

# Posterior Analytics

---

**by**  
Aristotle

Powered By



**Pdf Corner**

**First  
Published**

**2009**

# Posterior Analytics Pdf

By

**Aristotle**



This version of pdf is

Re-designed by

[Pdfcorner.com](https://www.pdfcorner.com)

© Copyright Reserved 2018

This is a revised and longer version of a paper which appeared in  
*Southern Journal of Philosophy* (1998), Vol. 36, No. 1, pp. 15–46.

## ARISTOTLE ON *EPISTEME* AND *NOUS*: THE *POSTERIOR ANALYTICS*

MURAT AYDEDE

Philosophy, Humanities Collegiate Division,  
Committee on the Conceptual Foundations of Science  
THE UNIVERSITY OF CHICAGO

**Office address:**

The University of Chicago  
Department of Philosophy  
1010 East 59th Street  
Chicago, IL 60637, U.S.A.

E-MAIL: [m-aydede@uchicago.edu](mailto:m-aydede@uchicago.edu)

**ABSTRACT.** According to the standard and largely traditional interpretation, Aristotle's conception of *nous*, at least as it occurs in the *Posterior Analytics*, is geared against a certain set of skeptical worries about the possibility of scientific knowledge, and ultimately of the knowledge of Aristotelian first principles. On this view, Aristotle introduces *nous* as an intuitive faculty that grasps the first principles once and for all as true in such a way that it does not leave any room for the skeptic to press his skeptical point any further. Thus the traditional interpretation views Aristotelian *nous* as having an internalist justificatory role in Aristotelian epistemology. In contrast, a minority (empiricist) view that has emerged recently holds the same internalist justificatory view of *nous* but rejects its internally certifiable infallibility by stressing the connection between *nous* and Aristotelian induction. I argue that both approaches are flawed in that Aristotle's project in the *Posterior Analytics* is not to answer the skeptic on internalist justificatory grounds, but rather lay out a largely externalist *explication* of scientific knowledge, i.e. what scientific knowledge consists in, without worrying as to whether we can ever show the skeptic to his satisfaction that we do ever possess knowledge so defined.

It is difficult to know whether one knows or not.  
APo 76a26

Whatever the overall drawbacks and difficulties of the *Posterior Analytics* are, one thing is quite clear, it is the most integrated and worked out text ever written by Aristotle on his philosophy of science and theory of scientific knowledge in general. And yet, as it stands, it is often quite perfunctory. It is not surprising that many critics and interpreters have found it difficult to penetrate and obscure in details especially when compared with his most important works such as *Physics*, *Metaphysics*, and *Nicomachean Ethics*. At almost every stage in the text one is confronted with serious interpretive problems. There is, however, one problem that, because of its central importance within Aristotle's overall system of thought, has especially occupied and puzzled the students of Aristotle. The problem centers around Aristotle's account of scientific knowledge (*episteme*) and its conditions, and thus, it can be seen to arise mainly from the general theoretical structure of the *Posterior Analytics*. I believe that the problem is largely an interpretive one: it arises only when Aristotle is interpreted in a certain way under certain epistemological assumptions whose roots are rather modern. Thus my aim in this paper will be to argue for an interpretation of the *Posterior Analytics* — for a possible way of seeing Aristotle's general programme in it — which is, I hope, free from the putative problem. Hence, I will attempt to dissolve rather than solve the problem.

It is crucial to be very clear about how it has been supposed to arise and thought to be solved by Aristotle. So my first job in the first section will be to state the problem as presented and interpreted by what I broadly take to be the orthodox and traditional view. I will be meticulous in my reconstruction, since my argumentative strategy will essentially depend on the framework I will provide. So I want the reader to bear with me in the first and the second sections. The job of Section II is to survey the broadly empiricist, and thus non-orthodox, attempts to solve the same problem. As will become apparent, although I am very sympathetic to these studies, I believe they too have problems. I hope to show that the inadequacies of both the orthodox and empiricist attempts to solve what they take to be the basic epistemological problem of the *Posterior Analytics* have the same source, namely, the epistemological assumptions made in diagnosing the alleged problem. Once this is clarified, I will show that there is no evidence that Aristotle makes those assumptions (although these are not foreign to Aristotle). In fact, I will present evidence to the contrary (§V). Sections III–IV will reconstruct Aristotle's analysis of *episteme*. Sections VI–VII will first analyze and then locate *nous* in the emerging picture. I will conclude that Aristotle's epistemology in the *Posterior Analytics* is free from the putative problem. Let us, then, start with what the problem is alleged to be.

