaks of what 'unit' signifies, this is a careless slip.

I want to defend a third interpretation. To demonstrate that P belongs to unit, we must assume what unit is, the essence. When Aristotle says that we must assume what 'unit' signifies, he does not mean the (mere) nominal account. Rather, he means what 'unit' signifies *within the established science*—that is, the essence. In this context, then, the proposition that states what 'unit' signifies has the same content as the proposition that states what unit is: both state unit's essence.³² This interpretation fits well with Aristotle's theory of demonstration: in a Model 1 demonstration, we demonstrate that P belongs to unit through unit's essence. P is an in-itself accident of unit. (See Chapter 3.)

If I am right that when Aristotle speaks of what 'unit' signifies (T36 and T37) he means unit's essence (which is what 'unit' signifies in the established science), why does he not simply say 'what unit is' (as he does in T39 and T24)? Furthermore, why

³¹ See *APo* 2.10, 93b30–2 (in T33), discussed in Chapter 10§6. I also discuss nominal accounts in Chapter 9§6.

³² Here I follow McKirahan 1992: 37 and depart from Ackrill 1981: 368–70. I am not suggesting that Aristotle fails to distinguish between what unit is (unit's essence) and what 'unit' signifies (unit's nominal account). As I argued in Chapters 9 and 10, he does distinguish between these, and the distinction is central to his account of inquiry and his solution to Meno's Paradox in *APo* 2.8. Rather, my claim is that, for Aristotle, within the context of the relevant science 'unit' signifies unit's essence, so that (in this context) the proposition that states what 'unit' signifies and the proposition that states unit's essence have the same content. In other contexts, and in particular at the start of inquiry, the two propositions do not have the same content.

does he say that we ‘assume’ (*lambanein*) what unit is (T39) or what ‘unit’ signifies (T37)? The answer to both questions, I believe, is that Aristotle is thinking of a student receiving from a teacher a demonstration in which P is shown to belong to unit because of unit’s essence.³³ The teacher states as an assumption, for the student’s sake, that ‘unit’ signifies ‘indivisible quantity’,³⁴ and on the basis of this (and other assumptions) she leads the student through the demonstration that P belongs to unit. Since, in this context, what ‘unit’ signifies is what unit is, Aristotle can switch freely between the two expressions.

In Chapter 1, I argued that knowledge (*gnōsis*), for Aristotle, is true cognition. In T36, assuming (*lambanein*) that unit exists and comprehending (*xunienai*) what ‘unit’ signifies are examples of knowledge (*proginōskein*). In T37 and T39, he speaks of assuming what ‘unit’ signifies and what unit is. Presumably here too assuming is a way of knowing. In assuming what unit is, the student believes truly that this is what it is and thus, in a weak sense, knows what it is. Unlike her teacher, she does not have scientific knowledge (*nous*) of what unit is. However, in order for her to learn the demonstration, her more limited grasp is sufficient.

According to T39, then, to demonstrate that an attribute P belongs to a primary subject-kind S, one must assume what S is (the essence). This solves the difficulty I raised above in section 2: T39 does after all make reference to the explanatory premises (definitions) required for demonstration. I now want to argue for a similar interpretation of what it is to assume what ‘P’ signifies.

Aristotle’s terminology is consistent across the relevant passages (T36, T37, and T39). He says that to demonstrate that P belongs to S we must assume what ‘P’ signifies (T39). Similarly, he says that to demonstrate that a subordinate subject-kind such as triangle exists, we must assume what ‘triangle’ signifies (T36 and T37). In general, then, if *x* is demonstrable, to demonstrate *x* we need to assume what ‘*x*’ signifies.

It is important that in these passages Aristotle discusses demonstrating and not merely proving that P belongs to S (or that S exists).³⁵ The demonstration must state the cause of P’s belonging to S. In a Model 2 demonstration, the cause (signified by the middle term) is the essence of the attribute that is demonstrated. (See Chapter 3§4.) However, if the demonstration that P belongs to S takes P’s essence as the middle term, why does Aristotle in T39 speak of ‘what “P” signifies’? Furthermore, why does he speak of ‘assuming’ (*lambanein*) what ‘P’ signifies rather than, say, knowing scientifically what P is?

The reason is that, as I just argued, in T39 he is thinking of a teacher presenting a demonstration to a student. As we have seen, Aristotle thinks that in the standard

³³ Aristotle explicitly discusses teaching and learning shortly after T39, at 76b23–34.

³⁴ *APo* 1.2, 72a22–3.

³⁵ He does not mention either proving or demonstrating in T36, and in T37 he mentions only proving. However, he mentions demonstrating in T39 (and in T38), and the similarities among the passages warrant the assumption that T36 and T37 deal with demonstration and not mere proof.

cases one knows that P belongs to S before one knows why it belongs, which is the same as knowing what P is. Furthermore, one cannot know what or why P is without knowing that it belongs to S.³⁶ Suppose the student does not know that P belongs to S. The teacher wishes to present the demonstration that it belongs. Since the student does not know that P belongs to S, she does not know what P is (the essence). The teacher proposes that 'P' signifies 'M'. From this (and other assumptions) she demonstrates that P belongs to S. The student now knows that P belongs to S. The teacher can then point out that M is P's essence. In this context, then, the proposition that states what 'P' signifies has the same content as the proposition that states what P is—'M' is what 'P' signifies in the established science. If the teacher were to state the mere nominal account of P, the resulting proof would fail to be a demonstration, for it would fail to state the cause of P's belonging to S. (For example, if the teacher were to state that 'eclipse' signifies 'a certain loss of light', the resulting proof would not be a demonstration.) Aristotle speaks of 'assuming what "P" signifies' because he is thinking of a student being taught the demonstration that P belongs to S, and he is sensitive to his own requirement that one cannot know what P is before one knows that it belongs to its subject.

In assuming (*lambanein*, T39) that 'P' signifies 'M', where M is P's essence, the student believes truly that 'P' signifies 'M' and thus, in a weak sense, knows P's essence. However, she does not, and cannot yet, know P's essence as such, for she does not yet know that P belongs to S. That is why Aristotle indicates (in T39) that the student assumes what 'P' signifies. However, once she learns the demonstration, she is in a good position to know, in a stronger sense, that M is P's essence. For she now knows that P belongs to S. In addition, the fact that M is the cause of P's belonging to S gives her good reason to believe that M is P's essence. Indeed, we might think that part of the reason the teacher presents the demonstration to the student is to convince her that M is P's essence. Similarly, once the student learns the demonstration that P belongs to unit through what 'unit' signifies ('indivisible quantity') the teacher can point out that the demonstration provides good reason for believing that this is unit's essence. For it explains why P belongs to unit, and the essence of a subject-kind explains its demonstrable attributes. In this way, part of the purpose of presenting the demonstration may be to convince the student that indivisible quantity is unit's essence, so that she can come to know, in a stronger sense than before, unit's essence. As I argued in Chapter 8§5, convincingness, for Aristotle, tracks explanatory power. For the inquirer to become convinced of definitions (first principles), she must explain (i.e., demonstrate) from them. Similarly, for the student to become convinced of definitions, her teacher must explain (i.e., demonstrate) from them. At this point the student does not have demonstrative

³⁶ See *APo* 2.8, 93a15–20 (T31), discussed in Chapter 10§4.

scientific knowledge of the demonstration's conclusion or *nous* of the premises, but, like the inquirer, she is on her way to this condition.

According to T39, demonstrating that P belongs to S requires assuming either what S is (what 'S' signifies in the science) or what P is (what 'P' signifies in the science) or both. In fact, this is exactly the view I have argued Aristotle adopts in the *APo*. (See Chapter 3§4.) In a Model 1 demonstration, the middle term signifies the essence of the subject. In a Model 2 demonstration, it signifies the essence of the attribute. Every Model 2 demonstration is explanatorily grounded in a Model 1 demonstration. What we find in T39 is a (albeit compressed) presentation of the integrated view. The explanatory premises of demonstrations are taken from the definitions both of the subject-kinds and of the demonstrable attributes.

My reading of T39 points to a similar interpretation of T38, which we found to be problematic for much the same reason as T39: its apparent omission of the proper principles, especially definitions.

T38 There are three things in demonstrations: one, what is being demonstrated, the conclusion (this is what belongs in itself to some kind); one, the axioms (axioms are the things from which [the demonstrations proceed]); third, the underlying kind whose attributes and in itself accidents demonstration makes clear. (75a39–b2)

I suggest that when Aristotle mentions the attribute P that is demonstrated, he also refers implicitly to P's essence (to what 'P' signifies in the established science). And when he mentions the underlying kind S to which P is demonstrated, he also refers implicitly to S's essence (to what 'S' signifies in the established science). We do not need to think that the meaning of 'axiom' has changed between *APo* 1.2 and 7; we need only think that T38, as with so much of the *APo*, is highly compressed and elliptical.

5. Teaching vs. Inquiring

One might object that on my interpretation, the expression 'what "*x*" signifies' refers to different things in different places in the *APo*. When Aristotle uses the expression in 2.10, 93b30–2 (in T33), it refers to what '*x*' signifies in ordinary language. This is what I have been calling a 'nominal account': for example, 'eclipse' signifies 'a certain loss of light'. Elsewhere, however, the expression refers to what '*x*' signifies within the established science (i.e., *x*'s essence).³⁷

However, there is a good explanation for this difference. The context of 2.10, 93b30–2 (in T33) is Aristotle's account of inquiry. Here what '*x*' signifies is what the inquirer knows prior to seeking whether and what *x* is (its essence). (See

³⁷ T36, T37; see also T39 and T41 (below).

Chapter 10§7.) If, in this context, ‘x’ signified its complete essence, inquiry would arguably be pointless and perhaps impossible: the inquirer would already know what she is seeking. The context of the other passages, I have argued, is teaching by demonstration. Here Aristotle indicates that in order to be taught, the student must assume what ‘x’ signifies. However, Aristotle also thinks that in order to be taught, the student must assume what x’s complete essence is. For this is the middle term in the demonstration. So, in this context, what ‘x’ signifies is x’s complete essence.

6. Demonstrating Subordinate Subject-Kinds: Teaching by Demonstration, Part 2

Let’s return to Aristotle’s account of the existence of subject-kinds. Recall that a primary subject-kind is assumed to exist in the relevant science. Aristotle does not mean that the ‘if it is’ question of *APo* 2.1–2 cannot be asked of, for example, unit. As I interpreted it (in Chapters 6–7), the question asks whether an entity is a genuine, essence-bearing subject-kind. An inquirer, at an early stage, can ask this about unit. Aristotle does not tell us how she answers it. What he does say is that the existence of unit is indemonstrable, so she will not answer it by attempting to discover a demonstration that unit exists. (I return to this below.)

Subordinate subject-kinds differ from primary ones in that their existence is demonstrable. Let’s look again at the two passages in *APo* 1 in which Aristotle mentions them. I also include a relevant passage from 2.7.

T36 There are two ways in which it is necessary to have prior knowledge (*proginōskein*): of some things we must assume beforehand (*proupolambanein*) that they are, of others we must comprehend (*xunienai*) what the thing spoken about is, and of some things both. For example, of the fact that everything is either asserted or denied truly, [we must assume] that it is the case; of triangle, [we must comprehend] that it signifies this; and of unit we must both [comprehend] what it signifies and [assume] that it exists. For these things are not equally clear to us. (71a11–17)

T37 I call principles in each kind those things of which it is not possible to prove that they exist. And so what the primaries and what the things from them (*ta ek toutōn*) signify is assumed (*lambanetai*), but that they exist must be assumed (*lambanein*) for the principles and proved for the others. For example, we must assume (*labein*) what unit or what straight and triangle [signify], and that unit and magnitude exist; but we must prove the other things. (76a31–6)

T41 Next, we say that everything that something is must be proved through a demonstration, unless it is the essence. But existence is not the essence of

anything; for being is not a genus (*genos*). Therefore, there will be a demonstration that [the thing] exists. And this is the very thing that the sciences now do. For the geometer assumes (*elaben*) what triangle signifies and proves that [triangle] exists.³⁸ (92b12–16)

Let's start with T36. The context is the first sentence of the *APO*: 'All teaching and all intellectual learning come to be from pre-existing knowledge.' (T1, 71a1–2) In the lines that follow Aristotle gives an inductive argument in defence of the claim: the mathematical sciences, deductive and inductive arguments, and rhetoric are all areas in which teaching and learning require prior knowledge (71a2–11). In T36, which immediately follows, Aristotle identifies two types of prior knowledge (*proginōskein*), giving four examples in total. One must assume (*lambanein*) that certain things are true or exist. For example, one must assume (i) that the principle of the excluded middle is true and (ii) that unit exists. One must also comprehend (*xunienai*) what certain terms signify. For example, one must comprehend (iii) what 'unit' signifies and what (iv) 'triangle' signifies. He also mentions (ii), (iii), and (iv) in T37.

I suggest that in T36 it is the student who must have prior knowledge of these different things, and she must know them before being taught by demonstration that a subordinate subject-kind such as triangle exists.³⁹ Aristotle's use of verbs for knowledge in T36 supports this reading. He first uses *proginōskein* for prior knowledge in general and then *proupolambanein* (to assume beforehand, to presuppose) and *xunienai* (to perceive, be aware of, understand, comprehend) for the specific forms of knowledge required. All three terms may be used for the lower-level knowledge characteristic of a student. In 'assuming beforehand' that unit exists, the student believes truly, and thus knows, in a weak sense, that it exists. And as I argue just below, in 'comprehending' what 'triangle' signifies, the student understands what the term signifies in the established science and thus knows, in a weak sense, what triangle is.

This interpretation of T36 is supported by T37 and T41, which mention demonstrating that triangle exists, and by T39, which (I have argued) discusses the prior knowledge the student requires for being taught by demonstration. However, T36, T37, and T41 differ from T39 in a significant way: T36, T37, and T41 concern subordinate subject-kinds, whereas T39 concerns demonstrable attributes. Whatever it means to demonstrate that triangle or human being exists (and Aristotle is not clear about this), it does not involve demonstrating that triangle or human being belongs to some other underlying subject. For these are subject-kinds, not demonstrable attributes.

³⁸ *Εἴτα καὶ δι' ἀποδείξεώς φαμεν ἀναγκαῖον εἶναι δεικνυσθαι ἅπαν ὅ τι ἔστιν, εἰ μὴ οὐσία εἴη. τὸ δ' εἶναι οὐκ οὐσία οὐδενί· οὐ γὰρ γένος τὸ ὄν. ἀποδείξῃς ἄρ' ἔσται ὅτι ἔστιν. ὅπερ καὶ νῦν ποιοῦσιν αἱ ἐπιστήμαι. τί μὲν γὰρ σημαίνει τὸ τρίγωνον, ἔλαβεν ὁ γεωμέτρης, ὅτι δ' ἔστι, δεικνυσιν.*

³⁹ Philoponus (*in An Post* 7.5–12.3) also takes T36 to be concerned only with learning by demonstration, but he seems to have in mind the learning of experts. Fine (2014: 192) argues that the passage describes the prior knowledge required for learning by deduction generally, not demonstration specifically. Ross (1949: 540–5) seems to have a similar view.

T36 and T37 indicate that to demonstrate that a subordinate subject-kind such as triangle exists, the student must assume (a) that the relevant primary (line or magnitude) exists, (b) what ‘triangle’ signifies, (c) what ‘line’ or ‘magnitude’ signifies, and (d) certain common axioms.⁴⁰ In section 4, I argued that when Aristotle makes similar claims about the procedure for demonstrating attributes, by ‘what “S” signifies’ and ‘what “P” signifies’ he means the essences of S and P. Similarly, to learn the demonstration that triangle exists, the student must assume what line and triangle are by assuming what each term signifies in the established science. A triangle is essentially composed of lines (*APo* 1.4, 73a34–5). So to learn that triangle exists, the student needs to assume that line exists. She also needs to assume what line is by assuming what ‘line’ signifies. And she needs to assume what triangle is by assuming what ‘triangle’ signifies. For the demonstration that triangle exists shows why it exists, and triangle’s essence is the cause of its existence, so the middle term signifies triangle’s essence. However, Aristotle cannot require that the student know triangle’s essence as such prior to learning the demonstration that triangle exists. For this requires knowing that triangle exists. So instead he requires that the student first know (*proginōskein*) in a weak way what triangle is by assuming what ‘triangle’ signifies (in the science). This allows her to learn the demonstration that triangle exists. After this, the teacher can take her back to the middle term, so that she can come to know, in a stronger sense than before, what triangle is.

The interpretation I have defended provides a solution to the difficulty Aristotle raises in T41. The solution requires distinguishing between the order of teaching and the order of discovery. We do not demonstrate the essence of triangle. Rather, we demonstrate the existence of triangle from the essence. In the order of teaching, this requires that the student first know (*proginōskein*) triangle’s essence in a weak way without knowing that triangle exists by assuming what ‘triangle’ signifies (in the science). In the order of discovery, this requires that the inquirer first prove without demonstrating that triangle exists, after which she seeks and discovers the essence, from which she demonstrates that triangle exists. At no time does one know triangle’s essence as such without knowing that triangle exists.

7. Discovering the Existence of Subordinate Subject-Kinds

The key to understanding Aristotle’s view in the last group of passages I examined (T36, T37, and T41) is to see that he has in mind the knowledge required by students prior to learning the demonstrations their teachers present, not the prior knowledge required by inquirers seeking to discover whether triangle or any other subordinate subject-kind exists. What is Aristotle’s account of how the inquirer seeks and

⁴⁰ For (b) and (c) Aristotle uses ‘comprehend’ (*xunienai*) in T36 and ‘assume’ (*lambanein*) in T37.

discovers that a subordinate subject-kind exists? He says next to nothing about this. However, we can try to reconstruct his view on the basis of some of his remarks in *APo* 2.2 and 8.

To begin with, recall that according to *APo* 2.2, in seeking whether, for example, human being (the subject-kind) exists, the inquirer (ideally) seeks whether there is a cause of its existence. Aristotle also claims that this cause is the essence. It seems, then, that in seeking whether human being exists, the inquirer (ideally) seeks whether it has an essence—whether it is a genuine, essence-bearing kind. A subordinate subject-kind is a species of a genus. Its essence is made up of the genus and differentiae. Perhaps Aristotle's thought is that we seek whether human being exists (has an essence) by seeking whether it is a species of its putative genus.

A passage in *APo* 2.8 we examined in the previous chapter suggests that the inquirer searches for whether human being exists by using a preliminary account:

T32 (a) But sometimes we grasp accidentally whether [an object] exists, and sometimes [we grasp whether it exists] when we grasp something of the object itself, for example, thunder, that it is a certain noise in the clouds, and eclipse, that it is a certain loss of light, and *human being*, *that it is a certain kind of animal*, and soul, that it moves itself. (93a21–4)

Animal is the genus of which human being is a species; 'a certain kind' looks like a placeholder for a candidate differentia of the genus that would help distinguish humans from other animals—say, two-footed. (This candidate differentia may turn out to be part of the essence of human being, as 'loss of light' turns out to be part of the essence of eclipse; or it may turn out to be a demonstrable attribute of human being, as 'inability to cast shadows' turns out to be a demonstrable attribute of eclipse. (See Chapter 10.)) So her preliminary account is 'human being, if it exists, exists as a two-footed animal'. Of course, humans are not the only two-footed animals, so the inquirer may need to supplement her account with other features discovered by empirical inquiry.

The inquirer, I suggest, seeks to establish that human being is a species of animal by drawing on the information supplied by her preliminary account. Just as she seeks whether eclipse exists as an *explanandum* by seeking whether the moon loses its light in a certain way, so too she seeks whether human being exists as a genuine species by seeking whether two-footed things are animals. If she discovers that they are, then she grasps the following non-demonstrative proof:

Animal belongs to all two-footed things⁴¹
Two-footed belongs to all human beings
 Animal belongs to all human beings

⁴¹ For Aristotle, if D is a differentia of the genus G (as two-footed is a differentia of animal), then G belongs to everything to which D belongs (but not vice versa). That is, for any x, if x is D then x is G. See Chapter 12§3.

This is not a demonstration that humans are animals—there is no such demonstration, for humans are essentially animals. Rather, it is a syllogistic proof establishing that human being is a species of the genus *animal*. (For the proof to work it must establish that human being is a unique species of animal, and to do this the middle term, and hence the preliminary account, must be enhanced so as to make it uniquely identifying.)

This interpretation solves the instance of Meno's Paradox that arises from *APo* 2.1 and that I discussed in Chapter 6§7. Aristotle's account of inquiry requires that, prior to seeking whether a subject-kind *S* exists, we have a grasp of *S*, a grasp that falls short of knowing scientifically *S*'s complete essence and exceeds total ignorance of *S*. Aristotle's conception of a preliminary account, as presented in T32, fits the bill exactly. We can seek whether *S* exists if we grasp a preliminary account of *S*, one that identifies *S*'s genus *G* and a candidate differentia that distinguishes *S* from other *G*s—either (what turns out to be) an essential attribute of *S* or (what turns out to be) one of its in itself accidents. Furthermore, I have argued that by grasping such an account we can seek and discover that *S* exists in the specific way required by *APo* 2.2: namely, as a genuine, essence-bearing kind.

My speculative reconstruction preserves Aristotle's distinction between the order of discovery and the order of teaching. In the order of discovery, we first grasp (at Stage 1) a preliminary account of human being, on the basis of which we discover a non-demonstrative proof that human being exists (at Stage 2). We then seek and discover what human being is (at Stage 3, by division; see Chapter 12), on the basis of which we can form the demonstration that it exists. We are then in a position to seek and discover the demonstrable attributes of human being and their causes (at Stages 4–5), as on the Socratic Picture. In the order of teaching, by contrast, we first assume what human being is (i.e., what 'human being' signifies in the established science) and then demonstrate that human being exists.

8. Discovering the Existence of Primary Subject-Kinds

In the previous section, I attempted to explain (on the basis of minimal textual resources) how an inquirer seeks and discovers that subordinate subject-kinds exist. How does she discover that primary subject-kinds exist? The question is important because on my reading the inquirer discovers that a subordinate subject-kind exists by locating it in the relevant genus, which is the primary subject-kind. So the procedure presupposes that the relevant primary exists. Furthermore, it presupposes that the inquirer knows that it exists; otherwise her procedure for establishing the existence of subordinate subject-kinds would fail. So in the order of discovery the inquirer first knows that animal exists and then she knows that human being does.

Even if my account of how we discover the existence of subordinate subject-kinds is mistaken, there is a strong argument to be made that in the order of inquiry we discover the existence of primaries first. Aristotle thinks that we know at Stage 2 that,

for example, triangle exists and then at Stage 3 what it is, on the basis of which we can form the demonstration that it exists. As we have seen, the demonstration at Stage 3 relies on the assumption that line, the relevant primary, exists. It is reasonable to suppose that the non-demonstrative proof that triangle exists at Stage 2 similarly relies on the assumption that line exists. (If lines do not exist, neither do triangles.) So how does the inquirer seek and discover that line (or animal) exists?

