POSTERIOR ANALYTICS

The Posterior Analytics contains Aristotle's epistemology and philosophy of science. His approach is broadly speaking foundational. Some of what we know can be justified by being shown to follow logically from other things that we know, but some of what we know does not need to be justified in this way. Such items of foundational knowledge are the first principles of the various sciences. In the excerpts below, Aristotle sets out the axiomatic structure of a science and presents his theory of explanation. The final chapter provides a tantalizing but obscure presentation of his ideas on the acquisition of first principles.

BOOK I

71a All teaching and all intellectual learning result from previous cognition. This is clear if we examine all the cases; for this is how the mathematical sciences and all crafts arise. This is also true of both deductive and inductive arguments, since they both succeed in teaching because they rely on previous cognition: deductive arguments begin with premisses we are assumed to understand, and inductive arguments prove the universal by relying on the fact that the particular is already clear. Rhetorical arguments also persuade in the same way, since they rely either on examples (and hence on induction) or on argumentations (and hence on deduction).

Previous cognition is needed in two ways. In some cases we must presuppose that something is1 (for example, that it is true that everything is either asserted or denied truly <of a given subject>). In other cases we must comprehend what the thing spoken of is (for example, that a triangle signifies this); and in other cases we must do both (for example, we must both comprehend what a unit signifies and presuppose that there is such a thing). For something different is needed to make each of these things clear to us.

We may also recognize that q by having previously recognized that p and

1. that something is: lit. 'that (subject unexpressed) is', hoti estin. We render this by 'that it is true' in 71a14 and by 'that there is such a thing' in 71a16. Cf. 93b33, Phys. 193a3, 217b31.
acquiring recognition of \( q \) at the same time <as we acquire recognition of \( r \>). This is how, for instance, we acquire recognition of the cases that fall under the universal of which we have cognition; for we previously knew that, say, every triangle has angles equal to two right angles, but we recognize that this figure in the semicircle is a triangle at the same time as we perform the induction <showing that this figure has two right angles>. For in some cases we learn in this way, (rather than recognizing the last term through the middle); this is true when we reach particulars, i.e. things not said of any subject.

Before we perform the induction or the deduction, we should presumably be said to know in one way but not in another. For if we did not know without qualification whether <a given triangle> is, how could we know without qualification that it has two right angles? But clearly we know it insofar as we know it universally, but we do not know it without qualification. Otherwise we will face the puzzle in the Meno, since we will turn out to learn either nothing or else nothing but what we <already> know.

For we should not agree with some people's attempted solution to this puzzle. Do you or do you not know that every pair is even? When you say you do, they produce a pair that you did not think existed and hence did not think was even. They solve this puzzle by saying that one does not know that every pair is even, but rather one knows that what one knows to be a pair is even. In fact, however, <contrary to this solution>, one knows that of which one has grasped and still possesses the demonstration, and the demonstration one has grasped is not about whatever one knows to be a triangle or a number, but about every number or triangle without qualification; for <in a demonstration> a premiss is not taken to say that what you know to be a triangle or rectangle is so and so, but, on the contrary, it is taken to apply to every case.

But, I think, it is quite possible for us to know in one way what we are learning, while being ignorant of it in another way. For what is absurd is not that we <already> know in some way the very thing we are learning; the absurdity arises only if we already know it to the precise extent and in the precise way in which we are learning it.

2. Otherwise we . . . <already know>: Plato presents the puzzle (Meno 80a–d) as follows: (1) For any item \( x \), either one knows \( x \) or one does not know \( x \). (2) If one knows \( x \), one cannot inquire into \( x \). (3) If one does not know \( x \), one cannot inquire into \( x \). (4) Therefore, whether one knows or does not know \( x \), one cannot inquire into \( x \). Aristotle solves the puzzle by rejecting (2) and distinguishing different sorts of knowledge: one can inquire into what one knows in some way, so long as one is inquiring in order to know it in another way, or in order to know some different fact about it. (The beginning of APo i 1 may allow that one can inquire in the absence of knowledge, so long as one has suitable beliefs, in which case Aristotle rejects not only (3) but also (2).)
We think we know a thing without qualification, and not in the sophistic, coincidental way, whenever we think we recognize the explanation because of which the thing is <so>, and recognize both that it is the explanation of that thing and that it does not admit of being otherwise. Clearly, then, knowing is something of this sort; for both those who lack knowledge and those who have it think they are in this condition, but those who have the knowledge are really in it. So whatever is known without qualification cannot be otherwise.