## - I -

At the beginning of the second chapter of Book I, Aristotle says that one knows (*epistatai*) a thing *simpliciter* when one knows the appropriate explanation of it and knows that the thing cannot be otherwise (71b9–13). The latter requirement can also be seen to be a restriction on the scope of what can be known *simpliciter*. And given Aristotle's insistence that the objects of science are necessary facts, the second clause is properly viewed as a clause in the definition of scientific knowledge (*episteme*).<sup>1</sup> Aristotle subsequently expands on the first, explanatory, requirement on scientific knowledge. Explanation takes the form of demonstration which is, in turn, syllogistic in character. To scientifically know that *P* is to demonstrate *P* which amounts to explaining *P*. What makes a syllogism demonstration is determined by the requirements imposed by Aristotle upon the premises of the syllogism: Aristotle tells us that the premises must be true, primitive, immediate, as well as better known than and naturally prior to, the conclusion. What makes a demonstration truly explanatory of the fact expressed in by the conclusion is that the premises contain the proper middle term denoting the cause of the fact. On Aristotle's view, there is a unique and natural order of explanation that corresponds to the real causal order in nature. The premises of scientific demonstration should reflect this natural order; hence, they must be necessary, universal, naturally prior to, and properly explanatory of its conclusion.

When scientific knowledge is defined in this way, one problem immediately arises. Scientific knowledge is knowledge demonstrated from appropriate premises. But how do we know the premises themselves? Unless they are properly grounded on further premises, they will not count as pieces of scientific knowledge, in which case they will not serve as the appropriate bases for any scientific knowledge. If there is no knowledge of the premises, there is no knowledge of the conclusion. In short, it appears that nothing counts as scientific knowledge if it is not demonstrated from premises that are themselves scientifically known. But how far can the demonstration go? As Aristotle explicitly rejects circular and infinitely regressive demonstration (*Apo* I 3), he says that there are certain

---

<sup>1</sup>Hence, we have Mure's translation of *episteme* as scientific knowledge. Tredennick finds this translation also useful in many cases. Although I will continue to use it from time to time, I think this translation is in a certain sense misleading: when understood literally scientific knowledge involves, as we will see shortly, both the knowledge of demonstrated propositions and the knowledge of indemonstrable propositions that are first principles, since the body of a given science, according to Aristotle, typically consists of these two types of propositions (cf. van Fraassen (1980) and Hintikka (1971)). This might explain, perhaps, why Aristotle sometimes uses the phrase 'indemonstrable *episteme*' to refer to the kind of knowledge we have of principles. See, e.g., 71b16, 72a25–b2, 72b17–24, 76a16–21. So, 71b9–13 does not define scientific knowledge in general but *demonstrative* scientific knowledge.

propositions whose knowledge does not require any further demonstration. They are by their very nature necessary, primitive, immediate, and thus self-explanatory. Allegedly, they command belief through themselves, and thus do not require demonstration to convince us of their truth. These propositions are called axioms and first principles.<sup>2</sup> According to Aristotle, as the orthodox view has it, they are apprehended by the most accurate and infallible faculty of man, *nous*. So, demonstration of a scientific proposition stops when the demonstration has the indemonstrable first principles as its premises, which we apprehend by *nous*.