Aristotle says even less about seeking and discovering the existence of primary subject-kinds than he does about subordinate ones. One clue is that in the list of preliminary accounts in *APo* 2.8 (T32a, 93a24) we find ‘soul, that it moves itself’. Arguably, soul is a primary in the relevant science, biology. So Aristotle’s view seems to be that the inquirer begins at Stage 1 with a preliminary account of soul, just as she begins with a preliminary account of human being: soul, if it exists, exists as something that moves itself. Despite this similarity, it is clear that the inquirer cannot discover that a primary subject-kind exists in the way she discovers that a subordinate one does, namely, by proving that it belongs in the relevant genus. For the primary is a genus and is not a member of one. This difference points to the fact that, in seeking whether a primary exists, the inquirer seeks whether it exists *as* a primary—as the genus of which different subordinate-subject kinds are species, and not as the species of any genus. This implies that the inquirer brings to her search some prior knowledge of the genus-species relations that hold between the primary subject-kind in which she is interested and the subordinates that fall under it. This is as it should be. The stages of scientific inquiry, even the earliest ones, do not describe the low-level learning of basic concept-acquisition. It presupposes that such low-level learning has already taken place.⁴² The inquirer at Stage 1 brings to the table rough and ready conceptions of the genus and at least some of its species. If Aristotle’s own treatises are any indication, her method of establishing the existence of the genus is dialectic. By examining the views of the many and the wise, using her preliminary account to guide her investigation, she discovers that the genus exists as a primary subject-kind.

It needs to be acknowledged, however, that the manner in which we seek and discover the existence of both types of subject-kind (in addition to the manner in which we demonstrate the existence of subordinate ones) is perhaps the least developed aspect of Aristotle’s theory of scientific inquiry. He has much more to say about how we discover the essences of subject-kinds. This is what I examine next.

⁴² Aristotle discusses this low-level learning in *APo* 2.19. See Chapter 13.

12

Discovering Causally Simple Essences

APo 2.13

In this chapter, I turn to the methods Aristotle sets out in *APo* 2.13 for discovering the essences of subject-kinds. I begin with an important but difficult passage (96b15–25, T19), one that brings together the different ingredients of a science into a rough outline of scientific inquiry. Then, in sections 2–11, I examine Aristotle's explanation, which appears in the first half of 2.13, of how we discover the (causally simple) essences of subordinate subject-kinds by means of the method of division. In section 12, I examine his explanation, which appears near the end of 2.13, of how we discover the (causally simple) essences of primary subject-kinds by means of the method of induction. As we have seen throughout our examination of the *APo*, Aristotle's order of presentation is the reverse of the order of learning. For, I shall argue, the inquirer first discovers the essence of the primary subject-kind and then the essences of the subordinate ones.

As we saw in Chapter 8§6, a serious problem threatens the Socratic Picture of the order of inquiry. One advantage it is supposed to enjoy over the Intuitionist Picture is that it does not appeal to a faculty of intuitive discovery to explain how we learn the essences of subject-kinds. However, it was far from clear how this is supposed to work. The Socratic Picture claims that at Stage 2 the inquirer has some means of discovering what the essential attributes of a (primary or subordinate) subject-kind *S* are, without relying on intuition and without already knowing what *S*'s demonstrable attributes are. But how can she do this? I shall argue that the first part of Aristotle's answer lies in his account of discovering the essences of subordinate subject-kinds by division, which makes crucial use of the concepts of 'genus' and 'differentia'. If the inquirer knows what *S*'s genus is, then, Aristotle thinks, there are a number of procedures she can follow for discovering its essential differences, procedures that involve empirical inquiry alone and not intuition. I shall argue that the second part of Aristotle's answer lies in his account of discovering the essences of primary subject-kinds by induction. By apprehending via empirical inquiry features shared amongst the species of a genus, the inquirer can discover in a non-intuitionist way what the essence of the genus is.

1. Division, Definition, and Explanation

A passage near the start of *APO* 2.13 sets the agenda for the rest of the chapter (I first discussed it in Chapter 8§4):

- T19** (a) It is necessary, whenever one is working on any whole, to divide the genus into the primary indivisible species, for example, number into three and two, then to try to obtain in this way [i.e., by division] the definitions of them (for example, straight line, circle, right angle). (b) And after this, having taken hold of what the essence of the genus is, for example, whether it is among the quantities or qualities, [it is necessary] to study the peculiar attributes (*ta idia pathē*) through the common primaries. (c) For the attributes of the things composed from the indivisibles will be clear from the definitions [of the indivisibles], because of the fact that the definition and the simple are a principle of everything, and the attributes belong in themselves to the simples alone and through them to others. (96b15–25)

This passage brings together in a cryptic and highly compressed way many of the elements I have argued are central to Aristotle's account of science and inquiry. First, the passage invokes the distinction between primary and subordinate subject-kinds and between subject-kinds in general and their demonstrable attributes. Second, it relies on the view that a primary subject-kind is part of the essences of the subordinates that fall under it. (See Chapter 11§3.) Finally, as I argued in Chapter 8§4, it provides key support for the Socratic Picture of the order of inquiry. For it indicates that we first define what a subject-kind is and then seek its demonstrable attributes. It also implicitly suggests that we first acquire non-noetic knowledge of a subject-kind's essence and we then acquire *nous* of that essence by using it to explain the kind's demonstrable attributes. Let's now look in detail at what Aristotle says.

I begin with a brief (and tendentious) overview.¹ In T19a, Aristotle distinguishes between the primary subject-kind, in particular the genus, and subordinate subject-kinds of a certain type. He recommends that we divide the primary into these subordinates and then seek their definitions by means of the method of division. In T19b, he identifies the next stage in our search: having obtained the definitions of the primary subject-kind and of the subordinates mentioned in T19a, we should study the demonstrable attributes that belong to them (i.e., those that belong to the primary and those that belong to the subordinates). In T19c, he explains why we should proceed in this order. The reason has to do with the explanatory power of definitions. If a demonstrable attribute *P* belongs to a subject-kind *S* because of *S*'s essence, then *P* belongs to every subject-kind that is

¹ See Goldin 2004 for a helpful survey of different interpretations of T19. Goldin's own reading of the passage partly depends on his view that Aristotle treats (what I call) subordinate subject-kinds as demonstrable attributes, a view I argued against in the previous chapter. There is also a useful discussion of the passage in Charles 2000: 230–2.

composed of S, and it belongs because of S's essence. I shall now defend this reading and then discuss its significance for Aristotle's theory of inquiry overall.

A new type of subordinate subject-kind

In T19a, Aristotle distinguishes between a primary subject-kind, which he describes as a 'whole' (*holon*) and a 'genus' or 'kind' (*genos*), and certain subordinate subject-kinds, or species, that fall under it. He calls these 'primary indivisible species', examples of which are two, three, straight line, circle, and right angle.² He seems to have in mind a distinction between two types of subordinate subject-kind: indivisible and divisible species. This explains why he does not mention triangle, his usual example of a subordinate subject-kind, for it is divisible into isosceles, scalene, etc. In fact, however, given what Aristotle says in T19c, the passage implicitly distinguishes three types of subordinate subject-kind: primary indivisible species (e.g., straight line, circle), divisible species (e.g., triangle), and non-primary indivisible species (e.g., human being).

What makes straight line a *primary* indivisible species, according to T19c, is that although it is not divisible into sub-species, it is that from or out of which other species are somehow composed.³ However, straight line is still a subordinate subject-kind; it is not a primary. Rather, it is composed out of a primary (line). On the other hand, what makes human being a *non-primary* indivisible species is that, like straight line, it is not divisible into sub-species, but, unlike straight line, it is not that out of which any other species is composed.

So T19 introduces a new type of entity: primary indivisible subordinate subject-kinds. (In T19c, he calls them 'indivisibles' and 'simples'.) They uniquely combine features shared by the two other types of subject-kind with which we are familiar. Like all subordinates, they are members of the genus that serves as the primary subject-kind in the science. Like some subordinates (e.g., human being), they are not divisible into sub-species. Finally, unlike all other subordinates, but like primaries, they are privileged members of the genus because they are that out of which other species are composed. More specifically, I suggest that they are that out of which other species are definitionally composed. For example, straight line is part of the essence of triangle: closed plane magnitude with three straight lines. Aristotle's view seems to be that in at least some of the sciences there are a small number of such primary indivisible subordinate subject-kinds, and a key task for the inquirer is to identify them.

Demonstrable attributes and definitions

If my reading of T19 is correct, then in some sciences there are the following subject-kinds: (1) the genus, which is a primary (e.g., magnitude), (2) a small number of

² My interpretation of the primary indivisible species follows that of Ross 1949: 658–9.

³ I take it that the indivisibles mentioned in T19c (at 96b21, *ek tôn atomôn*) are the same indivisibles mentioned in T19a (at 96b16, *ta atoma*). In T19c, he also calls the indivisibles 'simples' (*tois haplois*, 96b23). For a different view see Barnes 1993: 243.

privileged (or ‘primary’) species, which are subordinate and indivisible (e.g., straight line), and (3) all the remaining species, some of which are divisible and some indivisible (e.g., triangle, isosceles triangle).⁴ Aristotle’s claim in T19a is that we should divide (1), the genus, into (2), the primary indivisible species, and then define them. Since some sciences seem not to have primary indivisible species (e.g., biology), Aristotle’s account is not completely general. However, I shall argue that his central claims are. He focuses on the more complex sciences (using geometry as his model), leaving it to us to see how his account carries over to the less complex sciences.

The distinction between (1) the genus and (2) the primary indivisible species mentioned in T19a is implicit in T19b:

- T19 (b)** And after this, having taken hold of what the essence of the genus is, for example, whether it is among the quantities or qualities, [it is necessary] to study the peculiar attributes (*ta idia pathē*) through the common primaries.

‘This’ refers to the process (mentioned in T19a) of defining by division the primary indivisible species. The inquirer now knows their essences and the essence of the genus. This allows her to study the peculiar attributes (i.e., the in itself accidents). These are the demonstrable attributes that belong either to the genus or to the primary indivisible species or to both. (I return to T19b below.)

In T19c, Aristotle explains why after discovering the essences of the genus and the primary indivisible species we should study their demonstrable attributes:

- T19 (c)** For the attributes of the things composed from the indivisibles will be clear from the definitions [of the indivisibles], because of the fact that the definition and the simple are a principle of everything, and the attributes belong in themselves to the simples alone and through them to others.

Aristotle first indicates that some non-primary species (e.g., triangle) are composed out of primary indivisible ones (e.g., straight line). Again, I suggest that Aristotle has definitional composition in mind. He goes on to say that if we know why a demonstrable attribute belongs to a genus or to a primary indivisible species (a ‘simple’), then we know why it belongs to the things definitionally composed from that genus or from that species. More precisely, if a demonstrable attribute *P* belongs to a subject-kind (genus or species) *S* because of *S*’s essence, then *P* belongs to any other subject-kind composed of *S*, and it belongs because of *S*’s essence. This claim seems to apply in every science, whether or not it contains primary indivisible species. It also explains why we should inquire in the order Aristotle recommends: if we know the essences of the genus and the primary indivisible species, then we can learn why the demonstrable attributes that belong to the genus and to the primary indivisible species also belong to the species composed of them.

On the reading of T19b–c I have presented, every demonstrable attribute that belongs to a subject-kind *S* also belongs to any subject-kind definitionally composed

⁴ Presumably the existence of the subject-kinds in (2) is demonstrable, just as the existence of those in (3) is.

of S. This does not commit Aristotle to the incorrect and implausible view that every demonstrable attribute of a non-primary species is also a demonstrable attribute of the genus or of a primary indivisible species out of which the non-primary species is definitionally composed.⁵ Aristotle's claim is that if P is a demonstrable attribute of S_1 , and S_2 is definitionally composed of S_1 (i.e., if S_1 is part of the essence of S_2), then P is a demonstrable attribute of S_2 . His claim is not that if P is a demonstrable attribute of S_2 , and S_2 is definitionally composed of S_1 , then P is a demonstrable attribute of S_1 . 2R belongs to all triangles, not to all straight lines. So, when Aristotle says in T19c that 'the attributes belong in themselves to the simples *alone* and through them to others' (96b23–5) he does not mean that *all* in itself accidents (demonstrable attributes) belong to simples alone.⁶ Rather, the expression 'the attributes' refers to 'the peculiar attributes' (*ta idia pathē*) mentioned in T19b: the demonstrable attributes that belong in itself to the genus or to the primary indivisible species, which in T19c he calls 'the simples'. His point in T19c is nuanced but sound. On the one hand, he wants to say that the definitions of the simples are explanatorily powerful: if P belongs to straight line because of straight line's essence, and if straight line is part of the essence of triangle, then P belongs to triangle because of straight line's essence. On the other hand, he wants to make a distinction between in itself and non-in itself belonging: if P belongs in itself to straight line (as a demonstrable attribute), then if P belongs to triangle because of straight line, then P belongs to triangle *but not in itself*.

This is a point Aristotle makes elsewhere in the *APo*. For example, triangle has 2R in itself, and isosceles triangle has 2R because it is a triangle, but isosceles triangle does not have 2R in itself.⁷ It does not follow, however, that isosceles triangle does not have its own in itself accidents. It only follows that isosceles triangle does not have *in itself* the in itself accidents of triangle. So Aristotle's claim is not that the simples (the primary indivisible species) alone have all the in itself accidents. His claim is rather that the simples alone have *in themselves* their own in itself accidents. Other things have these accidents through them, but they do not have them in themselves.⁸ The alternative is to saddle Aristotle with the contradictory claim that on the one hand the in itself accidents belong to the simples alone and on the other hand they belong to other things. (For in T19c (96b23–5) he says that they belong to the simples alone and that they belong to other things.) His claim is rather that the in itself accidents belong to the simples alone *in themselves*, and that they belong through them to other things, but not to other things *in themselves*.

⁵ Barnes (1993: 244) states that a version of the reading I defend commits Aristotle to this 'patently false view'.

⁶ On belonging 'in itself' and the in itself accidents, see Chapter 3.

⁷ See *APo* 1.4, 73b32–74a3, 1.5, 74a25–b4.

⁸ A different translation of the end of T19c (96b23–5) would make Aristotle's meaning clearer: rather than 'the attributes belong in themselves to the simples alone and through them to others' we might translate 'the attributes that belong in themselves to the simples alone belong through them to others'. However, I am not certain that the syntax of the sentence can support this translation (especially *de* at 96b24), so I have opted for a more conventional one in the main text.

Aristotle's account of the relationship between primary indivisible species ('the simples') and the non-primary species that are definitionally composed of them extends to other similar relations among subject-kinds, including any genus-species relation (e.g., animal-human being). If P is an in itself accident of a genus G, then P belongs to every species of G, but it does not belong in itself to any species. Furthermore, if P is an in itself accident of G, then P belongs to G because of G's essence. It follows that P belongs to every species of G because of G's essence. For every species of G is definitionally composed of G (among other things). Definitions are explanatorily powerful: they are 'a principle of everything' (T19c, 96b22–3). In this way we can extract from T19c a general view that applies in every science, including those in which there are no primary indivisible species.

The order of inquiry

In T19a, Aristotle says that one first divides a genus into its primary indivisible species and then one seeks their definitions by means of division. Dividing the genus is the first step in the process of seeking the definitions of its species. This implies that the inquirer has already grasped what the essence of the genus is. For the genus is part of the essence of each species, and one cannot come to know the essence of the species unless one already knows the essence of the genus.⁹ So, in the order of discovery, one defines the genus before one defines its species.¹⁰ This is confirmed by the start of T19b: 'after this, having taken hold of what the essence of the genus is, for example, whether it is among the quantities or qualities'. 'This' is the process of dividing the genus into its primary indivisible species and obtaining their definitions by division. 'Having taken hold of what the essence of the genus is' refers to a prior stage, before defining the species, when the inquirer discovers the genus's essence. Since the genus is the primary subject-kind in the science, it is defined in terms of the categories of being: quantity, quality, etc. (For example, unit is defined as an indivisible quantity.¹¹)

At this point the inquirer knows (non-noetically) the essence of the primary subject-kind (the genus) and the essences of at least some of its subordinate subject-kinds (or species), namely, the primary indivisible ones. Aristotle then identifies her next step: she is to study the in itself accidents of the genus and of the primary indivisible species.¹² In this way, as I argued in Chapter 8§4, T19

⁹ See *Top* 4.4, 141b15–142a16.

¹⁰ This does not mean that one defines the genus without any inkling of the species. As I argue below in section 12, the inquirer discovers the essence of the genus by induction, working her way up to it from the species and acquiring along the way some grasp of what the species are. However, in doing so she does not define the species. Rather, she defines them later, after she has discovered the essence of the genus.

¹¹ *APo* 1.2, 72a22–3.

¹² Aristotle says that she is to study them 'through the common primaries' (96b20–1), namely, the common axioms, which are primaries because they are indemonstrable principles (Aristotle calls common axioms 'primaries' in *APo* 1.10, 76b14 (in T39b)). He makes virtually the same claim in 1.7, 75a39–b2 (T38).

provides strong evidence for the Socratic Picture of the order of inquiry. The inquirer is at Stage 3: she knows (non-noetically) what the essence of a subject-kind *S* is. She is thus in an excellent position to inquire about its demonstrable attributes and move to Stages 4 and 5. Since she knows *S*'s essence, she has a means of identifying which are its demonstrable attributes. If *P* belongs to *S* by necessity, then *P* belongs to *S* either essentially or demonstrably. Since the inquirer already knows that *S*'s essential attributes are, say, *G*, *D*₁, and *D*₂, if she discovers that *P* belongs to *S* by necessity, she can infer that it belongs demonstrably, since she knows that it does not belong essentially. In addition, since she knows *S*'s essence, she knows the ultimate cause of *S*'s demonstrable attributes. She can now seek the attributes' proximate causes, which are the same as their essences, and she can then link these proximate causes to *S*'s essence.¹³ In discovering the proximate causes and linking them to the ultimate cause, *S*'s essence, she constructs the (Model 1 and Model 2) demonstrations constitutive of her science. This process of discovering causes and constructing demonstrations, I have argued, is also the process by which she moves from non-noetic to noetic knowledge of *S*'s essence. (It is also the process by which she moves from non-scientific to scientific knowledge of the demonstrations.) By explaining demonstrable attributes from the essences of the subject-kinds studied by a science, the inquirer is able to come to know these essences as first principles—that is, as the most explanatorily basic and powerful entities in the science.

T19 advocates the Socratic Picture of the order of inquiry. The inquirer at Stage 2 should first define the genus and then its primary indivisible species. Aristotle does not say this but we can imagine that she should then define its non-primary species. For she is in an excellent position to do so, given that she now knows at least some of their definitional elements, namely, the genus and its primary indivisible species. In this way inquiry at Stage 2 is holistic. (In Chapter 8§§3–4, I argued that inquiry at Stage 3 is holistic.) Aristotle does not recommend that the inquirer first define one species *S* in isolation from other species of the same genus and then seek *S*'s demonstrable attributes. Rather, he recommends that she first define the genus and then all of its species and then seek their demonstrable attributes. At Stage 3 the inquirer should first seek the demonstrable attributes of the genus and of the primary indivisible species. In T19c, he explains why: these attributes belong to the other, non-primary species in virtue of belonging to the genus or to the primary indivisibles. However, since the non-primary species have their own demonstrable attributes, these too must be sought and then explained. The end result is scientific knowledge of a whole science: the essences of the primary and subordinate subject-kinds, their demonstrable attributes, and their causes.

¹³ See Chapter 3§4.

2. Discovering the Essences of Subject-Kinds

I have argued that T19 presents the outlines of the Socratic Picture of the order of inquiry. At Stage 2, after defining by induction the genus she is investigating, the inquirer should seek the essences of the species. Aristotle devotes most of *APo* 2.13 to explaining how she should seek them.

The chapter begins:

T42 We stated earlier how the what it is (*to ti estin*) is set out into definitions (*tous horous*)¹⁴ and in what way there is and is not demonstration or definition of it. But let's now discuss how we should hunt out the things predicated in the what it is.¹⁵ (96a20–3)

Aristotle recalls two parts of his earlier discussion in *APo* 2: the catalogue of types of definition in 2.10 (see Chapter 9§5) and the account of demonstrating definitions in 2.8 (see Chapter 10). He then announces the chapter's topic: how we 'hunt out', or seek, the essence of a thing. The method he goes on to recommend is division. 'Essence' here is perfectly general. In principle, division could apply to our discovery of both causally simple and causally complex essences. However, there is good reason to think that division is restricted to causally simple essences (i.e., the essences of subject-kinds). In the *Topics*, 'the things predicated in the essence' are the genus and differentia(e).¹⁶ It seems unlikely that we could construe all causally complex essences along this pattern. (What is the genus of eclipse? Loss? Loss of light?) Even if we could, the crucial feature of causally complex essences is the causal relation among its parts (A–C *because of* B), and it is difficult to see how division could reveal this to us. Finally, as T42 reminds us, demonstration is sufficient for discovering causally complex essences, so there is no need for division to play a role in our search for them. I conclude that 2.13 is focused on causally simple essences.¹⁷ The examples of *definienda* in 2.13 confirm this. Aristotle ignores the attributes with causally complex essences prominent in *APo* 2.8–10 (eclipse and thunder) and focuses instead on (indivisible) subject-kinds (the number three and human being).

In T42, Aristotle promises to explain how we 'hunt out' the things predicated in the essence—namely, the genus and differentia(e) of causally simple essences. 'Hunt out' is a term for inquiry.¹⁸ Aristotle's explanation is division. So division is a method

¹⁴ Some commentators take *tous horous* to mean 'the terms' and interpret the opening phrase as stating that 'we stated earlier how the what it is (i.e., the essence) is set out in the terms [of a demonstration]'. (See the translations in Barnes 1993, Detel 1993, and Pellegrin 2005; see also Bolton 1993: 208 and Ross's paraphrase (1949: 653).) However, *horos* in *APo* 2 almost always means 'definition', and it is not unusual for Aristotle to switch freely between *horos* and *horismos*, where both mean 'definition', even in a short space, as he does in this passage (on my reading). (See also *APo* 2.10: 93b29 (*horismos*), 93b38 (*horos*).) For a useful defence of the view that *horous* in T42 means 'definitions', see Charles 2000: 222.

¹⁵ Πῶς μὲν οὖν τὸ τί ἐστὶν εἰς τοὺς ὅρους ἀποδίδεται, καὶ τίνα τρόπον ἀπόδειξις ἢ ὁρισμὸς ἔστιν αὐτοῦ ἢ οὐκ ἔστιν, εἴρηται πρότερον· πῶς δὲ δεῖ θηρεύειν τὰ ἐν τῷ τί ἐστὶ κατηγορούμενα, νῦν λέγωμεν.

¹⁶ See, e.g., *Top* 7.3, 153a15–18, 7.5, 154a27–8.

¹⁷ For a different view, see Charles 2000: 222–39.

¹⁸ See, e.g., *APo* 1.31, 88a3.

of seeking and discovering essences.¹⁹ Other commentators disagree and take division to be a method for exhibiting essences obtained by other means.²⁰ The problem with this view is that it must ignore or explain away Aristotle's question at the start of 2.13—how do we 'hunt out' essences?—and his answer in the rest of the chapter: division.

APo 2.13 explains how an inquirer seeks and discovers the causally simple essences of subject-kinds. The primary subject-kind is the genus of which the subordinate subject-kinds are species. Since essences obtained by division are composed of genus and differentia(e), and since the primary subject-kind is a genus and is not a member of one, the essences of primary subject-kinds cannot be discovered by division. Rather, division presupposes that the relevant genus has been defined in some other way. This other way is induction, which Aristotle discusses near the end of 2.13 (97b7–15, T49 below). In the order of inquiry, division precedes demonstration: first we define the subject-kinds by division, then we seek their demonstrable attributes and their causes. In addition, induction precedes division: first we define the genus, then the species. I shall argue in section 12 that division builds on the results of induction.