We shall say later whether there is also some other way of knowing; but we certainly say that we know through demonstration. By 'demonstration' I mean a deduction expressing knowledge; by 'expressing knowledge' I mean that having the deduction constitutes having knowledge.

If, then, knowing is the sort of thing we assumed it is, demonstrative knowledge must also be derived from things that are true, primary, immediate, better known than, prior to, and explanatory of the conclusion; for this will also ensure that the principles are proper to what is being proved. For these conditions are not necessary for a deduction, but they are necessary for a demonstration, since without them a deduction will not produce knowledge.

The conclusions must be true, then, because we cannot know what is not <true> (for example, that the diagonal is commensurate). They must be derived from <premisses> that are primary and indemonstrable, because we will have no knowledge unless we have a demonstration of these <premisses>; for to have non-coincidental knowledge of something demonstrable is to have a demonstration of it.

They must be explanatory, better known, and prior. They must be explanatory, because we know something whenever we know its explanation. They must be prior if they are indeed explanatory. And they must be previously cognized not only in the sense that we comprehend them, but also in the sense that we know that they are <true>. Things are prior and better known in two ways; for what is prior by nature is not the same as what is prior to us, nor is what is better known <by nature> the same as what is better known to us. By 'what is prior and better known to us' I mean what is closer to perception, and by 'what is prior and better known without qualification' I mean what is further from perception. What is most

3. explanation: or 'cause', aitia. Aristotle is thinking not only of an explanatory statement, but also of the event or state of affairs that the statement refers to.

4. better known: gnōrimōterōn. The term is cognate with the verb (gnōrizēin) that we translate 'cognize' or 'recognize'. Aristotle applies it both to things that are 'more knowable' in themselves and to things that are 'more familiar' to us (see 72a1ff); hence we translate it uniformly as 'better known'.
universal is furthest from perception, and particulars are closest to it; particular and universal are opposite to each other.

Derivation from primary things is derivation from proper principles. (I mean the same by 'primary things' as I mean by 'principles'.) A principle of demonstration is an immediate premiss, and a premiss is immediate if no others are prior to it. A premiss is one or the other part of a contradiction, and it says one thing of one thing. It is dialectical if it takes either part indifferently, demonstrative if it determinately takes one part because it is true. A contradiction is an opposition which, in itself, has nothing in the middle. The part of the contradiction that asserts something of something is an affirmation, and the part that denies something of something is a denial.

By 'thesis' I mean an immediate principle of deduction that cannot be proved, but is not needed if one is to learn anything at all. By 'axiom' I mean a principle one needs in order to learn anything at all; for there are some things of this sort, and it is especially these to which we usually apply the name.

If a thesis asserts one or the other part of a contradiction—for example, that something is or that something is not—it is an assumption; otherwise it is a definition. For a definition is a thesis (since the arithmetician, for example, lays it down that a unit is what is indivisible in quantity), but it is not an assumption (since what it is to be a unit and that a unit is are not the same).

Since our conviction and knowledge about a thing must be based on our having the sort of deduction we call a demonstration, and since we have this sort of deduction when its premisses obtain, not only must we have previous cognition about all or some of the primary things, but we must also know them better. For if \( x \) makes \( y \) \( F \), \( x \) is more \( F \) than \( y \); if, for instance, we love \( y \) because of \( x \), \( x \) is loved more than \( y \). Hence if the primary things produce knowledge and conviction, we must have more knowledge and conviction about them, since they also produce it about subordinate things.

Now if we know \( q \), we cannot have greater conviction about \( p \) than about \( q \) unless we either know \( p \) or are in some condition better than knowledge about \( p \). This will result, however, unless previous knowledge

5. contradiction: reading antiphaseōs, and omitting apophanseōs... morion, b11-12. 'Pleasure is good' and 'Pleasure is not good' (i.e. it is not the case that pleasure is good) are the two parts of a contradiction.

6. dialectical... demonstrative: see Top. 100a25-b23.

7. Now if we know... than knowledge about p: More literallly: 'We cannot have greater conviction about things that we neither know nor are better disposed towards than if we knew, than <we have> about things we know.'
<of the principles> is the basis of conviction produced by demonstration; for we must have greater conviction about all or some of the principles than about the conclusion.