At this point, many critics have been truly puzzled. The standard reading is that the problem Aristotle confronted is a familiar one from the history of epistemology. Knowledge requires justification. But if anything is to confer justification on a knowledge claim, it must itself be justified. How far can the justification go if we are to reject circular and infinitely regressive justification? Surely we must have some sort of strong foundation upon which we can base all our knowledge. Indeed it is not uncommon to attribute the historical roots of foundationalism as an epistemological doctrine to Aristotle. However, according to this reading, the problem in the case of Aristotle is most serious. For, in the first place, Aristotle's first principles seem to find their contemporary parallels in the explanatory laws of current scientific theories. But these are neither analytic nor about anything like sense-data. They are full-fledged universal empirical propositions that explain phenomena. Secondly, on this reading, Aristotle requires of appropriate epistemic justification that it be demonstrative, or at least deductive. This would have the effect of demanding that justification should be complete, and apparently, certain.<sup>3</sup> Given the nature of Aristotelian starting-points and his insistence that they should be better known, it is hard to see how we can ever have knowledge so strictly defined.

---

<sup>2</sup>Axioms are also first principles in a certain sense. Aristotle sometimes calls them 'common axioms' or 'common principles' (see *APo* I 10 76a37–42). They are meant to be logical principles like the principle of non-contradiction or quasi-logical principles like the one which states "equals subtracted from equals leave equal remainders." It is not clear whether Aristotle really has intended them to function as premises or simply as rules of inference in deriving the conclusion from premises. See Ross (1965) p.56 and p.531; Barnes (1994), p.138–9. In this paper throughout I will concern myself not with the common axioms but only with the proper first principles that are peculiar to each specific science, especially non-mathematical sciences.

<sup>3</sup>This is indeed how Irwin (1978, 1988) interprets Aristotle's account of scientific knowledge. On his view, Aristotle's main concern is with the complete justification of knowledge claims: "...because [Aristotle] denies that demonstration requires demonstrable first principles... he implies that in some cases complete justification is non-inferential... Non-inferentially justified first principles allow us to claim knowledge without facing an infinite regress or a circle... Aristotle's rejection of the regress relies on his demand for the complete removal of possible grounds for challenge" (1988, p.135).

Indeed, Leshner (1973) points out that, when confronted with the danger of infinite regress, Aristotle's first response (72b19–20) falls remarkably short of its intended target when he says that not all knowledge is demonstrative. For Leshner says that this only indicates that knowledge of the first principles *must* be indemonstrative, not that we actually do have the knowledge of them. In a similar vein, Grene seems to be utterly puzzled and dissatisfied with Aristotle's move:

It is, on the face of it, a most unconvincing argument. How do we know there is knowledge of conclusions? Because there is knowledge of premises. How do we know there is knowledge of premises? There must be, if there is to be knowledge of conclusions. And *if* there are two sources of certainty, *nous* and *episteme*, and one of these is the source of inferential certainty, then the other must be the source of the certainty of the starting-points of inference. But how do we know there are two such sources? Presumably because if there were not, there could not be the whole premise-inference-conclusion structure we have been describing. To the student of Kant there is perhaps nothing alarming here... The existence of *nous* seems to be hung simply and solely on the demand that, to have Aristotelian science, we must have it, and so we do. (1963, p.111)

The main idea that needs to be emphasized here is that scientific knowledge as defined by Aristotle requires epistemic certainty, so that nothing less than an infallible mental faculty that would grasp the principles as true and certain would do for Aristotle's rigid account of knowledge.

In fact, there is another aspect of the problem which will bring the puzzling issue more sharply into focus. Aristotle repeatedly tells us that we acquire knowledge of first principles through an inductive process (*epagoge*) starting from sense-perception. He even somewhat describes the process in the notorious last chapter of the *Posterior Analytics*.<sup>4</sup> However, immediately after saying "Clearly then it must be by induction that we acquire the knowledge of the principles..." (100b3), he introduces in the famous passage (100b5–17), as the orthodox interpretation has it, the most accurate and infallible intellectual faculty of man, *nous*, by which, Aristotle says, we grasp, once and for all, the ultimate and necessary first principles as such.<sup>5</sup>

The apparent puzzle this invites, as interpreted traditionally, is this. If we acquire the knowledge of first principles through induction, one wonders how one can possibly be so certain, epistemologically, that one has scientific knowledge that *P* (when one does). Induction has been well known to lack such a power to secure epistemic certainty, as Aristotle himself seems to indicate in many

---

<sup>4</sup>*APo* II 19. A parallel account is also given in the beginning of *Met* I 1.