3. Genus, Differentia, and Division: An Overview

By division we discover definitions by genus and differentia(e). The objects of these definitions are subordinate subject-kinds (species). *APo* 2.13 focuses on indivisible species: for example, the number three, human being. A genus (e.g., animal) is a natural kind that encompasses several indivisible species. A differentia is a feature that qualifies a genus, belongs to different species within it, and distinguishes them from one another.²¹ It does so by specifying a determinate way of being the genus, a way of being exhibited by all and only those species to which it belongs. For example, footed is a differentia of animal. As such, being footed is a determinate way of being an animal, a way being exhibited by all and only those species of animal to which the attribute of being footed belongs—horse, dog, and so on. Aristotle stipulates that each differentia is a differentia of only one genus, which it entails, in the following sense: if D is a differentia of the genus G, then G belongs to everything to which D belongs (but not vice versa).²² Definitions by genus and differentia(e) include some of the most familiar examples of Aristotelian definitions: for example, 'human being is a rational animal'.

The method of division works in two broad steps. First we distinguish the species we wish to define from other things in general by selecting its genus. Then we distinguish it from other things in the genus by selecting its differentiae.²³ Division is thus a method of defining by differentiating. Humans are different from other

¹⁹ Balme (1987) and Pellegrin (1987: 323–5) both argue that for Plato and Aristotle division is not a method of classification but a method of finding definitions.

²⁰ See Ferejohn 1991: 23–5.

²¹ See, e.g., *Top* 4.6, 128a20–9.

²² See *Top* 6.6, 144b12–30, *APo* 2.13, 96a20–32 (T42–43, below).

²³ *Top* 6.3, 140a27–8.

things in general insofar as they are animals. They are different from other animals insofar as they are such-and-such kind of animal. The goal of defining by division is to mark off the species from all other things by carving out its distinctive niche within the broader kind to which it belongs. The goal of division is also to discover the species' unified essence. Aristotle thinks that each species is unified, that the unity of a species is bestowed on it by its essence, and thus that the essence of each species must be unified.²⁴ The main task of *APo* 2.13, then, is to show how we can discover by division essences that are at once sufficiently differentiating and sufficiently unified.

Aristotle expresses great confidence in the method of division. When he illustrates its proper use near the start of 2.13 (T44, below), he says that what we discover 'must be the essence'.²⁵ He also gives an independent argument that it must be the essence (96b6–14). Aristotle shows no hesitation here: the result of division, properly employed, is not a preliminary account, which fails to state the species' complete essence, or an *explanandum* for which we then seek the *explanans*. Rather, division gets us the essence; indeed, properly employed, it must.

The essence of a species is its formal cause, that which makes the species the very thing that it is. As such, an essence is explanatorily basic. The essence E of a species S explains why S is the very thing that it is, but S's being E is not explained by anything. In defining S, therefore, we are seeking its explanatorily basic feature(s). As Aristotle says in *APo* 2.2, to seek what S is is to seek why it is, what its formal cause is. (See Chapter 7.) Since division is the method of discovering the essences of species, division is the method of discovering their formal causes. Aristotle does not address this issue directly, but he seems to think that division is not sufficient for getting to know the essence *as* the cause—that is, *as* the species' explanatorily basic feature. For division is not informed by explanatory considerations. If this is right, it follows that division is not sufficient for acquiring *nous* of the essence. As I argued in section 1 (and in Chapters 6§4 and 8§§4–5), demonstration is also required: implicit in T19 is the view that we acquire *nous* of S's essence *as* S's cause by using it to explain S's demonstrable attributes.

The view I suggest Aristotle is committed to in *APo* 2.13, therefore, is this. Division gets us non-noetic knowledge of the essence if and only if it is properly employed. If division is not properly employed, the inquirer discovers her mistake(s) in the next stages of inquiry, when she attempts to demonstrate the species' demonstrable attributes from its essence. For if the essence does not adequately explain them, she knows that something went wrong in her previous divisions and that the species must be redefined.²⁶ (And if the essence does adequately explain them, then by seeing how it explains them the inquirer upgrades her knowledge to *nous*.) In the order of inquiry, demonstration comes after division and places an explanatory check on its

²⁴ See *APo* 2.6, 92a27–33, *Met* 7.12, and 8.6. For two recent discussions of these texts, see Code 2010 and Gill 2010.

²⁵ 96a34–5 (in T44 below); see also 96a37–8 (also in T44), 96b6, and 97a19 (in T48).

²⁶ See also my discussion of *DA* 1.1, 402b16–403a2 (T18) in Chapter 8§4.

results. Aristotle's aim in 2.13 is to set out rules for the proper use of division so that the inquirer can proceed with confidence to the next stage of her search.

4. Objections to Division: *APo* 2.5 and 6

Aristotle's account of division in *APo* 2.13 responds to two objections he raises in *APo* 2.5–6. The first objection is that division is not probative. To establish by division that the essence of S is GD_1D_2 is not to prove deductively that the essence of S is GD_1D_2 . Rather, division requires the definer to assume at each step that S is essentially G, essentially D_1 , and so on. If division makes the essence clear, it does so 'in some other way' (2.5, 91b33–4). We can put the objection in the form of a question:

Q1: How does division make clear what S's essence is, if not by deductively proving what it is?

The second objection turns on the unity of essence. As I noted in the previous section, the essence of each species must be unified. However, essences obtained by division do not seem to be unified. If to be human is to be a two-footed animal, why think that to be human is just one thing? It seems rather to be two things: to be two-footed and to be an animal (2.6, 92a27–33). The second objection raises another question:

Q2: In what way is an essence obtained by division unified?

In what follows, I shall explain how Aristotle's account of defining by division in *APo* 2.13 attempts to answer these objections.

5. The D Attribute Rule

After announcing his intention to explain 'how we should hunt out the things predicated in the essence' (96a22–3, in T42), Aristotle introduces a type of attribute that plays a crucial role in his account:

T43 Of the things that belong always to each thing, some extend further, but not outside of the genus. By extending further I mean whatever belongs universally to each thing but also to another thing. For example, there is something that belongs to every triplet but also to what is not a triplet:²⁷ being belongs to triplet but also to what is not a number, but odd belongs both to every triplet and extends beyond it, for it also belongs to quintuplet. But [odd] does not [extend] outside the genus [of number]. For quintuplet is a number, and nothing outside of number is odd.²⁸ (96a24–32)

²⁷ According to Aristotle's conception of numbers, three is triad or triplet (one is monad, two is dyad or pair, etc.). I use 'three' and 'triplet' interchangeably.

²⁸ *Τὼν δὲ ὑπαρχόντων αἰὲν ἐκάστω ἓνια ἐπεκτείνει ἐπὶ πλεόν, οὐ μέντοι ἔξω τοῦ γένους. λέγω δὲ ἐπὶ πλεόν ὑπάρχειν ὅσα ὑπάρχει μὲν ἐκάστω καθόλου, οὐ μὴν ἀλλὰ καὶ ἄλλω. οἷον ἔστι τι ὃ πάσῃ τριάδι ὑπάρχει, ἀλλὰ*

The type of attribute that belongs universally to one thing and extends beyond it but not outside the genus, I shall call a 'D attribute':

D Attribute: *x* is a D attribute of an indivisible species *S* if and only if *x* belongs to all *S* and to all of at least one other indivisible species within the same genus as *S* and to nothing outside the genus.²⁹

For example, odd belongs to all three, and to all of some (but not all) other numbers (five, seven, etc.), and it does not belong to anything that is not a number. So odd is a D attribute of three. D attributes include differentiae, such as odd. But they also include genera: since number belongs to all three and to all of every other number but not to anything that is not a number, number (the genus) is a D attribute of three.³⁰ Aristotle does not say so explicitly, but he seems to define D attributes as attributes of *indivisible* species in particular. (His example in T43 is an indivisible species.) This makes sense given what follows in APO 2.13: D attributes feature prominently in the method of division, the primary aim of which is to obtain definitions of indivisible species.

Aristotle's first rule for discovering essences appeals to D attributes:

T44 (a) We must take things of this sort [namely, D attributes] up to the point at which we have first taken just so many that, while each extends further [than the object], all [of them together] do not extend further; for this must be the essence (*ousian*) of the object.³¹ (b) For example, number belongs to all triplets, and so do odd and prime (in both senses—both as not being measured by number [= prime₁] and as not being compounded from numbers [= prime₂]³²). This, then, is exactly what triplet is: a number that is odd, prime [= prime₁], and prime in this sense [= prime₂]. (c) [Taking] each of these [severally], some also belong to all odds, and the last belongs to the pair, but all belong to nothing [other than the triplet].^{33,34} (96a32–b1)

καὶ μὴ τριάδι, ὥσπερ τὸ ὄν ὑπάρχει τῇ τριάδι, ἀλλὰ καὶ μὴ ἀριθμῷ, ἀλλὰ καὶ τὸ περιττὸν ὑπάρχει τε πάσῃ τριάδι καὶ ἐπὶ πλέον ὑπάρχει (καὶ γὰρ τῇ πεντάδι ὑπάρχει), ἀλλ' οὐκ ἔξω τοῦ γένους· ἡ μὲν γὰρ πεντὰς ἀριθμὸς, οὐδὲν δὲ ἔξω ἀριθμοῦ περιττόν.

²⁹ In Top 6.3 (140a27–32), Aristotle states that a definition should not contain any terms (apart from the genus) that apply to all things in the same genus. Below I note that both genera and differentiae are D attributes. If a D attribute *x* of a species *S* is a differentia, we should, following Top 6.3, add that *x* does not belong to every other species within the same genus as *S*. If *x* is *S*'s genus, it will belong to every species.

³⁰ As I noted above in section 3, each differentia is a differentia of only one genus. Therefore, since a D attribute is either a differentia or a genus, each D attribute will either belong to or be a single genus. Aristotle says as much in T43 when he stipulates that no D attribute extends outside the genus.

³¹ The translation of T44a is Barnes's, altered slightly.

³² A number is prime₁ if and only if it is not the product of two whole numbers. A number is prime₂ if and only if it is not the sum of two whole numbers. (For Aristotle, one (unit) is not a number.)

³³ I am grateful to Rusty Jones for help with T44c. (It is Jones's translation that I adopt. See also McKirahan 1992: 114.) The attributes that Aristotle says belong to all odds are number and odd. The last attribute, which also belongs to the pair, is prime₂. This marks a crucial change from Barnes's translation, according to which all four attributes (number, odd, prime₁, and prime₂) belong to all odds, which is clearly false.

³⁴ τὰ δὲ τοιαῦτα ληπτέον μέχρι τούτου, ὥς τοσαῦτα ληφθῇ πρῶτον ὃν ἕκαστον μὲν ἐπὶ πλέον ὑπάρξει, ἅπαντα δὲ μὴ ἐπὶ πλέον· ταύτην γὰρ ἀνάγκη οὐσίαν εἶναι τοῦ πράγματος. οἷον τριάδι ὑπάρχει πάσῃ ἀριθμῷ,

The rule, set down in T44a and illustrated in b–c, states that in seeking the essence of an indivisible species S, we must select D attributes until the ‘first’ (96a33) point at which the conjunction of the D attributes we have selected is co-extensive with S. Since each D attribute must extend beyond S (i.e., belong to at least one other indivisible species within the same genus as S), we are looking for the first set of D attributes that are conjunctively co-extensive with S but severally extend beyond it. For example, applying the rule yields the following as the essence of three: prime_2 prime_1 odd number.³⁵ The rule is as follows:

D Attribute Rule: The conjunction of the members of set E $\{D_1, \dots, D_n\}$ is the essence of an indivisible species S if and only if (i) each member of E is a D attribute of S, (ii) the conjunction of the members of E is co-extensive with S, and (iii) E is the first set of D attributes, the conjunction of which is co-extensive with S, that the definer obtains.³⁶

Aristotle expresses great confidence in his D Attribute Rule. There can be no doubt that in his view applying it yields the essence, for (as I noted above in section 3) he says so twice in T44 and several times in the lines that follow.³⁷ The rule’s stipulation that we define using only shared features (D attributes) tells us something important about how he sees the task of defining. In every essence that conforms to the rule, the genus and differentiae are D attributes. Therefore, every combination of a genus and a single differentia belongs to at least two indivisible species. For every differentia, in virtue of being a D attribute, belongs to at least two indivisible species. Therefore, no combination of a genus and a single differentia is the essence of any indivisible species. Rather, the essence of every indivisible species is made up of at least three attributes: the genus and at least two differentiae.³⁸

τὸ περιπτόν, τὸ πρῶτον ἀμφοτέρως, καὶ ὡς μὴ μετρεῖσθαι ἀριθμῶ καὶ ὡς μὴ συγκείσθαι ἐξ ἀριθμῶν. τοῦτο τοῖνυν ἤδη ἐστὶν ἡ τριάς, ἀριθμὸς περιπτὸς πρῶτος καὶ ὡδὶ πρῶτος. τούτων γὰρ ἕκαστον, τὰ μὲν καὶ τοῖς περιπτοῖς πᾶσιν ὑπάρχει, τὸ δὲ τελευταῖον καὶ τῇ δυάδι, πάντα δὲ οὐδενί.

³⁵ The number three is also an example of a *definiendum* in T19a (96b17), discussed above in section 1.

³⁶ One might object that conditions (i)–(iii) are sufficient for the conjunction of the members of E to be the essence of S but not necessary. (I am grateful to an anonymous reviewer for the press for raising this objection.) However, ‘we must take’ (*lēpteon*) in T44a (96a32) suggests that the conditions are necessary; Aristotle gives no indication that they are merely optional. In addition, in *Top* 6.6 (144b6), Aristotle says that ‘the differentia is said of more than the species’ (*ἐπὶ πλεόν ἢ διαφορὰ τῶν εἰδῶν λέγεται*). (Here ‘species’ seems to mean ‘indivisible species’.) As I noted in section 3, no differentia extends beyond its genus (see *Top* 6.6, 144b12–30 and *APO* 2.13, 96a20–32, T42–43). Therefore, Aristotle’s view is that every differentia belongs to more than one indivisible species of a genus and to nothing outside the genus. That is, every differentia is a D attribute. The same is true of the genus: it belongs to more than one indivisible species and to nothing outside of itself. Since the essence of a species contains only the genus and differentiae, the essence of a species contains only D attributes. (See also n38 below.) So from *Top* 6.6 we can derive requirement (i) of the D Attribute Rule. Requirement (ii) is perfectly natural. I discuss requirement (iii) in section 7.

³⁷ See again T44a (96a34–5): ‘this must be the essence of the object’; T44b (96a37–8): ‘this is exactly what triplet is’; 96b6: ‘that it is the essence is clear from the following’ (*ὅτι δ’ οὐσία, ἐκ τῶνδε δῆλον*); 97a19 (in T48): ‘one will have the account of the essence’ (*ἐξεῖ τον λόγον τῆς οὐσίας*).

³⁸ In *Top* 4.2 (122b39–123a1), Aristotle says that ‘the differentia is always said of equal to or of more than the species’ (*ἀεὶ δ’ ἢ διαφορὰ ἐπ’ ἴσης ἢ ἐπὶ πλείον τοῦ εἶδους λέγεται*). The second of the two disjuncts

This has some significant consequences for Aristotle's theory of definition. For example, rational animal cannot be the essence of human being. If humans are the only rational animals, then rational is not a D attribute of human being and so it cannot be part of the essence. And if humans are not the only rational animals, then this does not uniquely define the species.³⁹ One of the most familiar Aristotelian definitions is ruled out by his theory. Indeed, a whole familiar approach to definition is ruled out. For according to the D Attribute Rule, *no* attribute of an indivisible species unique to it can be part of its essence. To define human being (or any other indivisible species) is not to find the one feature that makes human beings different from all other animals. It is rather to find the one set of features each of which makes human beings the same as other animals but collectively make them different. In defining by division, we aim not at a single unique feature but at a unique combination of shared features.

Aristotle's D Attribute Rule also has an important consequence for our knowledge of definitions of indivisible species. Suppose GD_1D_2 is the essence of an indivisible species *S*. Knowing the essence of *S*, it seems, requires knowing that it conforms to the D Attribute Rule. Therefore, knowing the essence requires knowing of *G*, D_1 , and D_2 that each is an essential attribute of at least one other indivisible species in the same genus as *S*.⁴⁰ Therefore, knowing the essence of one indivisible species requires knowing essential attributes of several other indivisible species. Below, in section 10, we shall see that in *APO* 2.13 (97a6–11, T47) Aristotle considers a puzzle that arises from this line of thought: to know the essence of any one thing requires knowing the essence of every other thing. Aristotle rejects this view (97a11–22, T48), and certainly nothing in the D Attribute Rule commits him to it. However, the Rule commits him to a view an extreme version of which the puzzle articulates: the view that knowing the essence of any one thing requires knowing the essences of *some* other things. In this way, the Rule is of a piece with Aristotle's holistic conception of scientific inquiry. (See Chapter 8§§3–4.) We cannot know the essence of any one indivisible species in complete isolation. Similarly, we should not seek the essence of any one indivisible

is consistent with the D Attribute Rule. The first is too, so long as 'species' does not mean 'indivisible species'. For example, if footed animal is a species of animal, then the differentia *footed* is co-extensive with ('said of equal to') the species. But since footed animal is not an indivisible species, the D Attribute Rule is not violated. (The example comes from Alexander's commentary, in *Top* 317.10–13. Alexander immediately goes on to give two-footed as an example of a differentia that extends beyond the species, in this case an indivisible species: human being (317.13–14).) In addition, as I noted above in n36, in *Top* 6.6 (144b6), Aristotle says that 'the differentia is said of more than the species'. (Thanks to Marko Malink for these references.)

³⁹ It will not help to suppose that humans are the only rational animals and that some non-animals are rational. For then rational will not be a D attribute, given that each D attribute belongs to only one genus. And if rational is not a D attribute then it cannot be part of the human essence, according to Aristotle's rule.

⁴⁰ Aristotle's definition of a D attribute requires that each D attribute belong to at least two indivisible species of a genus, not that it belong essentially. However, since, as I argued above, every D attribute is either a genus or a differentia, and since every genus and differentia belongs essentially to every indivisible species to which it belongs, we can conclude that every D attribute belongs essentially to at least two indivisible species of a genus.

species in complete isolation. Rather, we should seek the essences of all the indivisible species of a genus together in a single stage of inquiry (Stage 2).

Why does Aristotle insist on excluding from the essence of any indivisible species any attribute that belongs uniquely to that species? That is, why does he insist on the first component of the D Attribute Rule? One possibility is the one I just discussed: it is of a piece with his holistic commitments. Another possibility is that it ensures a uniform approach to definition. Many, perhaps most, indivisible species cannot be defined by the conjunction of the genus and a single, unique differentia. Therefore, all species should be defined using non-unique (shared) differentiae. In addition, three assumptions about essence and definition seem to underlie the rule, and these may help explain why he adopts it: (a) to define an indivisible species is to differentiate it; (b) differentiation involves comparison; (c) a causally simple essence should not contain any superfluous element.

Consider the first two assumptions. As we saw above, the D Attribute Rule entails that the essence of each indivisible species contains at least three elements: the genus and at least two differentiae. Hence essences with only one differentia are ruled out. The problem with such essences, it seems, is that they do not succeed differentiating the species in a sufficiently illuminating way. To say that human beings are rational animals does not tell us anything about how humans compare to other animals, except that all other animals are non-rational. However, to say that human beings are, for example, two-footed tame animals (assuming two-footed and tame are D attributes) tells us that humans are like some animals in being two-footed and like other animals in being tame but are unique in possessing both features.

Now consider the third assumption, that a causally simple essence should not contain any superfluous element.⁴¹ It follows from this that the essence of human being cannot contain both a set of sufficiently differentiating D attributes (such as two-footed tame animal) and a unique differentia (such as rational). Suppose one proposed that the human essence is rational two-footed tame animal. Either rational or two-footed-tame is superfluous. Since each one of these belongs uniquely to the species (let's suppose), only one of them is required to mark it off. Since rational is not a D attribute, it cannot be part of the essence. Even if rational were a D attribute of human being, it could not be part of the essence, if two-footed tame animal is the first set of D attributes, the conjunction of which is co-extensive with human being, that the definer obtains. A question I consider below is what makes this set *first*.

The advantage of the D Attribute Rule is that it guarantees that the (causally simple) essences of subject-kinds are differentiating. It also ensures a uniform approach to defining indivisible species. The disadvantage is that it seems vulnerable to the unity objection Aristotle raises in *APo* 2.6. If the essence of human being is two-footed tame animal, why think that being human is just one thing and not several—being two-footed,

⁴¹ See *Top* 6.3, 140a33–b15.

being tame, and being an animal? That is, we will need to see Aristotle's answer to Q2: in what way is an essence obtained by division unified? I return to this in section 11.

6. Division Introduced

In T43–44, Aristotle says what an essence is. A little later in *APo* 2.13 he explains how to discover essences by the method of division. In doing so he explains in more detail the structure of an essence and the role of differentiae in it. His account begins:

T45 Divisions made according to differences are useful in this pursuit.⁴² I have said earlier in what way they are proofs. Only in the following way will they be useful for working out the what it is. Although they might seem not to be [useful at all] but to assume everything straight off, as if someone were to assume [everything in the what it is] from the beginning without a division. But it makes a difference which of the predicates are predicated first and which later—for example, [it makes a difference whether] one says *animal tame two-footed* or *two-footed animal tame*. For if every [what it is] is [composed] out of two things, and [if] *animal tame* is some one thing, and [if] human being (or whatever the one thing in question is) is next [composed] out of this and the difference, then one must make divisions in order to postulate [correctly the what it is].⁴³ (96b25–35; Barnes's translation, altered)

Aristotle addresses the first objection to division he raises in *APo* 2.5. When we make our divisions we assume that the attributes we select belong in the essence we are seeking without deductively proving that they belong. For example, in defining human being we divide the genus *animal* into tame and wild and assume that humans are (essentially) tame. Indeed, we might even think that division requires assuming all of the attributes in the essence in advance of making any divisions. But then why make any divisions at all? We seem already to have the essence. So the method seems to presuppose that we already have the very thing we are meant to seek by its means.

Aristotle's response has several parts. I argue below (in section 10) that division does not presuppose that all the essential attributes are selected in advance. Rather, we can make discoveries about which attributes are essential at the same time as we make discoveries about which divisions come next in the sequence. In addition, he argues (in T46, next section) that division is useful (even necessary) because it ensures that no essential attributes are omitted from the essence.

⁴² That is, 'hunting out the things predicated in the what it is' (96a22–3, in T42).