If we are to have knowledge through demonstration, then not only must we know the principles better and have greater conviction about them than about what is proved, but we must also not find anything more convincing or better known that is opposed to the principles and allows us to deduce a mistaken conclusion contrary <to the correct one>. For no one who has knowledge without qualification can be persuaded out of it.

Some people think that because <knowledge through demonstration> requires knowledge of the primary things, there is no knowledge; others think that there is knowledge, and that everything <knowable> is demonstrable. Neither of these views is either true or necessary.

The first party—those who assume that there is no knowledge at all—claim that we face an infinite regress. They assume that we cannot know posterior things because of prior things, if there are no primary things. Their assumption is correct, since it is impossible to go through an infinite series. If, on the other hand, the regress stops, and there are principles, these are, in their view, unrecognizable, since these principles cannot be demonstrated, and, in these people's view, demonstration is the only way of knowing. But if we cannot know the primary things, then neither can we know without qualification or fully the things derived from them; we can know them only conditionally, on the assumption that we can know the primary things.

The other party agree that knowledge results only from demonstration, but they claim that it is possible to demonstrate everything, since they take circular and reciprocal demonstration to be possible.

We reply that not all knowledge is demonstrative, and in fact knowledge of the immediate premisses is indemonstrable. Indeed, it is evident that this must be so; for if we must know the prior things (i.e. those from which the demonstration is derived), and if eventually the regress stops, these immediate premisses must be indemonstrable. Besides this, we also say that there is not only knowledge but also some origin of knowledge, which gives us cognition of the definitions.

Unqualified demonstration clearly cannot be circular, if it must be derived from what is prior and better known. For the same things cannot be both prior and posterior to the same things at the same time, except in different ways (so that, for example, some things are prior relative to us, and others are prior without qualification—this is the way induction makes something known). If this is so, our definition of unqualified knowledge will be faulty, and there will be two sorts of knowledge; or <rather>
perhaps the second sort of demonstration is not unqualified demonstration, since it is derived from what is <merely> better known to us.

Those who allow circular demonstration must concede not only the previous point, but also that they are simply saying that something is if it is. On these terms it is easy to prove anything. This is clear if we consider three terms—for it does not matter whether we say the demonstration turns back through many or few terms, or through few or two. For suppose that if A is, necessarily B is, and that if B is, necessarily C is; it follows that if A is, C will be. Suppose, then, that if A is, then B necessarily is, and if B is, A is (since this is what circular argument is), and let A be C. In that case, to say that if B is, A is is to say that if B is, C is; this is to say that if A is, C is. But since C is the same as A, it follows that those who allow circular demonstration simply say that if A is, then A is. On these terms it is easy to prove anything.

But not even this is possible, except for things that are reciprocally predicated, such as distinctive properties. If, then, one thing is laid down, we have proved that it is never necessary for anything else to be the case. (By 'one thing' I mean that neither one term nor one thesis is enough; two theses are the fewest needed for a demonstration, since they are also the fewest needed for a deduction.) If, then, A follows from B and C, and these follow from each other and from A, then in this way it is possible to prove all the postulates from each other in the first figure, as we proved in the discussion of deduction. We also proved that in the other figures, the result is either no deduction or none relevant to the things assumed. But it is not at all possible to give a circular proof of things that are not reciprocally predicated. And so, since there are few things that are reciprocally predicated in demonstrations, it is clearly empty and impossible to say that demonstration is reciprocal and that for this reason everything is demonstrable.

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Since what is known without qualification cannot be otherwise, what is known by demonstrative knowledge will be necessary. Demonstrative knowledge is what we have by having a demonstration; hence a demonstration is a deduction from things that are necessary. We must, then, find from what and from what sorts of things demonstrations are derived. Let us first determine what we mean by 'belonging in every case', 'in its own right', and 'universal'.

By 'belonging in every case' I mean what belongs not <merely> in some cases, or at some times, as opposed to others. If, for example, animal belongs to every man, it follows that if it is true to say that this is a man, it is also true to say that he is an animal, and that if he is a man now, he is also an animal now. The same applies if it is true to say that there is a point
in every line. A sign of this is the fact that when we are asked whether something belongs in every case, we advance objections by asking whether it fails to belong either in some cases or at some times.