<sup>5</sup>Compare also the same apparently puzzling order of Chapters 3 and 6 in Book VI of the *Nicomachean Ethics*. In Ch.3 Aristotle says that we acquire the universal principles by induction; in Ch.6 he argues that we have only the *nous* of them.

places.<sup>6</sup> On the other hand, if we have this allegedly infallible faculty, *nous*, with which to grasp the principles, why should we need induction at all to acquire knowledge of them? And, conversely, if it is induction (however problematic this might be) that gets us to the first principles, why should we need this apparently mysterious faculty, *nous*, that, given the Platonic tradition, seems to operate independently of sense-perception in its grasping power?<sup>7</sup>

The traditional and to a certain extent still orthodox way of making sense of this apparently puzzling situation is, roughly, this. There is no doubt that Aristotle views induction as indispensable in the path toward the first principles. But given his strong conditions for scientific knowledge and also induction's notorious frailty in guaranteeing epistemic certainty, induction seems obviously insufficient to establish first principles as knowledge. So it is *nous* as the infallible intuitive faculty that gives the strong epistemic warrant to the principles that they require in Aristotle's conception. By intuitively and immediately grasping the principles as true and necessary, *nous* validates and establishes the results of induction as knowledge. In other words, the orthodox view is that Aristotle in the *Posterior Analytics* defines scientific knowledge so strongly and rigidly that, at the end, seeing that normal inductive procedures will of necessity fall short of guaranteeing it, he is forced to postulate some sort of infallible and intuitive mental faculty, *nous*, that would epistemically secure the possibility that we have scientific knowledge so defined.<sup>8</sup>

Although the main idea of the orthodox interpretation is clear enough, as Leshner (1973) points out, there are interpretive nuances among scholars about how the inductive process is related to the immediate noetic grasp. Ross (1965), for instance, seems to think that induction has no justificatory role in our knowledge of the principles; all the justification that principles enjoy comes from our peculiar noetic grasp of them:

---

<sup>6</sup>E.g., *APo* II 5 91b15–16, b35–6; 7 92a38–b3. Also, cf. *APr* II 23. See below.

<sup>7</sup>I should emphasize that many of the traditional scholars talk about *nous* as a faculty or capacity. Although this is generally true for the *De Anima* and some other scientific treatises of Aristotle, in the *Posterior Analytics*, *nous* is introduced by Aristotle as a *hexis*, a mental state reached through the realization of a capacity or at the end of a mental process. See *APo* II 19 100b5ff. and below.

<sup>8</sup>Indeed, traditionally, 'intuitive intellect,' 'intuitive reason,' 'intellectual intuition,' or merely 'intuition' were the standard translations of '*nous*.' Barnes (1994), however, translates it as 'comprehension.' Kahn, in his characterization of the traditional interpretation, nicely summarizes the situation thus: "...in that perspective [Aristotle's] emphasis on the indispensable starting-point in sense perception seems to ally him with the empiricists, whereas the ultimate appeal to *nous* then takes on the air of a last-minute betrayal, a sellout to the rationalists — particularly if *nous* is understood as an infallible intuition of self-evident truths." (1981, p.386)

The induction here is not proof of the principle, but the psychological preparation upon which the knowledge of the principle supervenes. The knowledge of the principle is not produced by reasoning but achieved by direct insight... This is in fact what modern logicians call intuitive induction... The general principle, in such a case, being capable of being known directly on its own merits, the particular examples serve merely to direct our attention to the general principle... (p.49)<sup>9</sup>

On the other hand, it is certainly possible to view *nous* as involved both in (mechanically) getting the general inductive conclusion from the particulars and in epistemically validating it at the same time by somehow intuitively apprehending it *as* true. That is, *nous* can be seen both as the (only) justificatory source and as the psychological mechanism helping the induction from particulars. This seems to be the view held, for instance, by Lee,<sup>10</sup> Irwin,<sup>11</sup> Grene,<sup>12</sup> and in certain passages, at least, by Ross.<sup>13</sup>

Whatever the importance of these details of interpretation is, they bring out one thing most clearly: it is *nous*, and only *nous*, that epistemically justifies the principles in the sense required. Now it is important to be clear about this “re-