⁴³ αἱ δὲ διαιρέσεις αἱ κατὰ τὰς διαφορὰς χρήσιμοι εἰσιν εἰς τὸ οὕτω μετιέναι ὡς μέντοι δεικνύουσιν, εἴρηται ἐν τοῖς πρότερον. χρήσιμοι δ' ἂν εἴεν ὥδε μόνον πρὸς τὸ συλλογίζεσθαι τὸ τί ἐστίν. καίτοι δόξειέν γ' ἂν οὐδέν, ἀλλ' εὐθὺς λαμβάνειν ἅπαντα, ὥσπερ ἂν εἰ ἐξ ἀρχῆς ἐλάβανέ τις ἄνευ τῆς διαιρέσεως. διαφέρει δέ τι τὸ πρῶτον καὶ ὕστερον τῶν κατηγορουμένων κατηγορεῖσθαι, οἷον εἰπεῖν ζῶον ἡμερον δίπουν ἢ δίπουν ζῶον ἡμερον. εἰ γὰρ ἅπαν ἐκ δύο ἐστί, καὶ ἐν τι τὸ ζῶον ἡμερον, καὶ πάλιν ἐκ τούτου καὶ τῆς διαφορᾶς ὁ ἄνθρωπος ἢ ὅ τι δήποτ' ἐστὶ τὸ ἐν γινόμενον, ἀναγκαῖον διελόμενον αἰτεῖσθαι.

Another part of his response is in T45. In an essence, order matters. You can assume all of the attributes in an essence without knowing their correct order. And if you do not know their correct order, then you do not know the essence.⁴⁴ Division makes clear their correct order (although Aristotle has yet to explain how). Therefore, division is useful for getting to know the essence.⁴⁵ More specifically, in the last sentence of T45, Aristotle defends division in the following way. He notes that every essence is made up of two parts. Assuming the essence of human being is two-footed tame animal, the two parts are (1) the final differentia (two-footed) and (2) the genus together with all intermediate differentiae (animal-tame).⁴⁶ To define a species is to give the two parts of the essence in the correct order. It also seems reasonable to assume that it requires getting the genus and the intermediate differentia(e) in the correct order. Only division reliably reveals the correct order. Therefore, division is useful (in fact, necessary) for defining.

Aristotle's argument privileges the final differentia in an essence of the sort required by the D Attribute Rule. It is set apart from all other differentiae as one of the essence's two main parts. The idea seems to be that it above all succeeds in marking off the species, in that it distinguishes it from all other things to which the genus-plus-all-intermediate-differentiae belongs. In T45, Aristotle calls it '*the differentia*' (96b33–4). Take his example, the human essence: two-footed tame animal. To say that a human being is a tame animal is to say what kind of thing it is. To say that it is a two-footed tame animal is to say what specific kind of thing it is—it's not any old tame animal, it's the two-footed sort. According to this definition, being tame is a determinate way of being an animal (and not vice versa). Furthermore, let's suppose (but see the next section) that two-footed is a determinate way of being a tame animal (and not vice versa)—it is the determinate way in which humans are tame animals. This is why Aristotle says that we must put the two main parts of the essence in the correct order. For otherwise we will fail to identify what the essence is, for we will fail to identify, amongst a species' essential attributes, what is a determinate way of being what. Aristotle privileges the final differentia in an essence because it identifies the determinate way of being the genus-plus-all-intermediate-differentiae characteristic of the species defined. However, to conform to the D Attribute Rule, the final differentia cannot be unique to the species defined. Rather, only the essence taken as a whole is unique to the species defined. Humans are not the only two-footed animals or the only tame animals; they are the only two-footed tame animals (let's suppose).

⁴⁴ Barnes (1993: 244) gives a nice example: a yam is an American sweet potato, not a sweet American potato.

⁴⁵ See Falcon 1997: 129.

⁴⁶ I do not think Aristotle presents 'two-footed tame animal' as a serious candidate for the human essence. Rather, it looks like a toy example.

7. Exhaustive Division

In the passage that immediately follows T45, Aristotle's defence of division continues:

T46 Next, only in this way [namely, by making divisions] is it possible to omit nothing from the what it is. For whenever the first kind has been taken, if one then takes one of the lower divisions, not everything will fall into it. For example, not every animal is either whole-winged or split-winged; rather, every winged animal is (for it is this of which this is a difference). A first difference of animal is that into which every animal falls. And similarly for everything else, both the kinds outside it and the [kinds] under it. For example, [the first difference] of bird is that into which every bird [falls], and [the first difference] of fish is that into which every fish [falls]. If one proceeds in this way one can know that nothing has been omitted: otherwise it is inevitable that one will omit something without knowing it.⁴⁷ (96b35–97a6; Barnes's translation, altered slightly)

Aristotle's main claim is that if we divide properly, we will omit no essential attributes from the essence. We divide properly when we employ what I shall call 'exhaustive division'—that is, when everything in the kind that is divided falls into the sub-kinds marked out by the differentiae that divide it. More precisely:

Exhaustive Division: D_1/D_2 is an exhaustive division of x if and only if all x s are either D_1 or D_2 (and some x s are D_1 and some are D_2 and none are both).

In T46, Aristotle worries about omitting attributes from the essence. He does so for two reasons. First, he worries that any putative essence with missing attributes will not be co-extensive with the relevant species. Second, he worries about the structure and arrangement of the essence. Consider an example similar to the one in T46. We are defining human being. We start with the genus *animal*, which we divide by the differentia pair *tame/wild*. Human beings are tame animals, so we divide tame animal by the differentia pair *two-/four-footed*. Now suppose two-footed tame animal is co-extensive with human being. Since this is the first unique set of D attributes we obtain, it should be the human essence, according to the D Attribute Rule. However, Aristotle would point out that we made a mistake in our second division: two-/four-footed is a proper division of footed animal, not of tame animal. (It's not true that all tame animals are either two- or four-footed; some are not footed at all (let's suppose).) So our definition should read: human being is a two-footed footed

⁴⁷ Ἔτι πρὸς τὸ μηδὲν παραλείπειν ἐν τῷ τί ἐστίν οὕτω μόνως ἐνδέχεται. ὅταν γὰρ τὸ πρῶτον ληφθῇ γένος, ἂν μὲν τῶν κάτωθεν τινα διαιρέσεων λαμβάνῃ, οὐκ ἐμπεσείται ἅπαν εἰς τοῦτο, οἷον οὐ πᾶν ζῷον ἢ ὀλόπτερον ἢ σχιζόπτερον, ἀλλὰ πτηνὸν ζῷον ἅπαν· τούτου γὰρ διαφορά αὕτη. πρώτη δὲ διαφορά ἐστὶ ζῷου εἰς ἣν ἅπαν ζῷον ἐμπίπτει. ὁμοίως δὲ καὶ τῶν ἄλλων ἐκάστου, καὶ τῶν ἐξω γενῶν καὶ τῶν ὑπ' αὐτό, οἷον ὄρνιθος, εἰς ἣν ἅπας ὄρνις, καὶ ἰχθύος, εἰς ἣν ἅπας ἰχθύς. οὕτω μὲν οὖν βαδίζοντι ἔστιν εἰδέναι ὅτι οὐδὲν παραλείπεται· ἄλλως δὲ καὶ παραλείπειν ἀναγκαῖον καὶ μὴ εἰδέναι.

tame animal. However, by adding footed to the essence we have not narrowed its extension. The first essence was already co-extensive with human being; indeed, it already contained the attribute *footed* (*two-footed*)!

Aristotle's account in T46 explains what he means in T44 when he stipulates in the D Attribute Rule that we must stop at the 'first' unique set of D attributes we obtain (96a33, in T44a). He does not mean that our goal is to find the minimum number of D attributes needed for a unique set. If that were our goal he should not worry, as he does in T46, about omitting attributes such as *footed*. Nor does he mean that the essence is whichever set of D attributes happens to be the first unique set, among several possible ones, that we obtain. For in that case what a species' essence is would depend on our divisional practices. Worse still, a species could have more than one essence. Aristotle rejects both of these claims: our methods of defining latch onto reality, they don't make it up; and in the reality they latch onto, each species has exactly one essence.⁴⁸ Rather, Aristotle's view is that a species' essence is the first unique set of D attributes we obtain *when we select them in the correct order*. And we select in the correct order when we apply the method of division—that is, when we make exhaustive divisions at each step.

If my interpretation is right, it helps solve a problem with one of Aristotle's examples in *APo* 2.13. I noted in section 5 that an essence should not contain any superfluous element. Barnes points out that in the essence of three proposed in T44 (prime₂ prime₁ odd-number), prime₂ odd number is co-extensive with three. (Three is the only odd number that is not the sum of two whole numbers (prime₂), assuming, as Aristotle does, that one is not a number.) This suggests that prime₁ is superfluous.⁴⁹ However, if in the correct sequence of divisions prime₂/non-prime₂ is the proper division of prime₁ odd-number, then prime₁ is not superfluous. For in that case prime₂ odd number is like two-footed tame animal: it is co-extensive with the relevant species, but it misrepresents the structure of reality. Aristotle's non-superfluity assumption does not require that an essence contain no attribute beyond the minimum number required for a unique set of D attributes. Rather, it requires that an essence contain no attribute beyond the minimum required for a unique set of D attributes that have been selected and presented in the correct order.

8. Correctly Dividing a Genus

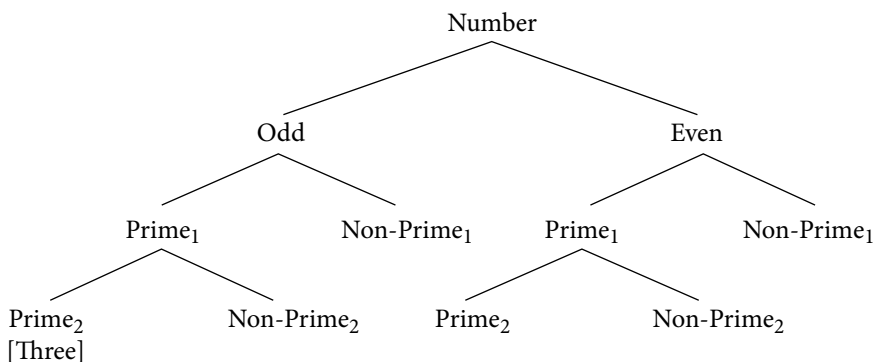
According to T45–46, in order to discover the essence of an indivisible species S, we should select D attributes of S in the correct order, and we do this by making exhaustive divisions at each step. Since S can have only one essence, there can be only one correct order of selecting S's D attributes. And if there is only one correct

⁴⁸ See *Top* 6.3, 140a33–b15.

⁴⁹ Barnes 1993: 241.

order, there can be only one correct exhaustive division at each step. Take any genus G. There is only one correct way of dividing G exhaustively by means of differentiae: by D_1 and D_2 . Take the combination of G and D_1 . There is only one correct way of dividing it exhaustively: by D_3 and D_4 . And so on. It follows that, for Aristotle, each genus admits of only one correct set of divisions. This is a significant claim.⁵⁰ Aristotle's idea is not only that there is a non-arbitrary method for selecting D attributes for the essence (namely, exhaustive division). His account also implies that there is only one correct order of selecting them, and thus only one correct division tree for each genus.⁵¹

To illustrate Aristotle's account let's take a simple case: the definition of three presented in T44:

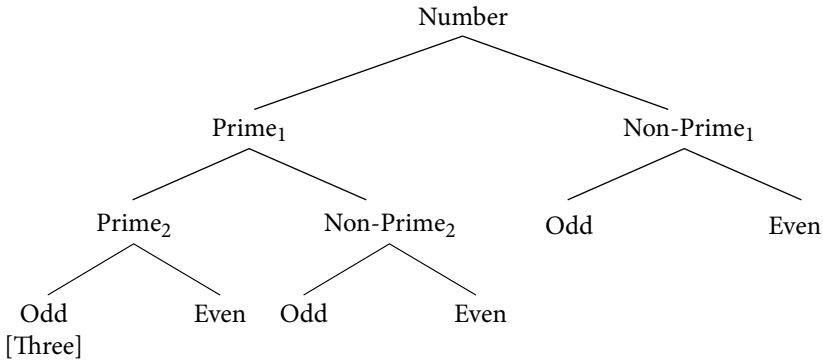


There are several things to notice here. First, each division is exhaustive: all numbers are odd or even; all odd numbers are prime₁ or non-prime₁; all prime₁ odd numbers are prime₂ or non-prime₂; and so on. Second, the method of exhaustive division permits us to employ the same pair of differentiae in more than one part of the tree. For example, prime₁/non-prime₁ is an exhaustive division of both odd number and even number. In addition, consider prime₂ as a differentia of prime₁-odd-number. Prime₂ must appear elsewhere in the division tree, for otherwise it will belong to three alone and thus will not be a D attribute. Finally, and more worryingly, although each division is exhaustive, it is not obvious that this tree represents the only order in which we might apply the same set of divisions and reach the essence of three.

⁵⁰ The image of the butcher carving nature at its joints in the *Phaedrus* (265e) suggests that Plato is also committed to it. See Brown 2010: 157.

⁵¹ In PA 1, Aristotle criticizes the method of dichotomous division to which he is committed in APO 2.13. In doing so, he seems to remain committed to the claim that each genus admits of only one correct set of divisions. For further discussion, see Balme 1987.

Consider an alternative tree:



Just as with the previous tree, each division is exhaustive. In addition, the essence of three contains the same attributes, although they are now arranged differently: odd prime₂ prime₁ number rather than prime₂ prime₁ odd number. Aristotle thinks that the attributes in an essence should be ordered correctly and that they admit of only one correct order, which we discover via the method of exhaustive division. What, then, is the problem with this second division tree and this differently ordered essence? What reason do we have to prefer the first? Since the first division of the genus sets the stage for the remaining ones, we can tackle this question by trying to determine why odd/even is a better first division of number than prime₁/non-prime₁ is.

One possibility is that the problem with the second division tree is that it splits up numbers that are naturally grouped together—namely, odd and even numbers. Since our divisions should reflect these natural groupings, odd/even is a better first division of number than prime₁/non-prime₁ is. However, this answer begs the question: it assumes that odd/even is a more natural way of grouping all numbers than prime₁/non-prime₁ is, which is just to assume that odd/even is a better first division of number than prime₁/non-prime₁ is.

A different and more promising possibility is that the question of why the first division tree is to be preferred over the second is a question that can only be answered from within arithmetic, just as the question of why, for example, tame/wild is a better first division of animal than footed/non-footed can only be answered from within zoology. There are no abstract, meta-scientific principles, or norms of inquiry,⁵² the definer can invoke to inform her divisions beyond the requirement of making them exhaustive (and ensuring each differentia in the division represents a genuine way of being the kind (genus or divisible species) it divides). It does not follow, however, that there are no norms of inquiry specific to her science for her to invoke. If there are such norms, the definer should appeal to them in making her divisions.

⁵² On 'norms of inquiry', see Lennox 2011.

If this interpretation is right, it explains why Aristotle does not mention any other requirements for division in *APO* 2.13: his aim is to set out the method in as abstract and widely-applicable a manner as possible. For this reason he is justified in assuming in 2.13 that each genus admits of only one correct first division. Which first division is the correct one is a question for a different account. But that there is one is a crucial part of the abstract theory. For if there is more than one correct first division of a genus, then there is more than one correct order for selecting attributes in a given essence. But different correct orders of selection yield different essences. Since each species has only one essence, each genus admits of only one correct first division—indeed, only one set of divisions as a whole.

9. Preliminary Conclusions

The goal of division is to discover the essence of an indivisible species *S*. *S*'s essence is the first, correctly ordered set of *D* attributes, the conjunction of which is co-extensive with *S*, that the definer obtains. The *D* attributes in an essence are ordered correctly if they are selected in the correct order. They are selected in the correct order if and only if they are selected from correct exhaustive divisions. Which exhaustive divisions of a genus are correct is determined by local norms of inquiry and discovered by empirical means. In short, the method of exhaustive division is necessary for the definer to discover (non-accidentally) what the single, correctly ordered essence of any indivisible species is.⁵³

Aristotle's account in T43–46 contains a partial defence of division against the objections he raises in *APO* 2.5–6. He accepts the criticism that division does not deductively prove which attributes are part of the essence. In T45–46, he argues that it makes the essence clear 'in some other way' (*APO* 2.5, 91b33–4). That is, he answers (in part) the first question I identified in section 4:

Q1: How does division make clear what *S*'s essence is, if not by deductively proving what it is?

The first part of Aristotle's answer is that division reveals what the essence is by revealing the proper order of the genus and differentiae (T45). The second part of his answer is that division, properly employed, ensures that no essential attributes are omitted (T46). We shall see the third part of his answer below in section 11: division is useful for discovering the differentiae in the first place.

⁵³ I say 'non-accidentally' because it seems possible to discover it by, say, induction or even a lucky guess, in which case the fact that we have all and only the right attributes in the right order is an accident. This is especially important with regard to induction. Aristotle would not deny that we can discover by induction without division that two-footed footed tame animal is the human essence. What he would deny is that our inductive procedures alone, unaided by division, could ever give us any reason to believe that this is the single, correctly ordered essence of human being. The fact that induction hits on all and only the right attributes in the right order is an accident.

10. Inquiry, Division, and Meno's Paradox

Aristotle's account of defining by division gives him the resources to solve an instance of Meno's Paradox, the one that comes closest to Meno's puzzle (see Chapter 1§1):

- (1) Either one knows what S is or one does not.
- (2) If one knows what S is, one cannot search for what S is.
- (3) If one does not know what S is, one cannot search for what S is.
- (4) Therefore, one cannot search for what S is.

The method of division presupposes that the definer has prior knowledge that the indivisible species S she wishes to define belongs to genus G. She knows that G is S's genus if she grasps a preliminary account of the form 'S is a G of a certain sort', for example, human being is an animal of a certain sort, where 'a certain sort' is a placeholder for one or more attributes (candidate differentiae) that allow(s) the inquirer to distinguish Ss from other Gs. And if she grasps this preliminary account, she can seek what S is, by employing the method of division Aristotle prescribes.

To return now to the text of *APo* 2.13, in the passage that immediately follows T46, Aristotle raises a puzzle about our knowledge of definitions. This puzzle, I shall argue, generates two further puzzles, the second of which is reminiscent of Meno's Paradox.

- T47 (a) It is not necessary for the one defining and making divisions to know everything that is. (b) Although some say that it is impossible to know the differences that apply to each thing without knowing each thing, and [that it is impossible] to know each thing without [knowing] the differences; (c) for a thing is the same as that from which it does not differ and different from that from which it does differ.⁵⁴ (97a6–11)

The puzzle arises from Aristotle's conception of defining as differentiating. Hence it is closely connected to the method of division. Indeed, Aristotle begins by mentioning definition and division. As we have seen, the essence of an indivisible species S must conform to the D Attribute Rule: it must be a unique and correctly ordered combination of shared features. The reason, I suggested in section 5, is that to define S is to differentiate it, which requires comparing it, which requires both sameness and difference. Sameness enters an essence by way of the D attributes, each of which belongs to at least one other indivisible species in the same genus. Difference also enters by way of the D attributes, the conjunction of which belongs uniquely to the defined species. To define S as GD_1D_2 is to say that Ss are the same as some things

⁵⁴ οὐδὲν δὲ δεῖ τὸν ὀρίζομενον καὶ διαιρούμενον ἅπαντα εἰδέναι τὰ ὄντα. καίτοι ἀδύνατόν φασι τινες εἶναι τὰς διαφορὰς εἰδέναι τὰς πρὸς ἕκαστον μὴ εἰδότα ἕκαστον· ἄνευ δὲ τῶν διαφορῶν οὐκ εἶναι ἕκαστον εἰδέναι· οὐ γὰρ μὴ διαφέρει, ταῦτόν εἶναι τούτῳ, οὐ δὲ διαφέρει, ἕτερον τούτου.

and different from others in being *G*, the same as some *G*s and different from others in being *D*₁, the same as some *G*s and different from others in being *D*₂, and unique among all things in being *G*, *D*₁, and *D*₂.

The puzzle Aristotle presents in T47 concerns what the definer needs to know about the other things an indivisible species *S* is the same as and different from in order to know *S*'s definition and essence. The conclusion of the puzzle is stated in T47a: the one defining must know everything that is. T47b states two assumptions that lead to the conclusion: first, that 'it is impossible to know the differences that apply to each thing without knowing each thing', and second, that '[it is impossible] to know each thing without [knowing] the differences'. Given the reference to defining in T47a, and given that elsewhere in *APo* 2.13 'the differences' (*differentiae*) are the essential attributes that, together with the genus, make up the essence of an indivisible species, it is reasonable to think that by 'knowing each thing' in T47b Aristotle means knowing the definition of each thing—what each thing is, its essence. For these same reasons, it is also plausible to think that by 'knowing everything that is' in T47a Aristotle means knowing the definition of everything—what each and every thing is.

Reversing the order of the two assumptions in T47b, we have the following puzzle:⁵⁵

Puzzle 1

- (1.1) For every *x*, if one knows what *x* is, then one knows how *x* differs from everything from which it differs.
- (1.2) If one knows how *x* differs from everything from which it differs, then one knows what everything from which *x* differs is.
- (1.3) Therefore, if one knows what *x* is, then one knows what everything from which *x* differs is.
- (1.4) Therefore, if one knows what *x* is, then one knows what everything is.

For example, suppose the essence of human being is two-footed tame animal. Since human beings are animals, they differ (in this respect) from all non-animals (e.g., numbers). Since they are tame animals, they differ (in this respect) from all non-tame animals (e.g., lions). Since they are two-footed animals, they differ (in this respect) from all non-two-footed animals (e.g., dogs). However, to know how humans differ from numbers, lions, and dogs requires knowing what numbers, lions, and dogs are. And knowing what each of these is requires knowing how each differs from everything from which it differs. And so on. The puzzle, then, is that knowing the essence of any one thing requires knowing the essence of each and every other thing. Since it seems impossible for any one person to know the essence of everything, it seems impossible to know the essence of anything.

⁵⁵ For reconstructions of the argument similar to my own, see Barnes 1993: 246 and Falcon 2000.

The argument in T47 is traditionally attributed to Speusippus, on the authority of Eudemos.⁵⁶ It is not clear what Speusippus's aim in presenting the argument was. He might have wanted to show that definition is impossible.⁵⁷ Or he might have wanted to show that definition requires 'a heroic pursuit of omniscience'.⁵⁸ For our purposes a more pressing question is what Aristotle's aim in presenting Speusippus's argument was. I want to argue that Aristotle's aim was to show that on a certain mistaken view of the prior knowledge required for seeking a definition, definitional inquiry is impossible.

The first sentence of the passage, T47a, provides a clue as to Aristotle's aim: 'It is not necessary for the one defining and making divisions to know everything that is' (97a6–7). Aristotle's claim can be interpreted in at least three different ways:

- a) It is not necessary for the one who knows the definition S to know what everything is.
- b) It is not necessary for the one defining S to get to know, in defining S, what everything is.
- c) It is not necessary for the one defining S to have prior knowledge of what everything is.

a) is a claim about one of the conditions for possessing knowledge of a definition. The negation of a) is the conclusion of Puzzle 1, above. This might suggest that a) is the right reading of T47a. However, the problem with a) is that it does not mention the activity of defining S, whereas T47a does: it mentions 'the one defining and making divisions (*ton horizomenon kai diairoumenon*, present active participles)'—that is, the one engaged in the activity of seeking a definition by division. Both b) and c) mention the activity of defining. b) is about the nature of definitional inquiry. It claims that inquiry is not radically holistic: it is not the case that in seeking (or discovering) any one definition we must seek (or discover) every definition.⁵⁹ c) is about the prior knowledge required for definitional inquiry. It claims that defining S does not presuppose omniscience: it is not the case that to seek the definition of S we must already know the definition of everything.