A belongs to B in its own right in the following cases:

(a) A belongs to B in what B is, as, for example, line belongs to triangle, and point to line; for here the essence of B is composed of A, and A is present in the account that says what B is.

(b) A belongs to B, and B itself is present in the account revealing what A is. In this way straight and curved, for instance, belong to line, while odd and even, prime and compound, equilateral and oblong, belong in this way to number. In all these cases either line or number is present in the account saying what <straight or odd, for example,> is. Similarly in other cases, this is what I mean by saying that A belongs to B in its own right. What belongs in neither of these ways I call coincidental—
as, for instance, musical or pale belongs to animal.

(c) A is not said of something else B that is the subject of A. A walker or a pale thing, for example, is a walker or a pale thing by being something else; but a substance—i.e. whatever signifies a this—is not what it is by being something else. I say, then, that what is not said of a subject is <a thing> in its own right, whereas what is said of a subject is a coincident.

(d) Moreover, in another way, if A belongs to B because of B itself, then A belongs to B in its own right; if A belongs to B, but not because of B itself, then A is coincidental to B. If, for example, lightning flashed while you were walking, that was coincidental; for the lightning was not caused by your walking but, as we say, was a coincidence. If, however, A belongs to B because of B itself, then it belongs to B in its own right. If, for example, an animal was killed in being sacrificed, the killing belongs to the sacrificing in its own right, since the animal was killed because it was sacrificed, and it was not a coincidence that the animal was killed in being sacrificed.

Hence in the case of unqualified objects of knowledge, whenever A is said to belong to B in its own right, either because B is present in A and A is predicated of B, or because A is present in B, then A belongs to B because of B itself and necessarily. <It belongs necessarily> either because it is impossible for A not to belong to B or because it is impossible for neither A nor its opposite (for example, straight and crooked, or odd and even) to belong to B (for example, a line or a number). For a contrary is

8. A walker or a pale thing: lit. 'the walking', 'the pale' (neuter adjectives). by being something else: i.e. by being (e.g.) a man. Cf. Met. 1028a24–31.
either a privation or a contradiction in the same genus; even, for example, is what is not odd among numbers, insofar as this follows. Hence, if it is necessary either to affirm or to deny, then what belongs to a subject in its own right necessarily belongs to that subject.

Let this, then, be our definition of what belongs in every case and of what belongs to something in its own right.

By ‘universal’ I mean what belongs to its subject in every case and in its own right, and insofar as it is itself. It is evident, then, that what is universal belongs to things necessarily. What belongs to the subject in its own right is the same as what belongs to it insofar as it is itself. A point and straightness, for instance, belong to a line in its own right, since they belong to a line insofar as it is a line. Similarly, two right angles belong to a triangle insofar as it is a triangle, since a triangle is equal in its own right to two right angles.

A universal belongs <to a species> whenever it is proved of an instance that is random and primary. Having two right angles, for instance, is not universal to figure; for though you may prove that some figure has two right angles, you cannot prove it of any random figure, nor do you use any random figure in proving it, since a quadrilateral is a figure but does not have angles equal to two right angles. Again, a random isosceles triangle has angles equal to two right angles, but it is not the primary case, since the triangle is prior. If, then, a random triangle is the primary case that is proved to have two right angles, or whatever it is, then that property belongs universally to this case primarily, and the demonstration holds universally of this case in its own right. It holds of the other cases in a way, but not in their own right; it does not even hold universally of the isosceles triangle, but more widely.

We must not fail to notice that we often turn out to be mistaken and that what we are proving does not belong primarily and universally in the way we think we are proving it to belong. We are deceived in this way in these cases: (1) We cannot find any higher <kind> besides a particular <less general kind>. (2) We can find <such a kind>, but it is nameless, applying to things that differ in species. (3) The <kind> we are proving something about is in fact a partial whole; for the demonstration will apply to the particular instances <of the partial whole>, but still it will not apply universally to this <kind> primarily. I say that a demonstration applies to a given <kind> primarily, insofar as it is this <kind>, whenever it applies universally to <this kind> primarily.

If, then, one were to prove that right angles do not meet, one might think that the demonstration applied to this case because it holds for all right angles. This is not so, however, since this <conclusion> results not because