---

<sup>9</sup>But cf. Ross (1945), p.217. A.E. Taylor also seems to be of the same opinion. He clearly distinguishes between “two quite different questions: (1) how we come to reflect on the [principles], (2) what evidence there is for their truth” (1955, p.37). To the first question he replies “by induction from experience” and characterizes the process as simply psychological. But “when the induction has done its work in calling attention to the principle, you have to see for yourself that the principle is true... by immediate inspection, just as in sense-perception you have to see for yourself that the colour before your eyes is red or blue.” (p.38) The comparison of the noetic grasp of principles with our conscious apprehension of sensible qualities is indeed striking, and a recurrent theme in the literature in describing the nature of noetic grasp. We will see its import shortly. The same distinction is also drawn by Le Blond (1939): “...au sujet de la connaissance des principes, il nous semble que les différents essais de réponse d’Aristote peuvent, en gros, se grouper en deux séries: réponses *de droit*, d’un côté, exposé de ce que devrait être la saisie des principes, pour justifier pleinement la science... La réponse *de fait*, [d’un autre côté,] l’essai d’explication de la saisie des principes, de la connaissance des universels et de la construction des définitions est tout autre...” (pp.145-6). But Le Blond nevertheless thinks that in II 19 “on reconnaît seulement un vigoureux effort de volonté pour combler le fossé qui sépare les expériences psychologiques sur la combinaison des images et l’appréhension infaillible des principes requis pour assurer la science. Mais c’est par un véritable *saut* qui demeure injustifié, qu’Aristote passe d’un point de vue à l’autre” (p.138). See also Grote (1872): “By referring the principia to Intellect, [Aristotle] does not intend to indicate their generating source, but their evidentiary value and dignity when generated and matured” (p.293).

<sup>10</sup>Lee (1935), see especially p.122.

<sup>11</sup>Irwin (1988), see p.135 and n.3. However, cf. his (1978), pp.214–5.

<sup>12</sup>Grene (1963): “The refinement of perception to make explicit the universal *in* the individual, the species *in* the specimen: this is the experience that underlies Aristotle’s confidence about *nous*” (p.112).

<sup>13</sup>See, for instance, Ross (1945), p.217.

quired sense.” So let us try to sort out what must be involved, according to the outlined orthodox interpretation, in one’s noetic grasp of a certain principle.

When *nous* grasps a certain principle, say *P*, as true, the subject, *S*, who has the *nous* of *P*, is supposed to be immediately and intuitively aware of its truth. The force of ‘immediately’ here is reasonably clear: *S*’s awareness of the truth of *P* does not depend in any way on her awareness of the truth of any further proposition. Her awareness is supposed to be non-inferential, just as, say, one’s awareness that one is appeared to redly (as the current jargon has it) can be considered to be non-inferential.

The force of ‘intuitively,’ however, is somewhat mysterious. When used in relation to *nous*, its force, as I take it, is to bring out the nature of the infallible awareness one has with respect to the truth of *P*. How can one be infallible about the truth of *P* when its truth-conditions fall outside of one’s ken and especially when *P* is a *universal* (empirical) proposition? In the case of infallible awareness of sensible qualities, there is at least a conceivable story to be told, as is well known: on one version of it, the truth-conditions of ‘I am appeared to redly’ are directly and immediately accessible to my consciousness, and the nature of this direct access is such that ‘I am appeared to redly’ is (becomes) true when and only when such an access is established, which, in turn, guarantees my awareness. Now since Aristotle explicitly rejects the existence of Platonic innate ideas<sup>14</sup> and seems well aware that in any inductive jump the conclusion goes beyond the initial data,<sup>15</sup> the infallible noetic grasp of the truth of principles becomes totally mysterious. Nevertheless, the orthodox view has it that however mysterious it may be Aristotle just postulates some such faculty.<sup>16</sup>

What is more important, however, is that the nature of this infallible awareness has been traditionally interpreted in such a way that when *S* has the *nous* of *P*, *S* not only knows that *P* — as knowledge is standardly understood at least as justified true belief<sup>17</sup> — but also *S* immediately knows that she knows

---

<sup>14</sup>See, e.g., *APo* II 19 99b27–36 and *Met* I 9 *passim*.