Given Aristotle's interest in definitional inquiry in APO 2.13, and given his response to the puzzle in T48 (below), the most plausible reading of T47a is c). So, while the puzzle Aristotle presents in T47b concerns the conditions for *knowing* a definition, Aristotle's aim in presenting it is to draw our attention to the prior knowledge required for *seeking* a definition. In fact, with c) in place we can construct an argument that closely parallels Puzzle 1 but targets definitional inquiry more directly. The second puzzle starts from the conclusion of the first. If knowing any one

⁵⁶ For the evidence, see Falcon 2000 and Ross 1949: 659–60. For an interesting attempt to reconstruct Speusippus's account of definition and division, see Wilson 1997.

⁵⁷ See Falcon 2000: 403.

⁵⁸ Barnes 1993: 245; see also Falcon 2000: 403.

⁵⁹ In section 5 above, I remarked that Aristotle recommends that we seek the definitions of all the species of a genus at a single stage of inquiry (Stage 2). This is much less radically holistic than the claim that b) denies.

definition requires knowing every definition, then it seems to follow that seeking any one definition requires prior knowledge of every definition. The reason why *knowing* the definition of x requires knowing the definition of everything is that knowing the definition of x requires knowing how x differs from everything from which it differs. The same reasoning seems to hold for *inquiry*: seeking the definition of x requires already knowing the definition of everything. For seeking the definition of x involves seeking how x differs from everything from which it differs, and seeking how x differs from everything from which it differs seems to require prior knowledge of what everything from which x differs is.

Puzzle 2

- (2.1) For every x , if one seeks what x is, then one seeks how x differs from everything from which it differs.
- (2.2) If one seeks how x differs from everything from which it differs, then one has prior knowledge of what everything from which x differs is.
- (2.3) Therefore, if one seeks what x is, then one has prior knowledge of what everything from which x differs is.
- (2.4) Therefore, if one seeks what x is, then one has prior knowledge of what everything is.

Take the species *human being*. Seeking what human being is requires seeking how human beings differ from everything from which they differ—for example, numbers, lions, and dogs. To seek how human beings differ from numbers, lions, and dogs seems to require knowing what numbers, lions, and dogs are. Otherwise, how could we discover the ways in which human beings differ from them? This quickly leads to the conclusion that seeking the definition of any one thing requires prior knowledge of the definition of everything.

The conclusion of Puzzle 2 generates a puzzle reminiscent of Meno's Paradox. The problem is that if seeking the definition of any one thing requires prior knowledge of the definition of everything, then definitional inquiry is impossible. Suppose there are only three definable objects: A, B, and C. The conclusion of Puzzle 2 states that to seek the definition of A one must already know the definitions of B and C. But to seek the definition of B one must already know the definitions of A and C, and to seek the definition of C one must already know the definitions of A and B. So there is no way for definitional inquiry to get started: either one already knows the definition of everything, in which case inquiry is unnecessary, or one does not, in which case it is impossible.

Puzzle 3

- (3.1) For every x , prior to seeking what x is, either one knows what everything is or one does not.
- (3.2) If one knows what everything is, one knows what x is.
- (3.3) If one knows what x is, one cannot seek what it is.
- (3.4) If one does not know what everything is, one cannot seek what x is. (From 2.4, above)
- (3.5) Therefore, one cannot seek what x is.

Puzzle 3 rests on the problematic claim that to seek what x is requires prior knowledge of what everything is (2.4, above). Although Aristotle does not explicitly present either Puzzle 2 or Puzzle 3, it is exactly this claim that his response to Puzzle 1 attacks:

T48 (a) And so first this is false. It is not in virtue of every difference that [something is] different; many differences belong to things that are the same in species, but [these are] not [differences] in their essences (*kat' ousian*) or in themselves. (b) Next, whenever one grasps the opposites and the difference and that everything falls here or there, and one grasps that the thing one is seeking (*to zētoumenon*) is in one of them, and one knows this, then it makes no difference whether one knows or does not know the other things, whatever they are, to which the differences are predicated. For it is clear that if, proceeding in this way, one reaches the things for which there is no longer a difference, then one will have the account of the essence (*ton logon tēs ousias*). (But that everything falls into the division, if they are opposite with nothing in between, is not a postulate; for it is necessary that everything is on one side or the other, if indeed it is a difference of that thing.)⁶⁰ (97a11–22)

Aristotle gives two responses to Puzzle 1. The first (T48a) attacks the support he provides in T47c for premise (1.1). The premise seems to state that knowing what x is requires knowing *every way* in which x differs from everything from which it differs. This in turn rests on the claim, stated in T47c, that every difference that holds between x and everything from which x differs is part of x 's essence. (As Aristotle says in T47c, x is the same—read: *in essence*—as that from which it does not differ and different—read: *in essence*—from that from which it does differ.) Aristotle denies the supporting claim: not every difference of x is an essential difference; some differences are accidental. For example, Socrates is short and Plato is tall and yet they share the same essence (in virtue of the fact that both are human beings). Since it is not the case that x is different in essence from that from which it differs merely accidentally, it is not the case that knowing what x is requires knowing *every way* in which x differs from everything from which it differs. So premise (1.1) is false.

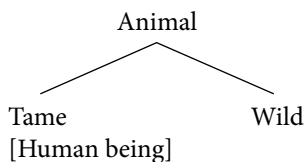
However, it is possible to reformulate the premise in light of the objection:

(1.1*) For every x , if one knows what x is, then one knows how x differs *in essence* from everything from which it differs *in essence*.

⁶⁰ πρῶτον μὲν οὖν τοῦτο ψεῦδος· οὐ γὰρ κατὰ πάσαν διαφορὰν ἕτερον· πολλὰ γὰρ διαφοραὶ ὑπάρχουσι τοῖς αὐτοῖς τῷ εἶδει, ἀλλ' οὐ κατ' οὐσίαν οὐδὲ καθ' αὐτά. εἴτα ὅταν λάβῃ τὰντικείμενα καὶ τὴν διαφορὰν καὶ ὅτι πᾶν ἐμπίπτει ἐνταῦθα ἢ ἐνταῦθα, καὶ λάβῃ ἐν θατέρῳ τὸ ζητούμενον εἶναι, καὶ τοῦτο γνώσκῃ, οὐδὲν διαφέρει εἰδέναι ἢ μὴ εἰδέναι ἐφ' ὧν κατηγοροῦνται ἄλλων αἱ διαφοραί. φανερόν γὰρ ὅτι ἂν οὕτω βαδίζων ἔλθῃ εἰς ταῦτα ὧν μηκέτι ἔστι διαφορά, ἕξει τὸν λόγον τῆς οὐσίας. τὸ δ' ἅπαν ἐμπίπτειν εἰς τὴν διαίρεσιν, ἂν ᾗ ἀντικείμενα ὧν μὴ ἔστι μεταξύ, οὐκ αἴτημα· ἀνάγκη γὰρ ἅπαν ἐν θατέρῳ αὐτῶν εἶναι, εἴπερ ἐκείνου διαφορὰ ἔστι.

(1.1*) is still problematic, because it is sufficient to generate the rest of Puzzle 1: to know what x is one must know what everything is (i.e., what the essence of each and every thing is).⁶¹ So Aristotle's first response leaves Puzzle 1 intact.

Aristotle's second response, which is in T48b, is a more direct attack on Puzzle 1. Suppose one is seeking by division the definition of human being. One must know the genus *animal*. Suppose one also knows that tame/wild is the correct first exhaustive division of animal and that human beings are tame.



Aristotle's claim in T48b is that grasping the division above does not require knowing which other species of animal are (essentially) tame or wild. Therefore, it does not require knowing the definition of all other species of animal. Aristotle seems to state that one does not need to know *any* other species of which tame or wild is an essential difference, but that is not quite right. If tame is an essential difference of human being, it is a D attribute, and if it is a D attribute, it belongs to at least one other indivisible species of animal. So to know that tame is an essential difference of human being requires knowing that it is an essential difference of at least one other indivisible species of animal. However, this falls far short of claiming that one must know all the essential differences of all animal species (let alone everything that exists). So Aristotle denies (1.1*): it is not the case that knowing what x is requires knowing how x differs in essence from everything from which it differs in essence. Now Aristotle thinks that to know what x is, if x is an indivisible species, one must know the essence of x 's genus. Therefore, his view is that knowing what x is does not require knowing the essence of anything apart from x 's genus, if x is an indivisible species. As I just mentioned, it also requires knowing some essential attributes of some other indivisible species, in order to know which differences are D attributes.

Aristotle's account in T48b, I now want to argue, makes clear his interest in the prior knowledge required for seeking definitions by means of the method of division. It also confirms that division is a way of seeking definitions, not just exhibiting them. An important clue is his reference in T48b (at 97a16) to 'the thing one is seeking'. This is a definition, which one is seeking by division. Aristotle's question is this: prior to seeking by division the definition of, for example, human being, what prior knowledge must the inquirer possess? He denies that she requires prior knowledge of every definition. Rather, she must know the definition of the genus *animal* of

⁶¹ See Falcon 2000: 406–7.

which human being is an indivisible species, and she must know enough about human beings to distinguish them from other animals. That is, she must grasp a preliminary account of the form 'human being is an animal of a certain sort' (where, as I noted above, 'a certain sort' is a place-holder for one or more candidate differentiae). The next step in Aristotle's account is crucial: the inquirer can now seek by division the essence of human being. She does so by seeking the correct first exhaustive division of animal. Suppose it is tame/wild. Aristotle's claim is that all the definer needs to know in order to grasp that tame is part of the human essence is (1) that tame/wild is the correct first division of animal, (2) that all humans are tame, and (3) that at least one other indivisible species of animal is essentially tame. Which division of animal is the correct first division and which of the two differentiae in it belongs to all human beings are empirical questions answered by empirical inquiry. Division is not an a priori method for analyzing concepts. It is an a posteriori method for seeking real essences. Aristotle's claim in T48b is that prior to seeking by division the essence of human being, the inquirer does not need to know the definition of every animal species, and subsequent to her discovery, she does not need to know all the animal species of which, for example, tame and wild are essential differences. Seeking definitions by division does not require or lead one into omniscience.

T48b, then, attacks the conclusion of Puzzle 2:

- (2.4) If one seeks what x is, then one has prior knowledge of what everything is.

Seeking what x is requires only prior knowledge of (i) a preliminary account of x and (ii) the essence of x 's genus. Aristotle attacks (2.4) by attacking the key premise on which it rests.

- (2.1) For every x , if one seeks what x is, then one seeks how x differs from everything from which it differs.

In seeking the definition of human being, we do not seek how human beings differ from everything from which they differ—not even from everything from which they differ in essence. Rather, we seek (a) the correct exhaustive divisions of the relevant genus and (b) which of the two differences in every relevant division is an essential difference of human being.

In section 1, I argued that definitional inquiry for Aristotle is holistic: there is a single stage of inquiry (Stage 2) in which one seeks the essences of all the indivisible species of a genus. However, to say that definitional inquiry is holistic is not to say that it requires prior knowledge of the essence of every species of a genus; nor is it to say that one seeks the essence of every species of a genus simultaneously. T48b suggests that we seek the definition of one indivisible species at a time, although our goal is knowledge of the definitions of all of them. In this way, Aristotle has a reply to Puzzle 3: he denies premise (3.4):

- (3.4) If one does not know what everything is, one cannot seek what x is.

Seeking what x is, if x is an indivisible species, does not require prior knowledge of the definition of everything. It does not require prior knowledge of the definition of anything except the genus. (It also requires a preliminary account of x .) Furthermore, to seek x 's essence by division does not require prior knowledge of what all the divisions of x 's genus are. Rather, these can be discovered via empirical inquiry as one divides. The method of division is useful in that it presents general rules that guide the inquirer's search. Apart from these abstract norms of inquiry, the inquirer must appeal to local norms, and do the hard work of empirical investigation, to determine what the correct division is at each step.

11. Defining by Division: Conclusions

We are now in a position to draw some conclusions about Aristotle's account of defining by division, and to see how he responds to the objections to division he raises in *APo* 2.5–6. (See section 4.)

The first objection was that division is not probative. Aristotle's response is that the method he outlines has no pretensions to be. If D_1 is part of the essence of a species S , then it is possible to prove (non-demonstratively) that S is D_1 but it is not possible to prove (demonstratively or otherwise) that S is essentially D_1 . However, while Aristotle accepts that the definer assumes at each step in the division that S is essentially D_1 , essentially D_2 , and so on, he denies that her assumptions are ungrounded. Rather, they are the outcome of empirical inquiry. The essence of S is a combination of its genus G and certain differentiae, D_1 and D_2 , which are D attributes. The definer discovers that G is S 's genus by induction from particulars. (Aristotle describes this process in *APo* 2.19. See Chapter 13 §§7–10.) She discovers that S is G before defining S —indeed, I argue in the next section that she discovers it before defining G . She seeks S 's essence by seeking its essential differentiae, and she does this by seeking, via empirical inquiry, the proper divisions of G . As Aristotle says, we 'establish [the definition] through the genus' (97a27–8)—that is, by dividing it correctly.

These divisions must meet certain criteria. First, they must involve coordinate pairs of genuine differentiae (i.e., genuine ways of being the kind (genus or divisible species) they divide), each of which is a D attribute. Second, the divisions must be exhaustive. Third, they must be properly ordered. Which differentiae are genuine (and D attributes), which divisions are exhaustive, and how they are properly ordered are empirical matters to be determined by the hard work of inquiry. By making properly ordered exhaustive divisions with genuine differentiae (which are also D attributes), the definer ensures that no essential attributes are omitted and no non-essential ones are illicitly introduced. In this way she also comes to know which attributes are essential: she knows that S is essentially D_1 because she knows that D_1 is part of a proper, empirically discovered division of G at the correct point in the

sequence. Put differently, she knows that S is essentially D₁ because S's essence is the conjunction of the members of the first correctly ordered set of D attributes she obtains, and she knows (from empirical inquiry) that D₁ is a member of that set. Therefore, although in setting out her divisions the definer assumes at each step that the selected attribute is essential, her assumptions are grounded in robust, non-intuitionist, empirical investigation.

Aristotle's account also suggests an answer to the problem of the unity of essence. A properly ordered essence obtained by the method of division is not an accidental conjunction of unrelated attributes. Rather, at each step in the division the differentiae represent genuine ways of being the kind (genus or divisible species) they divide. So human beings are not essentially several different things: animal, tame, footed, and two-footed. Rather, assuming that being tame is a genuine way of being an animal, and that being footed is a genuine way of being tame, and that being two-footed is a genuine way of being footed, the human essence is unified (or so Aristotle seems to want us to think).

12. Discovering the Essences of Primary Subject-Kinds

In the last passage in *APo* 2.13 I wish to examine, Aristotle completes his account of how we discover the (causally simple) essences of subject-kinds by explaining how we discover the essence of a *primary* subject-kind—that is, the genus.

T49 We must search (*zēteîn*) by looking at things that are the same and undifferentiated, [seeking] what they all have that is the same; and next [we must do the same] again in relation to other things that are the same in genus as those and are the same in species as one another but are different [in species] from those. And whenever, in relation to these, we get hold of what they all [have] that is the same, and similarly in relation to other things, [we must] next check (*skopeîn*) if the things we've gotten hold of [have something that is] the same, until we arrive at (*elthē*) a single account; for this will be the definition of the object (*tou pragmatos horismos*). If we do not come to a single [account] but to two or more, it is clear that the thing we are seeking is not some one thing but several.⁶² (97b7–15)

Aristotle begins by discussing how we must 'search' (*zēteîn*) and he concludes by discussing how we 'arrive at a single account', which is 'the definition of the object'.

⁶² Ζητεῖν δὲ δεῖ ἐπιβλέποντα ἐπὶ τὰ ὅμοια καὶ ἀδιάφορα, πρῶτον τί ἅπαντα ταυτὸν ἔχουσιν, εἴτα πάλιν ἐφ' ἑτέροις, ἃ ἐν ταυτῷ μὲν γένει ἐκείνοις, εἰσὶ δὲ αὐτοῖς μὲν ταυτὰ τῷ εἶδει, ἐκείνων δ' ἕτερα. ὅταν δ' ἐπὶ τούτων ληφθῇ τί πάντα ταυτόν, καὶ ἐπὶ τῶν ἄλλων ὁμοίως, ἐπὶ τῶν εἰλημμένων πάλιν σκοπεῖν εἰ ταυτόν, ἕως ἂν εἰς ἓνα ἔλθῃ λόγον· οὗτος γὰρ ἔσται τοῦ πράγματος ὁρισμός. ἐὰν δὲ μὴ βαδίζῃ εἰς ἓνα ἀλλ' εἰς δύο ἢ πλείους, δῆλον ὅτι οὐκ ἂν εἴη ἐν τι εἶναι τὸ ζητούμενον, ἀλλὰ πλείω.

How we must search is by induction and what we discover as a result is a definition. So T49 explains how to seek and discover definitions and essences by induction.

But definitions and essences of what? As we saw in Chapter 10, in *APo* 2.8 Aristotle explains how to seek and discover by means of demonstration the essences of demonstrable attributes. Since demonstration is sufficient for discovering the essences of demonstrable attributes, it is unlikely that T49 explains how to seek them. Otherwise there would be two independent methods for seeking the same essences: demonstration and induction. Either the two methods would converge on the same essence, which would be an unexplained accident, or they would lead to different essences—a problematic result either way. Earlier in *APo* 2.13 (T43–46), Aristotle explains how to seek and discover by means of division the essences of indivisible species. For the same reason I just mentioned, it is unlikely that T49 explains how to seek the essences of indivisible species. What Aristotle has not explained, and what his account of defining by division presupposes there is an explanation of, is how we seek and discover the essence of a primary subject-kind: the genus. So it is the genus, I suggest, that is defined by the method of induction. There is strong evidence for this in T49: the method Aristotle recommends moves from particular members of a species to the species, and then from several species of a genus to the genus. These moves are characteristic of induction.

The method T49 recommends for discovering the definition of a genus *G* works in four steps:⁶³

- Step 1: Collect several particular members of an indivisible species of *G*, *S*₁, and work out what attributes they all have in common qua *S*₁.⁶⁴ Let's say those attributes are *C*₁ and *C*₂.
- Step 2: Collect several particular members of a different indivisible species of *G*, *S*₂, and work out what they all have in common qua *S*₂: *C*₃ and *C*₄.
- Step 3: Repeat step 2 for every indivisible species of *G*. The result of Steps 1–3 is a pool of attributes each of which belongs universally to a single indivisible species of *G*: *C*₁, *C*₂, *C*₃, *C*₄, etc.
- Step 4: Work out what (if anything) *C*₁, *C*₂, *C*₃, *C*₄, etc. have in common. Call it *E*. *E* is the essence of *G*.⁶⁵ (If *C*₁, *C*₂, *C*₃, *C*₄, etc. do not have anything in common, then *G* is not a single genus and 'G' is used ambiguously. In that case the two or more genera of which *S*₁, *S*₂, etc. are species must be defined independently, via Steps 1–4.)⁶⁶

⁶³ There is a useful discussion of T49 in Balme 1987.

⁶⁴ See Barnes 1993: 249.

⁶⁵ We should add on Aristotle's behalf that *E* is the essence of *G* only if *E* is co-extensive with *G*.

⁶⁶ I interpret Step 4 differently from Barnes 1993: 248–9. On Barnes's reading, by Step 4 the inquirer has one set of common attributes for each species she has investigated. The inquirer's final step is to select the attribute(s) (if any) that appear(s) in every set. In other words, the essence of *G* will be one or more of the *C*s. On my reading, the inquirer seeks some *further* feature (or features) that all the common attributes (the *C*s) have in common—some feature that is not one of the *C*s but captures something in all of them. The decisive phrase ('[we must] next check if the things we've gotten hold of [have something that is] the same'

Induction occurs at every step of this procedure. Aristotle calls induction ‘the advance from particulars to the universal’.⁶⁷ ‘Particular’ is a relative term for Aristotle: something is particular relative to something more general. For example, Socrates and Plato are particulars relative to the species *human being*. The species is a particular relative to the genus *animal*. At every step of the method in T49, the inquirer proceeds from particulars to universals: at Steps 1–3, from particular members of an indivisible species to features shared by all its members; at Step 4, from specific members of a genus to features shared by all its members.

The inductive method Aristotle recommends in T49 is thoroughly empirical. One of the inquirer’s main tasks is to identify features that the individual members of the indivisible species of a genus share in common. She will identify these features by empirical means—by seeking, for example, what individual horses have in common and what individual cows have in common, and so on. Her principal move in Step 4—identifying what all the common attributes she has collected have in common—is also empirically grounded. For the common feature(s) she identifies as the essence of the genus must belong to the individual members of that genus. For example, ‘substance capable of perception’ signifies the essence of the genus *animal* only if all and only individual animals are substances capable of perception. So the inquirer will know that she has discovered the essence of the genus only if she has broad, empirically grounded knowledge of the individual members of G.

All intellectual learning comes to be from prior knowledge (T1, 71a1–2). According to T49, we learn the essence of a genus G by induction. What prior knowledge is required? Aristotle does not address this question explicitly in *APo* 2.13, but the passage provides some clues.⁶⁸ First, as we have seen, to seek the definition of any definable object *x*, the inquirer must begin with a preliminary account of *x*. So the inquirer of T49 must have a preliminary account of G. Aristotle seems to think that genera will be defined in terms of the categories of being (substance, quality, quantity, etc.). It seems, then, that the preliminary account of G will identify the category to which it belongs along with some other feature by means of which the inquirer can identify Gs. For example, the inquirer, prior to defining animal, may grasp that it is a substance capable of moving itself.

Second, the method of induction in T49 seems to presuppose prior knowledge of preliminary accounts of the indivisible species of the genus being defined. For in order to define G, the inquirer must identify individual members of indivisible species of G (e.g., individual human beings), which in turn requires some grasp of the species themselves. As I explained above, in seeking the essence of G, the inquirer must identify, for each indivisible species of G, a feature the members of that species share in

(ἐπὶ τῶν ἐλημμένων πάλιν σκοπεῖν εἰ ταῦτόν, 97b11–12) can be read either way. However, the example Aristotle uses to illustrate the method (97b15–25) seems to support my reading.

⁶⁷ ἐπαγωγή δὲ ἢ ἀπὸ τῶν καθ’ ἕκαστα ἐπὶ τὸ καθόλου ἔφοδος (*Top* 1.12, 105a13–14).

⁶⁸ He addresses the question in *APo* 2.19. See the next chapter.

common: C. In some cases it may turn out that C is a feature already mentioned in the preliminary account of S, which account the inquirer relied on in identifying members of S. In other cases it may turn out that C is a new feature, which the inquirer can then incorporate into her preliminary account of S and thereby enrich it. This helps explain why Aristotle thinks, as I have argued, that the inquirer should first seek the essence of the genus and then the essences of its indivisible species. It is not only that knowing the essence of an indivisible species requires knowing the essence of its genus. It is also that by seeking inductively the essence of the genus, the inquirer enriches the preliminary accounts of its indivisible species required for seeking their essences by means of the method of division. Now Aristotle's account presupposes some explanation of how we acquire the preliminary accounts of genera and their species in the first place. In the next chapter, I argue that he provides the explanation in *APO* 2.19.