<sup>15</sup>*APo* II 5 91b15–16. Cf. *APr* II 23, see also Engberg-Pedersen’s persuasive discussion of this chapter (1979): he argues that Aristotle’s concern there is not what Ross has thought it to be, namely, perfect induction. Cf. also Hamlyn (1976), Hintikka (1980), and Kal (1988).

<sup>16</sup>Calling *nous* an intuitive faculty, to my mind, has no clear and unproblematic sense in this context apart from saying that *nous* is just such a faculty that infallibly and immediately apprehends once and for all the truth of certain empirical and universal propositions without any justificatory recourse to perception. This interpretation is probably the result of the influence of rationalist tradition. But even rationalists with their nativism are better situated in giving sense to their “intuition.” Ross likens *nous* to the intuition involved in what he calls the notion of intuitive induction of modern logicians. But this can only be an analogy, and perhaps true at most for Aristotelian *mathematical* sciences. On the other hand, it seems to me that many traditional scholars, when characterizing Aristotelian *nous* as having such an intuitive power, had in mind the Active Intellect of the *De Anima* III 5.

<sup>17</sup>It is easy to see how *nous* as understood traditionally entails knowledge as justified

that  $P$ . In other words, one of the immediate consequences of interpreting *nous* as direct and infallible awareness was the commitment to a version of the K-K Thesis.<sup>18</sup> So we have:

- (i)  $\Box [S \text{ noei that } P \rightarrow (S \text{ knows that } P \ \& \ S \text{ believes that } S \text{ knows that } P \ \& \ S \text{'s belief that } S \text{ knows that } P \text{ is always true})]$ .

Here the point to emphasize clearly is that the nature of the non-inferential and intuitive justificatory grounds for  $S$ 's knowledge that  $P$  is such that they also simultaneously constitute the conclusive grounds for  $S$ 's belief that  $S$  knows that  $P$  that are transparent, i.e. directly accessible, to  $S$ . Notice that on this interpretation of Aristotelian *nous* any skeptical challenge is supposed to be completely blocked when  $S$  *noei* that  $P$  and *claims to know* that  $P$ .<sup>19</sup> This is supposed to be one of those cases where claims to knowledge are not open to any sort of skeptical challenge, just as, for instance, Descartes' clear and distinct ideas and knowledge claims about one's own immediate phenomenal experience were thought not open to skeptical challenges.

So much for the truth of principles. But, of course, according to the orthodox interpretation, if *nous* is to serve its purpose in establishing the ultimate and infallible foundations of scientific knowledge (and thereby in showing the possibility of scientific knowledge), it is not enough for one to infallibly grasp simply as true a certain proposition  $P$  which *happens* to be a principle: in addition, one should infallibly grasp, or be aware of,  $P$  as a principle, or more accurately, *as the* appropriate principle. And this involves grasping  $P$  as necessary, primitive, immediate, and explanatorily appropriate. For unless we know the principles as such, we cannot claim to scientifically know anything. But how do we know the principles as such? The orthodox view is that Aristotle's answer here is again "by means of *nous*." Irwin, for example, is very explicit about this:<sup>20</sup>

---

true belief (JTB). Suppose  $S$  *noei* that  $P$ , then  $S$  has complete and non-inferential justification for her belief that  $P$  that objectively guarantees the truth of  $P$ . Then it trivially follows that the three standard clauses of JTB analysis of knowledge are satisfied for  $S$ . In other words, necessarily, if  $S$  *noei* that  $P$ ,  $S$  knows (JTB) that  $P$ .

<sup>18</sup>See Hintikka (1962).

<sup>19</sup>On this point, Irwin's interpretation is quite explicit. According to Aristotle, he says, "we must be aware of being better justified in believing [the principles] than in believing anything else; that is what makes them best known, and removes any objective ground for challenging them" (1988, p.135).