In T49, Aristotle explains how we discover the essence of a genus—that is, a primary subject-kind. The method he recommends is induction. Since induction and division are methods for discovering the essences of different kinds of object—primary and subordinate subject-kinds, respectively—we do not need to interpret T49 as presenting an alternative to division. Rather, induction and division complement each other: division presupposes induction and builds on its results.

Aristotle expresses confidence in the method of induction. In T49, he says that if we apply it correctly what results 'will be the definition of the object' (97b13). However, as I argued in my discussion of T19 (96b15–25) in section 1, when the definer first grasps (by induction) the essence of a genus G, she has non-noetic knowledge of it. In T49, Aristotle says that the inquirer 'arrives at' (*elthē(i)*) the definition. If he meant she acquires *nous*, we would have expected him to say so. On the interpretation I have defended, she acquires noetic knowledge later, after she has defined (by division) the indivisible species of G and explained (by demonstration) the in-itself accidents of G and of its species. In the order of inquiry, demonstration comes after induction and division and builds on their results.

PART III

Learning by Induction

The Origin and Aim of *APo* 2.19

I have argued that in the *APo* Aristotle is committed to the Socratic Picture of the order of inquiry according to which one first seeks whether and what a subject-kind is (Stages 1–2) and then whether and why a demonstrable attribute belongs to it (Stages 3–5). In *APo* 2.8, he explains how an inquirer at Stage 4 discovers by demonstration the causally complex essences of demonstrable attributes, which essences include the attribute's cause. (See Chapter 10.) In 2.13, he explains how an inquirer at Stage 2 discovers by division and induction the causally simple essences of subject-kinds. (See Chapter 12.) In all three methods, the inquirer begins with a preliminary account of the object whose essence she seeks. How does she acquire these preliminary accounts? What is the prior knowledge from which she learns them? What is the ultimate origin of the knowledge she achieves at the end of inquiry? In this chapter, I argue that Aristotle addresses these questions in the final chapter of the *APo*, 2.19.

The background of *APo* 2.19 is the theory of science and demonstration Aristotle presents earlier in the *APo*. A science is a hierarchically organized series of demonstrations. The highest demonstrations have as their premises the first principles (*archai*) of the science, especially the definitions of subject-kinds. First principles are indemonstrable: everything else in the science is deduced and explained from them; they are not deduced or explained from anything. Since we cannot acquire knowledge of first principles by demonstration, the question arises, how do we learn them? *APo* 2.19 aims to help answer this question. One of my main claims in this chapter is that it aims to provide a much smaller part of the answer than commentators usually think.

I begin (in sections 1–3) with an overview of my interpretation. I then turn (in sections 4–10) to the text of 2.19, focusing on the first three quarters of the chapter (99b15–100b5). Here Aristotle poses a question about our acquisition of first principles, raises a puzzle (reminiscent of Meno's Paradox) that develops the question, and then answers the question and solves the puzzle in four difficult and closely packed, bits of text.

1. Opening Moves and Overview

In the opening lines of *APo* 2.19, Aristotle summarizes what he takes himself to have accomplished thus far in the *Analytics*:

T50 So it is clear concerning syllogism and demonstration what each is and how each comes about, and so too concerning demonstrative scientific knowledge; for these are the same.¹ (99b15–17)

He then announces the two questions he intends to address:

T51 But concerning the principles, how they become known and what is the state that knows them, this will be clear from what follows after we have first set out the problems.² (99b17–19)

The chapter's structure falls easily out of this sentence. Aristotle begins by raising a series of puzzles (99b20–32). He then tackles the first of his two questions: how do the principles become known? (99b32–100b5; T53–55 and T57–58 below) And he concludes by answering the second: what is the state that we are in when we know them? (100b5–17)

Despite its structural clarity, the details of 2.19 are notoriously difficult to work out and a variety of interpretations have been defended. In recent decades, however, there has emerged widespread agreement about what Aristotle's account looks like in broad outline: the way principles become known is by induction, and the state that knows them is *nous* (non-demonstrative scientific knowledge; see Chapter 4§§1–4).³ From here interpretations diverge widely—especially, but not only, over the question of what role, if any, *nous* plays in induction. A traditional view is that induction is necessary but not sufficient for reaching knowledge of first principles; induction must be aided in this endeavour by the intuitive activity of *nous*⁴—in particular, by the so-called agent *nous* of *De Anima* 3.5.⁵ An alternative view, defended by Barnes, is that induction is sufficient for reaching principles; *nous* is the outcome of induction and plays no role in it.⁶ Despite this disagreement between what Barnes calls the 'easy rationalist' and 'honest empiricist' ways of reading the chapter,⁷ at least this much seems clear to commentators: induction (with or without *nous*) answers Aristotle's first question, *nous* his second.

There is no doubt that *nous* is Aristotle's answer to the second question.⁸ However, I shall argue that, contrary to the prevailing view, induction is not Aristotle's answer to the first question. My claim is not that 2.19 presents a different answer to this question; rather, my claim is that it presents an answer to a different question from

¹ *Περὶ μὲν οὖν συλλογισμοῦ καὶ ἀποδείξεως, τί τε ἐκάτερόν ἐστι καὶ πῶς γίνεται, φανερόν, ἅμα δὲ καὶ περὶ ἐπιστήμης ἀποδεικτικῆς ταῦτόν γάρ ἐστιν.*

² *περὶ δὲ τῶν ἀρχῶν, πῶς τε γίνονται γνώριμοι καὶ τίς ἡ γνωρίζουσα ἔξις, ἐντεῦθεν ἔσται δῆλον προσαπορήσας πρῶτον.*

³ See Barnes 1993: 268–9, Engberg-Pedersen 1979: 317, Kosman 1973: 385–6, Modrak 1987: 158, 172–4.

⁴ See Bayer 1997, Irwin 1988: 134–7, 531–2. I discuss the intuitionist interpretation in Chapter 8§1.

⁵ See Kahn 1981: 397–414.

⁶ See Barnes 1993: 267–70. Leshner 1973 strikes a middle ground, arguing that induction involves low-level noetic activity (what Aristotle elsewhere in the *APO* calls *noēsis* (1.31, 88a7 (in T22), a16))—in particular the recognition of a universal in one or more particular instances (see also Engberg-Pedersen 1979: 307–11, Modrak 1987: 160–1). I discuss Leshner's view below in n61.

⁷ Barnes 1993: 259, 270.

⁸ See 100b5–17.

the one usually supposed. Commentators generally believe that when Aristotle asks ‘how do the principles become known?’ he is concerned to identify, in Barnes’s words, ‘the process or method by which we gain knowledge of first principles’⁹—namely, induction. I shall argue instead that the question concerns *the original prior knowledge from which first principles become known*—namely, perception. For Aristotle, all intellectual learning requires prior knowledge, and different types of learning require different types of prior knowledge (71a1–2, T1). A natural way for him to answer the question of how first principles become known is for him to identify the prior knowledge from which they first begin to become known: perception. Perception, of course, is not all that is required for getting to know principles, nor is it all Aristotle discusses in 2.19.¹⁰ It is, however, his primary focus, the central concept around which the argument of the chapter is organized.

My reading departs from the usual view of 2.19 according to which Aristotle’s concern in answering the first question is to explain how we reach knowledge of first principles. On this view, Aristotle identifies cognitive states necessary (perhaps even sufficient) for acquiring this knowledge (perception, memory, experience, and so on) and the reasoning by which we acquire it (induction, with or without *nous*). The view I wish to propose finds in 2.19 a more modest project. Aristotle does not try to explain how we reach first principles. Rather, his aim is to explain and defend his anti-Platonist claim that our knowledge of first principles originates in perception. He does so in two ways: (1) he identifies the cognitive states that first emerge out of perception (memory, experience, and so on) and that mark the early stages in our intellectual development; and (2) he argues that induction, starting from perception, is the means by which we reach one of these early stages—namely, the grasp of a preliminary account, which we use to seek, at the appropriate stages of inquiry, whether and what a subject-kind or demonstrable attribute is. Everyone agrees that 2.19 explains at least part of our intellectual development. The question is, how much?

Note that my account assigns two independent roles to induction: it is the means by which we acquire preliminary accounts; and, as I argued in the previous chapter (section 12), it is the means by which we acquire non-noetic knowledge of the definitions of genera. *APO* 2.19 is concerned with induction in its first role; 2.13 (T49, 97b7–15) is concerned with induction in its second role. (I return to this below in section 9.)

⁹ Barnes 1993: 268 (my emphasis).

¹⁰ In the last part of 2.19 (100b5–17), Aristotle argues that *nous* is the state we are in when we know first principles. There is no evidence in this passage (or, as far as I can tell, anywhere else) that *nous* is involved in learning first principles. Rather, it is the cognitive condition that eventually results from learning them. I discuss how we acquire *nous* of first principles in Chapters 6§4, 8§§4–5, and 12§1.

2. Motivation

One way to motivate my reading is to consider an interpretive problem with *APO* 2.19. Commentators often note that when Aristotle addresses the first question (99b32–100b5, T54–55, T57–58 below) his account seems to vacillate.¹¹ At the start (99b32–100a14, T54–55, T57) he seems intent on explaining how we acquire knowledge of first principles, in particular definitions, which are the most important type of principle.¹² But then in the final part of his account (100a14–b5, T58), which contains the chapter's only explicit reference to induction (100b4), he seems to revert to explaining something much more basic: how we acquire, by induction, ordinary concepts such as 'human being' and 'animal'. Since definitions are propositions but concepts are not, Aristotle looks confused about a rudimentary philosophical distinction.¹³ But more significantly, since *nous* is the state in which we know first principles (100b5–17), and since having noetic knowledge of a definition is much more cognitively demanding than grasping an ordinary concept, he seems confused about fundamental differences in levels of learning, switching problematically from an account of scientific learning to an account of ordinary learning with no apparent notice. To overcome this problem it is tempting to adopt a deflationary strategy and downgrade the earlier section (99b32–100a14)—the one apparently concerned with learning definitional principles—to the level of ordinary learning, in line with the passage on induction (100a14–b5). The problem now is that Aristotle seems to fail to answer his first question, which, as it is usually understood, demands an account of high-level, scientific learning, not (or at least not only) low-level, ordinary learning. However, if, as I wish to argue, the first question does *not* ask about the process by which we learn principles but about the origin of our knowledge of them, then Aristotle is *not* obliged to discuss high-level learning. And if he is not so obliged, then the deflationary strategy can be consistently deployed—or so I hope to show.

A second way to motivate my reading is to consider the disagreement I mentioned above between the 'rationalist' and 'empiricist' interpretations of the chapter. Neither option is particularly attractive. As we have seen, induction, for Aristotle, is the means by which we move from knowledge of several particulars to knowledge of a universal proposition that identifies something they share in common.¹⁴ From perceiving that Socrates is two-footed, and Callias, and Plato, and so on, I grasp that all humans are two-footed. The rationalist worries that induction, so conceived, is too weak to get us to noetic knowledge of first principles. And rightly so. To have noetic knowledge of first principles is to know the highest, most explanatory truths in a science and to know them *as such*. Are we really to suppose that we reach this

¹¹ See Barnes 1993: 259, Modrak 1987: 161, Scott 1995: 110.

¹² Aristotle calls definitions 'the principles of demonstration' (*APo* 2.3, 90b24). In *APo* 1.3 (72b23–4), he states that the principle of scientific knowledge (i.e., *nous*) is that by which we know definitions.

¹³ See Barnes 1993: 271, Kahn 1981: 389–90, Ross 1949: 675. For further discussion, see n63.

¹⁴ E.g., *Top* 1.12, 105a13–14. See Chapter 12§12.

exalted state by a simple process of generalization over particulars? The rationalist's solution is to appeal to *nous* as a faculty of intuitive discovery, which takes us from the results of induction to noetic knowledge of principles as such. The empiricist, on the other hand, worries that this saddles Aristotle with a mysterious view, one that has little basis in his texts. And rightly so. Aristotle is clear that *nous* is the state we are in when we *know* first principles, not the faculty by which we *get to* know them.¹⁵ There is truth on both sides: induction is too weak to get us to noetic knowledge of first principles, but *nous* is not part of Aristotle's explanation of how we get there. The solution I wish to propose is this: we should not look to 2.19 for Aristotle's account of the process or route by which we reach first principles. The chapter addresses a different and more basic question: where does the route begin?

There is a third way to motivate my reading. I have argued that in *APo* 2.1–10 and 13 Aristotle presents a detailed explanation of how we discover definitions, which are the most important first principles. Furthermore, I have argued that implicit in his account is an explanation of how we acquire *noetic* knowledge of them. If my interpretation is right, then on the usual way of taking Aristotle's first question his account in 2.19 is redundant: he has already answered the main question commentators think 2.19 addresses. This suggests that we should look for a different way of taking his first question: it asks not about the method(s) by which we acquire knowledge of first principles but the original prior knowledge from which we begin learning them.

3. The Origin and Aim of *APo* 2.19

Aristotle's discussions of definitional inquiry earlier in *APo* 2 provide the background against which I propose interpreting 2.19. It is a mistake to read the chapter as a quasi-independent treatise—*On Coming to Know First Principles*—cut off, as it were, from the rest of Book 2.¹⁶ By the time we reach 2.19 Aristotle has told us a great deal about how we come to know first principles. What he has not explained is how we acquire the preliminary accounts necessary for definitional inquiry. My suggestion is that it is part of the task of 2.19 to do exactly this. Aristotle's claim, I shall argue, is that we acquire preliminary accounts by induction.¹⁷

There is, however, another question for Aristotle to confront in 2.19, another task left over from previous chapters. Imagine a Platonist, inspired by the *Meno*, who believes that the soul possesses latent innate knowledge (*epistēmē*) of first

¹⁵ *APo* 1.3, 72b18–25, 2.19, 100b5–17. For discussion, see Barnes 1993: 167–70, Kosman 1973.

¹⁶ Barnes (1993: 271) speculates (needlessly, in my view) that 2.19 'began life as an independent essay... and was at some later stage tacked on to the discussions of B 1–18'.

¹⁷ Tuominen (2010: 121) also argues that 2.19 explains how we come to know 'starting-points for inquiry' and that in this respect the chapter is congruent with what Aristotle says about inquiry elsewhere in *APo* 2. In my view, however, she spoils her good thought by adopting the more usual line, arguing that 2.19 also explains how we reach first principles.

principles.¹⁸ The problem is that Aristotle's account of inquiry in *APo* 2.1–10 and 13 does not rule out this view. The Platonist could follow Aristotle every step of the way, agreeing about the methods by which we learn definitional principles but all the while believing that the basis of our search is latent innate knowledge of the very principles we seek. The Platonist's view is a thesis about origin, not about method; it identifies where our explicit knowledge of principles comes from, not the process by which we acquire it. Aristotle, who rejects innatism, faces a question: what is the origin of our knowledge of first principles? If it is not from latent innate knowledge of the principles themselves, then *how do they become known* (*pōs ginontai gnōrimoi*, 99b18, in T51)? His answer to this question is: from perception.

There is good textual support for this interpretation. Near the beginning of the chapter, just after he states his two questions, Aristotle raises a puzzle: '[we might wonder] also whether the states [in which we know the first principles], not being present [in us], come about [in us] or rather are present [in us] without being noticed' (99b25–6).¹⁹ The puzzle, which I examine in more detail in the next section, concerns the first question: how do the principles become known? In fact, it poses a prior question: *do* they become known? Perhaps they are already known—perhaps, as the Platonist thinks, latent knowledge of first principles is in us innately. Aristotle thinks principles *do* become known; he is not an innatist. His question is, how (*pōs*) do they become known? That is, from what origin?²⁰ If the principles become known, they become known from some prior knowledge. But from what original prior knowledge? It will not do for Aristotle to identify some more proximate starting-point (e.g., knowledge of a preliminary account), since the Platonist can always claim that behind this lurks our latent innate knowledge. To counter the Platonist, Aristotle must go right back to the beginning, back to the original knowledge from which first principles begin to become known. His view, which he states twice in the chapter (99b32–5 (in T53), 100a10–11 (in T57)), is that (in his second formulation) 'the states [in which we know principles] neither inhere [in us] in a determinate form nor come about from other states which are more knowing; rather, [they come about] from perception' (100a10–11).²¹

These lines state what I take to be the central claim of 2.19: knowledge of first principles originates in perception. Aristotle presents the claim as a solution to the puzzle about the origin of first principles. But this puzzle, I have argued, is simply an

¹⁸ See Chapter 1 §§2–3, 7. For an interesting discussion of the Platonic background of 2.19, see Adamson 2011.

¹⁹ καὶ πότερον οὐκ ἐνοῦσαι αἱ ἐξέεις ἐγγίνονται ἢ ἐνοῦσαι λεληθασιν.

²⁰ My claim is that the interrogative *pōs* ('how?', 'in what way?') asks after the manner in which the principles become known and that one way of answering this is by stating the origin from which they become known. This is not the only way of answering the question, but it is the appropriate way given the context in which the question is eventually placed—namely, the puzzle about the origin of our knowledge of principles.

²¹ οὐτε δὲ ἐνυπάρχουσιν ἀφωρισμέναι αἱ ἐξέεις, οὐτ' ἀπ' ἄλλων ἐξέων γίνονται γνωστικωτέρων, ἀλλ' ἀπὸ αἰσθήσεως.

elaboration of the chapter's first question. So when Aristotle asks 'how do the principles become known?' he in effect asks 'how do they begin to become known?' And when he solves the puzzle by adverting to perception we should hear in this his answer to the first question. In the context of 2.19, *from perception* is how the principles become known. The noun *aisthēsis* ('perception') and the verb *aisthanesthai* ('to perceive') occur ten times in the chapter; by contrast *epagōgē* ('induction') occurs just once, at the very end of Aristotle's account (100b4, in T58d below). Since perception is not a method by which we learn principles but the knowledge from which they originate, there is yet more reason to believe that the usual way of interpreting the first question is mistaken.

Aristotle has two tasks in *APO* 2.19, both of which grow out of his account of definitional inquiry earlier in Book 2: (i) identify the *original* prior knowledge (perception) from which principles become known; (ii) identify the means (induction) by which we reach the preliminary accounts that are the objects of the *proximate* prior knowledge required for learning principles properly speaking. These tasks are related. If Aristotle can show that induction, starting from perception, leads us to preliminary accounts, then not only will he have completed his explanation of how we learn principles, he will also have made a strong case for his claim that perception is their origin. Perception is the origin because it gives rise, via induction, to the proximate prior knowledge required for learning principles properly speaking—that is, according to the methods set out in *APO* 2.1–10 and 13. If this is right, then Aristotle is neither a naïve inductivist nor a mysterious intuitionist (as the empiricist and rationalist readings of 2.19 respectively portray him). Instead, his account of learning first principles appeals to the standard practices of Aristotelian science: explaining and defining.²²

4. Meno's Paradox

As we saw in the previous section, Aristotle approaches the first question by raising a puzzle:

T52 [we might wonder] also whether the states [in which we know the first principles], not being present [in us], come about [in us] or rather are present [in us] without being noticed. If we have [such states], it's absurd; for then we have pieces of knowledge more exact than demonstration without noticing. But if we acquire [them] without possessing [them] earlier, how would we acquire knowledge and learn from no pre-existing knowledge? For this is impossible, as I also said in connection with demonstration. It is clear, then, both that we cannot possess [these states] and also that they cannot come about [in us] when we are ignorant and possess no state.²³ (99b25–32)

²² For a similar claim, see Charles 2000: 269.

²³ καὶ πότερον οὐκ ἐνοῦσαι αἱ ἔξεις ἐγγίνονται ἢ ἐνοῦσαι λελήθασιν. εἰ μὲν δὴ ἔχομεν αὐτάς, ἄτοπον· συμβαίνει γὰρ ἀκριβεστέρας ἔχοντας γνώσεις ἀποδείξεως λανθάνειν. εἰ δὲ λαμβάνομεν μὴ ἔχοντας πρότερον,

The *Meno* is clearly in the background. Aristotle attacks Plato's claim that we possess latent innate knowledge (i.e., knowledge of principles that is 'present in us without being noticed', 99b25–6). In addition, Aristotle's puzzle is reminiscent of Socrates's dilemma. (See Chapter 1§2.) Like Socrates, Aristotle starts from the assumption that either we already have the knowledge (*gnōsis*) we seek or we do not, and he too questions the possibility of our obtaining any knowledge at all. Since it is absurd to suppose, as Plato did, that we possess latent innate knowledge of principles, Aristotle infers that it must be the case that we learn them. Then he raises the spectre of our having to learn them starting from no prior knowledge. However, since all intellectual learning requires prior knowledge, and learning first principles is intellectual learning, it follows that learning first principles is impossible. The conjunction of the two positions Aristotle considers leads to the conclusion that we cannot know first principles.

- (1) Either we have latent innate knowledge of the principles or we have no knowledge.
- (2) If we have latent innate knowledge of the principles, then we have the highest form of knowledge without noticing—which is absurd.
- (3) If we have no knowledge, then we cannot learn the principles—for all intellectual learning requires prior knowledge.
- (4) Therefore, it is impossible for us to know the principles—either we already know them (which is absurd) or we must learn them (which is impossible).

Premise (1) presents us with a very stark choice—an extreme 'all or nothing' conception of knowledge. Notice, however, that it is not a choice between latent innate knowledge of first principles and no knowledge of *them*. Rather, it is a choice between latent innate knowledge of first principles and no knowledge (*gnōsis*) *at all*—that is, complete ignorance.²⁴ Aristotle can move from 'no pre-existing knowledge' (*mē prouparchousēs gnōseōs*, 99b29) to 'ignorance', even 'complete ignorance' (*agnoousi kai mēdemian echousin hexin*, 99b31–2), because he uses the term 'knowledge' (*gnōsis*) for a very wide range of cognitive states, from perception of particulars to *nous* of first principles. (See Chapter 1§5.) Hence to say that we have no knowledge (*gnōsis*) is to make a very strong claim: it is to deny that we have anything from this broad range of cognitive states, that we have any true cognition.

In premise (1) Aristotle seems to be thinking of a view according to which if we do not have knowledge of first principles, then we have no knowledge (*gnōsis*) at all. This view would depend on the further assumption that all knowledge is either of first principles directly or is derived from knowledge of them.²⁵ If this view were correct,

πὼς ἂν γνωρίζοιμεν καὶ μαθάνοιμεν ἐκ μὴ προϋπαρχούσης γνώσεως; ἀδύνατον γάρ, ὥσπερ καὶ ἐπὶ τῆς ἀποδείξεως ἐλέγομεν. φανερόν τοίνυν ὅτι οὐτ' ἔχειν οἶόν τε, οὐτ' ἀγνοοῦσι καὶ μηδεμίαν ἔχουσιν ἔξιν ἐγγίγνεσθαι.

²⁴ For a similarly stark choice (we have a science of everything or we know nothing at all), see *Met* 1.9, 992b18–993a10.

²⁵ See again *Met* 1.9, 992b18–993a10.

then knowledge (*gnōsis*) would indeed be ‘all or nothing’ in the way described in our passage: either we would already have knowledge of first principles or we would have no knowledge at all (for *ex hypothesi* all knowledge is of or from first principles). And if we have no knowledge at all, then we have no way of learning first principles. For intellectual learning requires prior knowledge—but we have none. Hence Aristotle’s puzzle.

Who would think that all knowledge is of or from first principles? Perhaps an inattentive listener to Aristotle’s own lectures; in particular someone confused about the connection between two key terms in his epistemology: *gnōsis* (knowledge) and *epistēmē* (scientific knowledge). (See Chapter 1§5.) *Epistēmē* is much narrower than *gnōsis*. As we saw in Chapter 4, Aristotle distinguishes between (a) non-demonstrative *epistēmē* (*nous*), which is of first principles, and (b) demonstrative *epistēmē*, which is from first principles. *Epistēmē* is one type of *gnōsis*. But if someone were to think, mistakenly, that all *gnōsis* is *epistēmē*, then he would think that all *gnōsis* is of or from first principles, for all (unqualified) *epistēmē* is. His mistake would get him into serious trouble when he came to Aristotle’s claim that all learning requires prior *gnōsis*. Thinking that it specifies that all learning requires knowledge of or from first principles, our unfortunate student would find himself in the grip of Aristotle’s puzzle. For if all intellectual learning requires prior *gnōsis*, and if all *gnōsis* is (unqualified) *epistēmē*, and if we do not possess such *gnōsis* innately, then all intellectual learning is impossible: we have no *gnōsis* from which to begin. The puzzle tells a cautionary tale: do not make the mistake of thinking that just because *epistēmē* is the highest form of *gnōsis* it is the only form; realize that there are different levels or grades of *gnōsis*, that there are ways of knowing that fall between *epistēmē* and complete ignorance and that can provide a basis from which to learn.

Aristotle’s puzzle brings into relief his task in APO 2.19. In order to steer between the twin dangers of Platonic innatism (we already know first principles) and scepticism (we can never know them) he must show that first principles can become known. And to do this he needs to deny premise (1) by identifying a type of intermediate knowledge (*gnōsis*) that falls between complete ignorance and knowledge of or from first principles (*epistēmē*), one that is a suitable origin for them.

His solution takes exactly this form (I quote starting from the end of T52):

T53 It is clear, then, both that we cannot possess [these states] and also that they cannot come about [in us] when we are ignorant and possess no state. We must therefore possess some sort of capacity, but not one that will be more valuable than these states in respect of exactness. And this is clearly true of all animals: they have an innate discriminatory capacity, which is called perception.²⁶ (99b30–5)

²⁶ φανερόν τοίνυν ὅτι οὐτ’ ἔχειν οἶόν τε, οὐτ’ ἀγνοοῦσι καὶ μηδεμίαν ἔχουσιν ἔξιν ἐγγίγνεσθαι. ἀνάγκη ἄρα ἔχειν μὲν τινα δύναμιν, μὴ τοιαύτην δ’ ἔχειν ἢ ἔσται τούτων τιμιωτέρα κατ’ ἀκρίβειαν. φαίνεται δὲ τοῦτο γε πᾶσιν ὑπάρχον τοῖς ζώοις. ἔχει γὰρ δύναμιν σύμφυτον κριτικὴν, ἣν καλοῦσιν αἰσθησιν.

Perception meets all the demands for a solution: Aristotle considers it a type of knowledge (*gnōsis*);²⁷ it exceeds complete ignorance but falls short of *epistēmē*; and he is confident that it is a suitable origin from which first principles can begin to become known. One reason for his confidence becomes clear later in 2.19: he believes that although we perceive particulars, not universals, the faculty of perception is receptive of the universals that particulars instantiate, and these universals, once grasped, allow us to seek and learn first principles.²⁸

Aristotle's view is that we are born with the capacity for perception the subsequent exercise of which allows us to acquire perceptual knowledge of particulars. Acquiring this knowledge is learning but not intellectual learning. (See Chapter 1§4.) (If it were intellectual learning, it would have to come to be from some prior knowledge (71a1–2, T1), which Aristotle never identifies.) I perceive that Callias is two-footed and as a result I retain a perceptual image of Callias as two-footed. I do the same for Socrates, and so on. Eventually I acquire a pool of perceptual knowledge from which I can grasp a universal proposition, 'all human beings are two-footed', which can form the basis of a preliminary account: all human beings are two-footed animals. In virtue of grasping this account, I can search for the definition of human being, which is a first principle. Acquiring knowledge of the preliminary account is a case of intellectual learning: it is learning by induction.

Plato and Aristotle agree that there are intermediate cognitive states that fall between complete knowledge and complete ignorance. They also agree that we can seek and discover first principles if and only if we are in one or another of these intermediate states. However, they disagree about which of these states we, as a matter of fact, learn first principles from. Plato thinks that we seek and discover (recollect), for example, the human essence from our latent innate knowledge (*epistēmē*) of the human essence. (See Chapter 1§§2–3, 7.) Aristotle thinks that we seek and discover the human essence from our grasp (*echein*, APO 2.8, 93a22 (T32a), 93a29 (T34a)) of a preliminary account: for example, all human beings are two-footed animals. (See Chapter 10§4.) Now Plato might agree that grasping preliminary accounts is necessary for inquiry and discovery (recollection). A preliminary account would then be the object of our occurrent mental state when we begin to seek. However, Plato also posits the existence of non-occurrent (latent and innate) mental states, the objects of which are the very things we seek when we seek first principles. Aristotle, by contrast, thinks this view is 'absurd' (99b26, T52). Furthermore, it has no role to play in the explanation of our learning: since we learn preliminary accounts starting from perception and first principles starting from our grasp of preliminary accounts, positing latent innate knowledge of principles is superfluous.

²⁷ See *De Mem* 1, 450a11–12, *Met* 1.1, 981b10, *GA* 1.23, 731a31–3, *APO* 2.19, 99b38–9 (in T54).

²⁸ See 100a14–b5 (T58), discussed below in sections 9–10.

5. Perception and *Logos*

Aristotle's puzzle and solution lead directly to a discussion of cognitive development (I quote starting from the second sentence of T53):²⁹

T54 We must therefore possess some sort of capacity, but not one that will be more valuable than these states in respect of exactness. And this is clearly true of all animals: they have an innate discriminatory capacity, which is called perception. Given that the capacity to perceive is present in [them], some animals retain what they have perceived, and others do not. Those [animals] that do not [retain it] have no knowledge (*gnōsis*) when they are not perceiving (either in general or about the things they do not [retain]). But those [animals] that do [retain what they have perceived] still have [it] in their soul even after perceiving. When many such things are [retained] there is then a further difference: some animals come to have reason (*logos*)³⁰ from the retention of such things, and others do not.³¹ (99b32–100a3)

Aristotle begins by identifying perception, an innate capacity common to all animals, as the origin of our knowledge of principles. He then draws a line between those animals that are capable of retaining perceptual knowledge (i.e., those capable of memory) and those that are not. He then draws a second line between those animals that are capable of acquiring reason from memory and those that are not. The second line divides humans from other animals, because reason is available to humans alone. Hence Aristotle lists an ascending sequence of cognitive activities of which a diminishing number of animals are capable: perception, memory, reason.³²

²⁹ I divide the remaining parts of *APo* 2.19 I shall examine as follows: T54: 99b32–100a3, T55: 100a3–9, T57: 100a10–14, T58: 100a14–b5. In Bronstein 2012, I provide a more detailed account of these passages than I am able to here.

³⁰ Some commentators take *logos* to mean 'account'—that is, 'definition'. (See Barnes 1993: 264, Engberg-Pedersen 1979: 315–16, Irwin and Fine 1995: 67, Modrak 1987: 162.) The problem with this interpretation is that it gives the impression that knowledge of a definition emerges directly from memory, but this is not Aristotle's view, as the next passage makes clear (100a3–9, T55). Instead, *logos* looks like a place-holder for the longer list of post-memoric states Aristotle goes on to identify in the next passage: experience, the grasp of a certain kind of universal, and *nous*, the state that knows definitions (principles). If this right, then the term 'reason' captures well what Aristotle is trying to say. (See Gregorić and Grgić 2006: 21–3, Hamlyn 1976: 176–7, Kahn 1981: 403.) My objection to translating *logos* as 'account' or 'definition' also applies to Frede's view that *logos* stands for *nous*, given that *nous* (as 100a3–9 (T55) makes clear) does not come directly from memory. (Frede: 1996: 169.) One possible point of confusion is that Frede translates *nous* as 'reason', which he identifies as our capacity to grasp principles, whereas I use 'reason' more broadly. Gregorić and Grgić 2006: 21–3 helpfully distinguish between basic and noetic rationality, arguing, correctly in my view, that *logos* in T54 refers to basic rationality.

³¹ ἀνάγκη ἄρα ἔχει μὲν τινα δύναμιν, μὴ τοιαύτην δ' ἔχει ἡ ἔσται τούτων τιμωτέρα κατ' ἀκρίβειαν. φαίνεται δὲ τοῦτό γε πᾶσιν ὑπάρχον τοῖς ζώοις. ἔχει γὰρ δύναμιν σύμφυτον κριτικὴν, ἣν καλοῦσιν αἰσθήσιν· ἐνούσης δ' αἰσθήσεως τοῖς μὲν τῶν ζώων ἐγγίγνεται μόνῃ τοῦ αἰσθήματος, τοῖς δ' οὐκ ἐγγίγνεται. ὅσοις μὲν οὖν μὴ ἐγγίγνεται, ἡ ὅλως ἢ περὶ ἃ μὴ ἐγγίγνεται, οὐκ ἔστι τοῦτοις γνώσις ἔξω τοῦ αἰσθάνεσθαι· ἐν οἷς δ' ἔνεστιν αἰσθομένοις ἔχειν ἔτι ἐν τῇ ψυχῇ. πολλῶν δὲ τοιούτων γινομένων ἥδη διαφορὰ τις γίνεται, ὥστε τοῖς μὲν γίνεσθαι λόγον ἐκ τῆς τῶν τοιούτων μονῆς, τοῖς δὲ μή.

³² My interpretation finds support in the parallel account in *Met* 1.1. Here Aristotle says that memory comes to be from perception (980a28–9), and he goes on to discuss the different cognitive abilities of

Aristotle's goal in T54 is to explain the origin of human understanding in the animal world broadly speaking. He advances the striking claim that our unique cognitive abilities emerge from a capacity common even to the lowliest of animals: perception. He does so with a view to defending his solution to the puzzle I examined in the previous section: since animal knowledge in general emerges from perception, we have some reason to think that the same holds true for human knowledge of first principles in particular. Aristotle does not try to explain the process or method by which we come to know first principles. Instead he provides an argument in support of his claim about where our knowledge originates.

6. Perception to *Nous*

The next passage focuses more specifically on the question of our knowledge of first principles:

T55 And so from perception there arises memory, as we say, and from memory (when it occurs often in connection with the same thing) experience; for many memories form a single experience. And from experience, or [rather] from the entire universal that has come to rest in the soul (the one apart from the many, whatever is one and the same in all those things), [there arises] a principle of craft and scientific knowledge (*technēs archē kai epistēmēs*)—of craft if it concerns what comes to be, of scientific knowledge if it concerns what is.³³ (100a3–9)

Aristotle identifies four stages prior to *nous*, which he here calls the 'principle of craft and scientific knowledge'.³⁴ perception, memory, experience, and the grasp of 'the entire universal'. By 'universal' Aristotle means, I take it, a proposition of the form 'all As are B'. We reach this universal by induction, which he discusses just after T55 (100a14–b5, T58).³⁵ However, knowing this universal is not equivalent to knowing a first principle. Aristotle is clear that *nous*, the state we are in when we know first principles, comes after knowing this universal, for he says that the principle of craft and scientific knowledge (i.e., *nous*) arises from the universal (*ek . . . tou katholou*,

animals on either side of this divide (980b21–5). He then contrasts those animals that live by perception and memory (and who have, he says, a small share of experience) with humans, who are capable of reasoning (*logismos*) and craft (*technē*) (980b25–8). We find, then, the same sequence of states in the two passages: perception, memory, reason.

³³ Έκ μὲν οὖν αἰσθήσεως γίνεται μνήμη, ὥσπερ λέγομεν, ἐκ δὲ μνήμης πολλάκις τοῦ αὐτοῦ γινομένης ἐμπειρία· αἱ γὰρ πολλαὶ μνήμαι τῷ ἀριθμῷ ἐμπειρία μία ἐστίν. ἐκ δ' ἐμπειρίας ἡ ἐκ παντὸς ἡρεμήσαντος τοῦ καθόλου ἐν τῇ ψυχῇ, τοῦ ἐνὸς παρὰ τὰ πολλὰ, ὃ ἂν ἐν ἅπασιν ἐν ἐνῇ ἐκείνοις τὸ αὐτό, τέχνης ἀρχὴ καὶ ἐπιστήμης, εἰ μὲν περὶ γένεσιν, τέχνης, εἰ δὲ περὶ τὸ ὄν, ἐπιστήμης.

³⁴ See APO 1.33, 88b36: 'by *nous* I mean the principle of scientific knowledge' (λέγω γὰρ νοῦν ἀρχὴν ἐπιστήμης); 2.19, 100b15: '*nous* is the principle of scientific knowledge' (νοῦς ἂν εἴη ἐπιστήμης ἀρχή). See also 1.3, 72b24.

³⁵ Aristotle says repeatedly that induction is the route from particulars to the universal. See, e.g., APO 1.1, 71a8–9, Top 1.12, 105a13–14.

100a6–7).³⁶ Nor is it the case that we reach knowledge of first principles directly after grasping this universal. Rather, I suggest that the universal we reach by induction is a preliminary account required for scientific inquiry. Aristotle omits important stages between grasping the universal and *nous*, and so there is a gap in his account. However, this gap is not filled by further inductive activity alone or by the allegedly intuitive activity of *nous*; rather, it is filled by the methods of inquiry he sets out earlier in Book 2.

In T54, Aristotle says that knowledge of first principles originates in perception. In T55, he continues to defend this claim by explaining how it is that perception, our lowliest cognitive ability, can play such a significant role. The explanation is that perception gives rise to memory, which leads to experience, which leads to a universal, from which the search for explanatory principles can properly begin, according to the methods outlined earlier in Book 2. Aristotle does not trot out a series of cognitive states with the hope of convincing us that this is a complete explanation of how we traverse the huge gulf from perception to *nous*. Rather, he starts to fill the gap between them with a reasonable progression of increasingly sophisticated cognitive states, which mark the early stages—and only the early stages—in our intellectual development. In this way, he once again defends his anti-Platonist answer to his first question in 2.19 and his solution to the puzzle that develops it.

7. Experience, Induction, and Inquiry

The role Aristotle attributes to experience in our ascent to *nous* is not easy to understand. One phrase in particular requires close attention: ‘from experience or [rather] from the entire universal that has come to rest in the soul’ (100a6–7). I have rendered the ‘or’ as a corrective,³⁷ indicating that the universal is its own stage distinct from experience. Some commentators disagree and take the ‘or’ epexegetically to mean ‘that is’.³⁸ On this view the phrase ‘the entire universal’ describes what we grasp at the level of experience.

It is hard to decide this dispute on the basis of T55 alone,³⁹ but the parallel discussion in *Metaphysics* 1.1 tips the balance in favour of the ‘corrective’ reading I have opted for.

³⁶ Contra Leshner (1973: 59) who identifies the universal at 100a6–7 with the principle of craft and scientific knowledge at 100a8. (This also appears to be Philoponus(?)’s view: in *An Post* 436.1–12.) For a convincing criticism of this view, see McKirahan 1992: 303 n23, 306 n95. Tuominen (2010: 125) and Salmieri (2010: 179–84) make the same mistake as Leshner, conflating what on grammatical grounds alone we must take to be two distinct stages (*ek... tou katholou... technēs archē kai epistēmēs*).

³⁷ See Bayer 1997: 124 n38, Charles 2000: 149–51, Hankinson 2011: 46–7, Irwin and Fine 1995: 67, Leshner 1973: 59 n38, McKirahan 1992: 243. *NE* 3.1, 1110a1–2 may provide a parallel.

³⁸ See Barnes 1993: 264, LaBarge 2006: 38, LeBlond 1996: 129 n1, Ross 1949: 674. For an especially strong defence of the epexegetic reading, see Hasper and Yurdin 2014: 122–3 n7.

³⁹ See LeBlond (1996: 129 n1) for a survey of views.

- T56** To have a judgment that when Callias was ill of this disease this did him good, and similarly in the case of Socrates and in many particular cases, is a matter of experience; but to judge that it has done good to all persons of a certain constitution, marked off in one class, when they were ill of this disease, for example to phlegmatic or bilious people when burning with fever, this is a matter of craft.^{40,41} (981a7–12)

He goes on to say that ‘experience is knowledge (*gnōsis*) of particulars’ as opposed to craft, which is of universals (981a15–16), and just before T56 he says that a single universal judgment about similar objects comes to be from experience (981a5–7). This provides strong support for the corrective reading, which draws a clear line between experience and the knowledge of a universal that emerges from it.

In both *APO* 2.19 and *Metaphysics* 1.1, Aristotle says that (1) many memories of the same thing (100a4 (in T55), 980b29) give rise to, or constitute, a single experience and that (2) experience gives rise to knowledge of a universal. How are these two moves meant to work? Consider the case of curing fevers. Aristotle’s idea seems to be that we have several memories of the same kind of curing process occurring in several different patients.⁴² We remember that applying leeches to the patient’s skin cured Socrates of fever, and Callias, and so on, and together these memories produce one experience. The experience is single, I suggest, because it is of a single phenomenon expressed in a single predicate—‘cured of fever by applying leeches’. At the same time, experience does not consist in a properly universal judgment because the predicate is attached to a plurality of individual subjects (Socrates, Callias, and so on) considered as individuals and not as belonging to a single kind or class. That is, the proposition that is the content of the experienced person’s judgment is not universal but particular: for example, Socrates was cured of fever by applying leeches. What experience does allow are correct judgments that apply the predicate to other individuals not included in our memories. Because we remember Socrates, Callias, and others being cured of fever by applying leeches, and because these memories form a single experience of fever-curing, we can judge correctly that, for example, Coriscus too will be cured in this way.⁴³ We take the first step beyond experience and toward scientific knowledge when we grasp that the individuals familiar from experience form a single kind, which is unified by a common, salient feature: say, being phlegmatic. At this point we judge that a single predicate belongs universally to a kind: all phlegmatics are cured of fever by applying leeches.

⁴⁰ τὸ μὲν γὰρ ἔχειν ὑπόληψιν ὅτι Καλλιὰ κάμνοντι τὴνδὲ τὴν νόσον τοδὶ συνήνεγκε καὶ Σωκράτει καὶ καθ’ ἕκαστον οὕτω πολλοῖς, ἐμπειρίας ἐστίν· τὸ δ’ ὅτι πᾶσι τοῖς τοιοῖσδε κατ’ εἶδος ἐν ἀφορισθεῖσι, κάμνουσι τὴνδὲ τὴν νόσον, συνήνεγκεν, οἷον τοῖς φλεγματώδεσιν ἢ χολώδεσι [ἢ] πυρέττουσι καύσω, τέχνης.

⁴¹ Ross’s translation, in Barnes 1984, altered slightly.

⁴² When Aristotle says that we have many memories of the same thing, I take it he means the same *kind* of thing (e.g., a certain kind of cure for a certain kind of illness), not the same *particular* thing (e.g., Socrates).

⁴³ See Charles 2000: 151–2.

This account, drawn largely from Aristotle's discussion in *Metaphysics* 1.1, fits neatly with T55 from *APO* 2.19. Aristotle identifies two stages: experience and knowledge of a universal. He characterizes the universal as 'the one apart from the many, that which is one and the same in all those things' (100a7–8). The referent of 'all those things' is 'the many memories' that are said at 100a5–6 to form a single experience. Aristotle's point is that to move from experience to knowledge of this universal we must see what is common to all of the memories constituting our experience—we must see, for example, that it was being phlegmatic that was common to Socrates, Callias, and so on, who, we remember, were cured of their fevers by applying leeches. This interpretation helps make sense of the curious phrase 'the entire universal'. This is Aristotle's way of signaling that the universal emerges from, and comprehends, the whole of our previous experience, and in particular all of the memories that help constitute it, a point he emphasizes in the bracketed bit.

The move from experience to knowledge of a universal, explained and illustrated in *Metaphysics* 1.1 and summarized in *APO* 2.19, is an example of induction. Although Aristotle does not use this term either in T55 or in *Metaphysics* 1.1, what he describes in the *Metaphysics* fits the bill exactly. Induction, he says in *APO* 1.1, is 'revealing the universal through the particular being clear'⁴⁴ (71a8–9). In *Topics* 1.12, he calls it 'the advance from particulars to the universal' (105a13–14).⁴⁵ Although he uses the term in other ways,⁴⁶ throughout the *APO* and the *Topics* it usually signifies (as I mentioned above in section 2) the means by which we move from knowledge of several particulars to knowledge of a universal proposition (of the form 'all As are B') that identifies something they share in common.⁴⁷ As we have seen, this is just what occurs in the move from experience to the universal.

The universal we come to know by induction (e.g., all phlegmatics are cured of fever by applying leeches) is not a definition in or first principle of any science or craft. Being cured of fever in a particular way is not what it is to be phlegmatic. It might turn out that the predicate expresses a consequence of what it is to be phlegmatic, but the inquirer who grasps the proposition does not know that at this stage. Instead, the universal is a preliminary account of phlegmatism, analogous to the second preliminary account of eclipse in *APO* 2.8 ('the full and unobstructed moon's inability to cast shadows'; see Chapter 10§12). (I take it that being phlegmatic is a demonstrable attribute of a certain subject, just as eclipse is a demonstrable attribute of the moon.) The account is useful because it identifies a candidate *explanandum* whose genuineness the inquirer will seek to confirm. She hypothesizes that there is a non-accidental connection between being the sort of subject that is

⁴⁴ οἱ δὲ δεικνύντες τὸ καθόλου διὰ τοῦ δηλόν εἶναι τὸ καθ' ἕκαστον.

⁴⁵ See also *APO* 1.18, 81b2, 2.7, 92a37–b1, *Top* 1.18, 108b11, 8.1, 156a4–5, 156b14, *SE* 14, 174a34.

⁴⁶ See Ross 1949: 47–51, 481–3, Engberg-Pedersen 1979. Induction sometimes consists in grasping a particular in light of a universal; see *APr* 2.21, 67a23 and *APO* 1.1, 71a21, T5b (see Chapter 1§8).

⁴⁷ See Engberg-Pedersen 1979: 304–5.

phlegmatic and being the sort of subject that is cured of fever by applying leeches, and she tests her hypothesis against the particular facts of her experience. If her search is successful, she discovers that it is not by chance that this cure is effective for phlegmatics; she knows that there is a cause, an explanatory middle term, that links subject and predicate in her initial judgment.⁴⁸ At this point in her search, she knows the fact that such a connection exists, but she does not yet know the cause, the reason why (although crucially she does know that there *is* a cause). She is, however, in an excellent position to seek the cause, because she can return to the particulars she knows through experience and investigate what it is about phlegmatism that makes the sort of subject that is phlegmatic susceptible to this cure.

If my interpretation is right, then the move from experience to the universal is not, as scholars often suppose, the move from facts to causes,⁴⁹ but the move from particular to universal facts for which we then seek causes (by first confirming that they *have* causes). In this way, the sequence Aristotle sets out in T55—perception, memory, experience, knowledge of the universal—tells the pre-history of scientific inquiry by identifying the cognitive states that precede the search for causes, definitions, and first principles as discussed earlier in *Apo* 2.