<sup>20</sup>See also his (1978), where he writes: "How do the methods for reaching first principles yield first principles with the right status? Though first principles are not known, because not demonstrated, they cannot merely be matters of belief; we must grasp their truth and necessity from themselves apart from their inferential relations to other truths... The cognitive condition in which we grasp all this is "intuitive intellect"... But how do we reach this state? We approach, but do not reach it, by ordinary inductive methods. Observation pro-

The knower must grasp self-evident principles as such; for if they are grasped non-inferentially, without any further justification, they must be grasped as true and necessary when considered in themselves, with no reference to anything else. If first principles are to meet all Aristotle's conditions, they must be grasped by intuition that certifies that they have the relevant properties. (1988, p.134)

The essential point to bear in mind is that we must know for certain that the principles have the relevant properties if we are to know for certain that we *have* scientific knowledge. So, it is thought that *nous* is required as an intuitive and infallible grasping, or certifying, faculty, because any other sort of justification for the belief in the proposition that the principles are necessary, primitive, immediate, and explanatorily appropriate (call this compound proposition '*R*') would have to be discursive, in which case we are again faced with the danger of circularity or infinite regress. Or, worse still, it is thought that since Aristotle is after showing the possibility of scientific knowledge as he defines it, he needs certainty, hence complete justification; an *inferential* justification for *R* on inductive grounds would not do for him, because it would of necessity fall short of epistemically guaranteeing the truth of *R*. So, as the orthodox reading has it, we need to know *R* in a way that when we do we also have to know for sure that we do, and this is supposed to be exactly what the nature of our noetic grasp allows us to do. So,

(ii)  $\square [S \text{ } \textit{noei} \text{ that } R \rightarrow (S \text{ knows that } R \ \& \ S \text{ believes that } S \text{ knows that } R \ \& \ S\text{'s belief that } S \text{ knows that } R \text{ is always true})]$ .

Here, again, the noetic nature of the non-inferential and intuitive justificatory grounds for *S*'s knowledge that *R* is such that they also simultaneously constitute the conclusive grounds for *S*'s belief that *S* knows that *R* that are transparent, i.e. directly accessible, to *S*.

Such is, then, the traditional and orthodox reading of Aristotle's conception of *episteme* and *nous*. I find this reading unconvincing and contrived, especially with respect to *nous*. Too much is demanded from *nous*; it is totally unclear that Aristotle really intended *nous* to do so much epistemological work. Nowhere in his relevant writings, for instance, does Aristotle assign to *nous* the job of grasping the principles *as* necessary, primitive, immediate, or explanatorily appropriate, let alone grasping them intuitively and infallibly as such.<sup>21</sup> It is indeed

---

duces only beliefs... A first principle is not grasped by intuitive intellect just in so far as it results from induction... What else is required?" (pp.214–15). This something else, Irwin submits, is *nous*.

<sup>21</sup>In the *Posterior Analytics*, for instance, only in seven places up to the last chapter does Aristotle explicitly mention *nous* or make tacit reference to it: 71b16, 72a35, 72b25, 83b34, 85a2, 88a8, 89b8. And in II 19, it is introduced only in the last paragraph (100b5ff.) where it

very interesting to see that such a heavy and demanding interpretation could be based on such scant, strictly speaking, non-existent, textual evidence. Why is then such a reading forced upon Aristotle? Part of the reason is clear from what I have been saying so far about the traditional view of Aristotle's epistemology. What underlies and guides this characterization of Aristotle's epistemology, however, has much to do with the interpreters' specific understanding of what the essential task of epistemology is: namely, to successfully defend one's knowledge claims against the skeptic, to show that knowledge is possible.<sup>22</sup>

So, according to this view, one of the main projects Aristotle sets for himself in the *Posterior Analytics* is to answer the skeptic who challenges the very possibility of scientific knowledge. But this is not all. The sort of skeptic that the traditional scholars have in mind is the one that is known to be very stubborn and thus very hard to satisfy, who requires that successful defence of one's *knowledge claims* be a necessary condition on showing that knowledge is possible. But knowledge requires truth. Hence, the skeptic is unlikely to be satisfied with a defence that falls short of establishing the truth of one's claim to knowledge. So "successful defence" in the eyes of the skeptic amounts to *conclusive defence* of one's knowledge claim. Hence we have, for instance, Irwin's insistence that Aristotle is after conclusive and complete epistemic justification of claims to scientific knowledge (see the quotes from him above).