T55 ends with the claim that *nous* emerges from (our knowledge of) ‘the entire universal’. This too is compatible with the account of inquiry earlier in *Apo* 2. If my interpretation is right, then *nous* emerges only indirectly via the methods set out in 2.1–10 and 13 (induction, division, and demonstration). There is, therefore, a significant gap between knowledge of the universal and *nous*. This gap is filled by the 2.1–10, 13 account. But this methodological story is the background to 2.19, not its subject-matter. The chapter’s goal is instead to secure perception as the capacity from which it all begins.

8. The Rout Simile

Aristotle’s account in 2.19 continues in the following passage in which he summarizes T55 and the central claim of *Apo* 2.19:

T57 Thus the states [in which we know principles] neither inhere [in us] in a determinate form nor come about from other states that are more knowing; rather, [they come about] from perception, as in a battle when a rout has happened, first one [soldier] makes a stand, then another does, and then another until a starting-point (*archēn*) is reached. And the soul is the sort of thing that is capable of undergoing this.⁵⁰ (100a10–14)

⁴⁸ See Charles 2000: 157–70. For a different account, see Gregorić and Grgić 2006 and LaBarge 2006.

⁴⁹ See McKirahan 1992: 240–3.

⁵⁰ οὐτε δὴ ἐνυπάρχουσιν ἀφωρισμέναι αἱ ἕξεις, οὐτ’ ἀπ’ ἄλλων ἕξεων γίνονται γνωστικωτέρων, ἀλλ’ ἀπὸ αἰσθήσεως, ὅλον ἐν μάχῃ τροπῆς γενομένης ἐνὸς στάντος ἑτερος ἔστη, εἰθ’ ἑτερος, ἕως ἐπὶ ἀρχὴν ἦλθεν. ἡ δὲ ψυχὴ ὑπάρχει τοιαύτη ὅσα οἷα δύνασθαι πάσχειν τοῦτο.

Nous of first principles originates in perception of particulars. Similarly, when an army reaches a ‘starting-point’ (perhaps for an organized retreat or a second attack on the enemy), this originates in the activity of individual soldiers taking a stand. And just as there are several intermediate stages between the individual soldiers taking a stand and the army reaching a starting-point, so too there are several intermediate stages between perception and *nous*. T57 does not indicate that *nous* of principles comes directly from perception, nor does it indicate that induction is the route to it.⁵¹

9. Perception and Induction: Preliminaries

We now arrive at the final passage in 2.19 in which Aristotle addresses the question of the origin of our knowledge of principles:

- T58** (a) Let us say again what we have said just now but not said clearly. (b) When one of the undifferentiated things makes a stand, there is a first (*prōton*) universal in the soul; for although one perceives the particular, perception is of the universal, for example of human being, not of Callias the human being. (c) Again a stand is made among these things, until things that are partless and universal make a stand. For example such-and-such an animal [makes a stand], until animal does; and with animal [a stand is made] in the same way. (d) Thus it is plain that we must get to know the *prōta* by induction; for in fact perception instills the universal in this way.⁵² (100a14–b5)

This is the passage that would seem to provide the strongest support for the view I have been arguing against—namely, that Aristotle’s aim in *APO* 2.19 is to advance the claim that induction is the method by which we acquire knowledge of first principles. He says that we get to know the *prōta* (‘first things’, ‘primaries’) by induction. Since he uses ‘primary’ and ‘principle’ (*archē*) inter-changeably throughout the *APO*,⁵³ and since *nous* is the state that knows first principles, it seems to follow straightforwardly that, according to T58, we reach *nous* of first principles by induction.

However, this reading is not a happy one. As I discussed above in section 2, induction is too weak to get us to *nous*. First principles are the most explanatorily powerful entities in a science, and (I have argued) to acquire *nous* of them—to get to know first principles *as* principles—requires seeing them in their capacity to explain.

⁵¹ For a helpful discussion of the rout simile, see Leshner 2010b and 2011. In Bronstein 2012, I offer a different interpretation from the one I present here. I am grateful to Tim Clarke for pointing me in this new direction.

⁵² ὁ δ’ ἐλέχθη μὲν πάλοι, οὐ σαφῶς δὲ ἐλέχθη, πάλιν εἰπωμεν. στάντος γὰρ τῶν ἀδιαφόρων ἐνός, πρῶτον μὲν ἐν τῇ ψυχῇ καθόλου (καὶ γὰρ αἰσθάνεται μὲν τὸ καθ’ ἕκαστον, ἡ δ’ αἰσθησις τοῦ καθόλου ἐστίν, οἷον ἀνθρώπου, ἀλλ’ οὐ Καλλίου ἀνθρώπου)· πάλιν ἐν τούτοις ἵσταται, ἕως ἂν τὰ ἀμερῇ στήῃ καὶ τὰ καθόλου, οἷον τοιονδὶ ζῶον, ἕως ζῶον, καὶ ἐν τούτῳ ὡσαύτως. δῆλον δὲ ὅτι ἡμῖν τὰ πρῶτα ἐπαγωγῇ γνωρίζειν ἀναγκαῖον· καὶ γὰρ ἡ αἰσθησις οὕτω τὸ καθόλου ἐμποιεῖ.

⁵³ See *APO* 1.2, 71b21 (in T10), 72a6–7, 1.3, 72b5, 1.6, 74b24–5, 1.9, 76a30.

However, there is no hint in T58 that induction involves explanatory reasoning of the sort required by Aristotle's account. How, then, could it get us to *nous*?

One might argue that Aristotle's claim in T58d is that we acquire by induction *non-noetic* knowledge of first principles. After all, in the previous chapter (section 12) I argued that we acquire by induction *non-noetic* knowledge of the definitions of genera, and these definitions are first principles, so perhaps T58 is describing the same inductive process.

However, there is a significant problem with this way of reading T58. If it were right, then Aristotle would be saying that we first learn the definition of human being and then the definition of animal, but this reverses the proper order of discovery, which goes from the essence of the genus to the essence of the species.⁵⁴ Even if (contrary to my account in the previous chapter) it were possible to learn the definition of human being without knowledge of the definition of animal, learning the former would seem to require some grasp of the latter. For how can you get to know what a human being is without some grasp of what an animal is? And yet T58 gives the impression that we grasp human being well before we grasp animal. In addition, in *APO* 2.13 (T49), Aristotle says that the result of induction 'will be the definition of the object' (97b13), a claim he does not make in T58, which suggests that he is not explaining how we learn definitions.

The interpretation of 2.19 I have defended points toward a different and, I believe, more satisfying reading of T58. It is uncontroversial to say that the passage describes how we acquire a grasp of certain universals. I suggest that these are the same universals Aristotle discusses in T55 ('the entire universal', 100a5–6): universal propositions of the form 'all As are B' our knowledge of which emerges from perception, memory, and experience. But what, then, are we to make of the claim in T58d that we get to know the *prōta* by induction? In T58b, Aristotle speaks of our acquisition of a *prōton* ('first') universal. I suggest that *prōta* in T58d picks up *prōton* in T58b. Aristotle's claim is that we get to know the *first universals* by induction. 'First' is a fitting term given that, as I argued above in sections 6–7, these serve as the preliminary accounts for scientific inquiry. On this reading, the *prōta* are first in the order of discovery, not in the order of knowing. T55 identifies the states from which we acquire these first universals: perception, memory, and experience. T58 supplements this account by identifying the means by which we acquire them: induction. In this way, T58 contributes to the main argument of *APO* 2.19: since induction, starting from perception, gets us to first universals (preliminary accounts), and since these universals are necessary for scientific inquiry, and since successful inquiry ends with noetic knowledge of a first principle, Aristotle is justified in claiming that our knowledge of first principles originates in perception.

⁵⁴ *Top* 6.4, 141b25–34. See Bolton 1991: 8.

I argued in the previous chapter that in defining a genus by induction and its species by division, the inquirer relies on preliminary accounts of the objects to be defined. Aristotle owes us an explanation of how these accounts are acquired. On my reading, the explanation is in T58. According to T58, we ascend from perceptions of particulars such as Socrates and Callias to preliminary accounts of human being and animal. According to *APO* 2.13 (T49), we then employ these accounts when we ascend again from particulars to species and from species to genus in defining the genus by induction. We employ them again when we descend from the genus to the species in defining the species by division. The first ascent, which is what T58 describes, is ordinary learning. The second ascent and the descent, which are what *APO* 2.13 describes, are scientific learning—discovering real definitions.

This interpretation makes good sense of Aristotle's promise in T58a to explain 'what we have said just now but not said clearly.' This refers specifically to 100a6–8 (in T55), where Aristotle indicates that a certain kind of universal emerges from perception, memory, and experience. The goal of T58 is to clarify our inductive advance (alluded to in T55) from perception of sensible particulars to knowledge of a preliminary account.

This interpretation also makes good sense of the last part of T58d, where Aristotle explains (*gar*) his remark about induction: 'for in fact perception instills the universal in this way' (100b4–5). The universal that perception instills is a *first* universal, a universal proposition that can serve as a preliminary account, our knowledge of which is closely tied to our perceptual experience; and the way perception instills it is by induction. If this interpretation of *prōta* in T58d is right, then T58 does not claim that induction is the way we acquire (noetic or non-noetic) knowledge of first principles. Instead it claims that induction is the way we acquire knowledge of the preliminary accounts that facilitate the search for definitions, which is where the real work of learning first principles takes place.⁵⁵

In the previous chapter (section 12), I argued that induction is sufficient for acquiring non-noetic knowledge of some but not all first principles, namely, the definitions of genera. It is not sufficient for acquiring (non-noetic or noetic) knowledge of the definitions of species, for, as we saw, knowing the essence of a species requires knowing the proper order of the attributes in the essence, and Aristotle argues that only division can reliably reveal this. Aristotle also thinks that induction is necessary (but not sufficient) for acquiring noetic knowledge of all definitional first principles. This is because induction is necessary (and sufficient) for acquiring knowledge of the preliminary accounts required for discovering definitions by

⁵⁵ Kahn (1981: 396) gestures at an account similar to my own: 'As described in II 19, induction seems to account only for a nominal definition of eclipse as darkening of the moon. The gap between this and the scientific account given by Anaxagoras would have to be filled by a much more complex theory of induction and scientific method which Aristotle scarcely attempts'. In my view, *APO* 2.1–10 and 13 present the method Kahn finds missing.

division and induction, as discussed in *APo* 2.13. That we learn these preliminary accounts by induction from perception is Aristotle's principal claim in T58, on my reading.⁵⁶

10. Perception and Induction: Details

Let's look more closely at T58—a challenging text on anybody's reading.

T58 (b) When one of the undifferentiated things makes a stand there is a first (*prōton*) universal in the soul; for although one perceives the particular, perception is of the universal, for example of human being, not of Callias the human being.

Aristotle begins to clarify our acquisition of universals by assigning an important role to perception. Some scholars take 'one of the undifferentiated things' to be one of the indivisible species⁵⁷—for example, human being—which is undifferentiated because it cannot be sub-divided into further species. The problem with this reading, as Barnes points out, is that the burden of the passage is to explain how we acquire a grasp of such species.⁵⁸ Far from explaining their acquisition, Aristotle begins the passage by assuming we already have them. A better reading assigns a different meaning to 'undifferentiated'. Aristotle often uses it to refer to individuals such as Callias and Socrates, which are 'undifferentiated [i.e., the same] in species'.⁵⁹ Aristotle's point is that when a particular human being, for example Callias, 'makes a stand' in the soul, we acquire a 'first universal'. Callias 'makes a stand' in the soul when, as a result of perceiving him, we retain a perceptual representation of him—that is, a memory.

The next step is to understand how it is that when we retain a perceptual representation of a particular we possess a first universal. Suppose I have perceived one human being (Callias) and possess as a result one perceptual representation of a human being. I have not thereby reached the universal proposition 'all human beings are two-footed animals' (a preliminary account of human being). However, Callias instantiates a number of universal features, such as being a human being, being an

⁵⁶ My interpretation of T58 is consistent with Aristotle's three main discussions of induction and first principles outside of *APo* 2: *APo* 1.18, *NE* 1.7, 1098b3–4, and 6.3, 1139b28–31. Each of these passages suggests the weak claim that induction is necessary for learning principles, not the strong claim that it is sufficient.

⁵⁷ See Barnes 1993: 266, McKirahan 1992: 245, Ross 1949: 677.

⁵⁸ See Barnes 1993: 266; see also Tredennick's Loeb translation and Bayer 1997: 126.

⁵⁹ See *Top* 1.7, 103a10–11, *PA* 1.4, 644a24, *DC* 1.8, 277a2. See also *APo* 2.13, 97b7–8 (in T49), discussed in the previous chapter. For a similar interpretation of 'undifferentiated' in T58b, see Salmieri 2010: 165–6. For a much different interpretation, see Bolton (1991: 6–9) who takes each of them to be 'a unity composed of (as yet) undifferentiated things' (1991: 6) and identifies them with the confused universals discussed in *Phys* 1.1. Attractive as this reading is, I have found no other passage in Aristotle where 'undifferentiated' has this meaning, and Bolton cites none, which gives us some reason for doubt.

animal, being two-footed, and so on. In virtue of receiving and retaining a perceptual representation of Callias, I receive and retain (although I do not yet grasp) the universal features encoded in the image. So when Aristotle says that when I retain a representation of Callias there is a first universal in my soul, he means there is a first universal in my soul *potentially*. To decode the relevant universals and reach a preliminary account I need to acquire a number of other images of particular human beings and then move inductively to a universal proposition that identifies something they all share in common.

If this interpretation is right, then we can make sense of Aristotle's otherwise mysterious statement in the second part of T58b that 'although one perceives the particular, perception is of the universal, for example of human being, not of Callias the human being' (100a16–b1). When we perceive a particular (Callias) we retain a perceptual representation of it. The content encoded in this representation outstrips what the faculty of perception alone can grasp, since the content includes universal features (e.g., human being, two-footed) that the perceived particular instantiates. So the faculty of perception is receptive of universals, even though it cannot apprehend them as such. Perception is of the universal, not because the universal is perceivable, but because the universal is instantiated in particulars each of which is perceivable, and in virtue of this the universal is encoded in the representations we receive when we perceive particulars.⁶⁰ Perceiving particulars is necessary but not sufficient for reaching universals. We need the perceptual faculty as a whole (including imagination and memory) and experience, which provide the basis for our advance.

In T58d, Aristotle calls the advance to the universal 'induction'. For example, from our grasp—acquired via perception, memory, and experience—that several particular human beings (Callias, Socrates, and so on) are two-footed, we grasp that all human beings are two-footed. T58 gives a sketch of how this takes place. As a result of perceiving Callias, Socrates, and so on we retain perceptual representations of each of them ('when one of the undifferentiated things makes a stand', 100a15–16, T58b). These representations resemble each other in some respects and differ in others. We have what Aristotle in T55 calls 'experience' when we take one of these common features (e.g., being two-footed) and predicate it individually of each of the particulars represented in our images. So we perceive that Callias is two-footed, and Socrates, and so on, and we apply the same predicate to new particulars we encounter. Induction takes place when we grasp that this common feature belongs to all members of a kind signified by a single term—for example, all

⁶⁰ Compare Aristotle's claim in *APo* 1.31 that 'perception (*aisthēsis*) is of what is such-and-such', that is, universal (87b28–9). Here too he insists that we perceive (*aisthanesthai*) particulars and that it is impossible to perceive universals (87b29–31). He clarifies the connection between perception and the universal at the end of the chapter when he says that it is *from*, and not *by*, seeing that we grasp universals (88a12–14). He means that on the basis of perceiving particulars we grasp, via induction, the universal. This is the same claim he makes in T58.

human beings.⁶¹ The perceptual faculty makes an essential contribution to this, for in this case induction proceeds from sensible particulars our only access to which is through perception.⁶² Hence Aristotle can claim in the final clause of T58d that ‘perception instills the universal in this way [namely, by induction]’ (100b4–5). For, however brief and sketchy his account may be, T58b–c does make it clear that the faculty of perception provides the resources for our inductive advance.

The universals we acquire by induction are, as I suggested above, the propositions that serve as preliminary accounts we use to begin inquiring—the same ones Aristotle has in mind in his discussion of ‘the entire universal’ in T55: for example, all human beings are two-footed animals. In *APO* 2.8, in the list of preliminary accounts, we find ‘human being is a certain kind of animal’ (93a23–4, T32a). The phrase ‘a certain kind’ is a placeholder for an attribute all human beings share, one that, according to T58, we should be able to access through perception—hence ‘two-footed’ is a good candidate. We use this preliminary account to begin our search (by the method of division) for the complete definition, which expresses the complete essence, of human being.⁶³

Aristotle’s account continues:

T58 (c) Again a stand is made among these things, until things that are partless and universal make a stand. For example such-and-such an animal [makes a stand], until animal does; and with animal [a stand is made] in the same way.

Aristotle indicates that the inductive process by which we acquire preliminary accounts of species such as human being repeats itself at higher levels of generality. By ‘these things’ he means a plurality of species (e.g., human being, horse), and by ‘making a stand’ he means grasping a feature they share in common. In this way, T58b and c describe different types of inductive advance. In b, we move from

⁶¹ *APO* 1.31, 88a16 gives us some reason to think that Aristotle’s term for our knowledge of the universals obtained via induction is *noēsis*. However, contra Leshner 1973, it does not follow that *nous* is the state we are in when we know such universals, nor does it follow that there is no difference between *noēsis* of such universals and *nous* of first principles. In the *APO*, *noēsis* is used for our knowledge of any universal connection; *nous* is reserved for our knowledge of first principles. (Elsewhere there is a tighter connection between the two: *noēsis* is the activity of *nous*; see *Met* 12.9, 1074b15–35.) See McKirahan (1992: 257–9) whose objections to Leshner’s account I take to be decisive.

⁶² *APO* 1.18, 81b5–9.

⁶³ My interpretation is similar to a version of what we might call ‘the concept view’ of T58. According to this view Aristotle draws no strict distinction between concepts and propositions because he assumes that grasping concepts involves, or can be cashed out in terms of, grasping propositions, and T58 describes our acquisition of such concepts/propositions. (See Barnes 1993: 271, Bayer 1997: 119 n22, Charles 2000: 264 n37, Hamlyn 1976: 178, Kahn 1981: 393–5, McKirahan 1992: 246–7, Modrak 1987: 162, 164.) For example, grasping the concept ‘human being’ involves grasping a proposition such as ‘human beings are two-footed animals’. The main reason I avoid using ‘concept’, preferring instead ‘preliminary account’, is that ‘concept’ risks obscuring what I take to be the central question about T58: does it describe our acquisition of full-fledged scientific definitions? I say ‘no’, but not all defenders of the concept view agree, for some think that grasping a concept involves, or can be cashed out in terms of, grasping a complete definition. (See Charles 2000: 264 n37, Modrak 1987: 164.)

memories of several sensible particulars to the grasp of a universal proposition that identifies something they share in common. In c, we move from the grasp of several species to the grasp of a universal proposition that identifies something they share in common. Since Aristotle defines induction as the advance from particulars to a universal, the idea in c seems to be that species are treated as particulars, and we move from them to the next level of universality; the process is then repeated. For example, from our grasp that all humans are two-footed and all horses are four-footed, and so on, we grasp that all footed things are a certain kind of animal ('animal of such-and-such a kind', 100b2–3)—for example, land-dwelling. We are then led to grasp something about all animals, for example, that they are living beings of a certain sort. We eventually grasp something about all substances (one of the 'partless universals', 100b2),⁶⁴ at which point our ascent comes to a stop.⁶⁵ The result of each inductive step is a universal proposition that can serve as a preliminary account our knowledge of which allows us to seek the relevant object's essence.

Conclusion

I have argued that *APo* 2.19 assigns an important but limited role to induction: it is the means by which we acquire preliminary accounts. So the direct outcome of induction is not noetic knowledge of a first principle. The preliminary accounts we acquire by induction do not state the complete essences of the relevant objects and so they are not full-fledged scientific definitions; rather, they identify features of those objects that allow us to seek their essences.⁶⁶ Aristotle does not need induction to contribute anything more to our acquisition of knowledge of first principles in order for him to answer the first question he raises at the start of 2.19 (how do the principles become known?). For, as I have argued, the question concerns the original prior knowledge from which first principles begin to become known, not the whole route we traverse to them.

⁶⁴ I follow Ross (1949: 678) in taking 'the partless things' (100b2) to refer to the categories of being: substance, quality, quantity, etc.

⁶⁵ Compare the similar sequence in *APo* 1.22, 83b3: 'human being is two-footed, this [i.e., two-footed] is animal, this [i.e., animal] is another thing' (ἄνθρωπος δίπους, τοῦτο ζῷον, τοῦτο δ' ἕτερον).

⁶⁶ Charles (2000: 266–9) objects to deflationary interpretations, of the sort I defend, on the ground that they are not sufficient to rule out a 'Platonist' reading of *APo* 2.19, according to which we acquire knowledge of principles by *nous*, conceived of as a faculty of intuition. (This is what I called the 'rationalist' and 'intuitionist' view above in sections 1–3.) I have tried to block this objection by arguing that while there is a gap between the knowledge we gain by induction, as described in 2.19, and noetic knowledge of principles, this gap is not filled by the intuitive activity of *nous* (as Charles worries it will be) but by the account of inquiry earlier in Book 2, where defining and explaining, not intuition, are the means by which we acquire *nous*.

Conclusion

To learn, for Aristotle, is to acquire knowledge. But more than that, learning is the process by which one becomes a certain kind of person: a knower, especially a scientific knower—an expert scientist. In this book, I have argued that the *APo* guides us through all of the stages in the intellectual development of a scientist, from the earliest stages of learning to the final stages in which she achieves the highest intellectual grasp of the first principles of her science: *nous*. Along the way Aristotle explains the nature of the knowledge she acquires at each stage in her development and the nature of the objects she knows. Aristotle’s account of learning is substantially informed by Meno’s Paradox. In explaining how an inquirer proceeds through the different stages in the Socratic Picture of the order of inquiry, he provides (at least implicitly) compelling solutions to different instances of the puzzle and to different puzzles reminiscent of it, each of which threatens the possibility of a different type of learning or inquiry.

Aristotle also provides a robust, non-intuitionist, and non-mysterious account of how we reach *nous* of the first principles of science, especially the definitions of subject-kinds. We first acquire non-noetic knowledge of them by means of division or induction. We then acquire noetic knowledge of them by explaining from them the kind’s demonstrable attributes (in itself accidents). By seeing how the essence of S explains S’s demonstrable attributes, the inquirer arrives at *nous* of S’s essence. In the order of inquiry, demonstration comes after division and induction and builds on (and confirms) their results. This is characteristic of Aristotle’s practice throughout the *APo* of making the order of presentation the reverse of the order of discovery. Moving backwards through the text, he explains how we acquire preliminary accounts (2.19), which we use to discover by induction the causally simple essences of primary subject-kinds (end of 2.13). Knowledge of preliminary accounts and the essences of primaries is also necessary for seeking by division the essences of subordinate subject-kinds (rest of 2.13). According to the Socratic Picture, knowledge of the essence of a subject-kind S aids our search for its demonstrable attributes and their causes and essences (2.8). Finally, knowledge of definitions in general, both of subject-kinds and of demonstrable attributes, is required for learning by demonstration, which experts are able to undertake (Book 1). In this way, the *APo* provides a surprisingly complete and coherent account of knowledge and learning.

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