So, it is not difficult to understand the main rationale behind assigning to Aristotle's *nous* such a heavy epistemic burden if one starts with some such assumptions about what the basic task of an epistemological enterprise should be like. For Aristotle's strict account of scientific knowledge does not only require truth but also the non-demonstrative knowledge of the appropriate first principles *qua* principles, which involves the knowledge that certain universal propositions have certain characteristics like necessity, immediacy, primitiveness, explanatoriness. So the orthodox idea is that since Aristotle saw that inductive evi-

---

is explicitly mentioned four times. In none of these passages, does Aristotle even come close to saying that it is *nous* that intuitively and infallibly grasps the principles as having the required properties. All he says, where he is explicit, is that it is *nous* that apprehends the principles (*archai*, 100b5ff.). In 88b36–89a1, he says, *nous* is the starting-point of *episteme*, and non-demonstrative *episteme* is the belief in an immediate premise. Here, however, there doesn't seem to be any implication that the non-demonstrative *episteme* is the belief in an immediate premise *qua* immediate. See Lesher (1973).

<sup>22</sup>This understanding is again traditional in a broad sense. Take, for instance, the following remarks: "There is a certain disingenuousness in Aristotle's rather smug solution. To affirm that not all knowledge is demonstrable is to reject what he has given every show of affirming in the precedent chapter of this very treatise. Worst of all, the 'necessity' which he says compels us to assert that knowledge of immediate premises is independent of demonstration is itself a consequence of the assumption that knowledge in the strict sense is possible — which is the very point at issue" G.R. Morrow (1970, p.333). For somewhat similarly spirited remarks, see also the quotation from Grene (1963) above.

dence would not satisfy the skeptic, he ultimately made recourse to an intuitive and infallible faculty, *nous*, by means of which we not only infallibly know, but also infallibly know when and what we know.

- II -

However, even this solution to the epistemological problem Aristotle is claimed to have faced has been a constant source of embarrassment on the part of interpreters especially in the light of Aristotle's known naturalism and his own insistence on the empirical nature of a proper scientific inquiry that are well-attested even by the same traditional scholars themselves.<sup>23</sup>

Indeed, the intuition that there is something wrong with the traditional interpretation of Aristotle's *nous* has also been at the source of some of the recent works especially on the *Posterior Analytics*. In the last twenty years or so, as works on Aristotle's scientific treatises and generally on his actual methods in empirical research have grown, more and more scholars have come to doubt the accuracy of the orthodox view of Aristotle's epistemology as laid down in the *Posterior Analytics*.<sup>24</sup> Apart from the implications of Aristotle's own practice in his scientific inquiries, there is also his own insistence on the importance of empirical data in testing theories, in other words, his own epistemological use of *phainomena*.<sup>25</sup>

---

<sup>23</sup>Couloubaritsis (1980), for instance, after having outlined the traditional interpretation of Aristotle's "solution," nicely summarizes the embarrassment and its source as follows: "Faut-il se contenter d'un tel embarras et clore le débat? ...Dans ces conditions, peut-on croire qu'[Aristote] s'est contenté lui-même d'un pis-aller ou d'une sorte de "deux ex machina" pour surmonter son embarras? Ou bien plutôt l'embarras ne serait-il pas de notre côté, parce que nous ne voyons pas encore très clairement quelles sont ses conceptions de la connaissance des principes et de l'intellect? En tout cas, il nous paraît assez étonnant que le Stagirite ait pu assumer à une ligne d'intervalle pareille contradiction et qu'il ait ainsi conçu la connaissance des principes comme l'objet de la sensation, par une activité inductive, et en même temps comme objet d'une intuition infallible par l'intellect — c'est-à-dire par cette activité qui constitue en quelque sorte l'opposé de la sensation. Nous avons l'impression que le fil de l'argumentation d'Aristote en cet endroit nous échappe" (pp.446-47).

<sup>24</sup>In this connection, I should cite the influential papers by Kosman (1973), Leshner (1973), Burnyeat (1981), Bolton (1987). Also Barnes' commentaries (1994) in general are in this vein — the first edition had appeared in 1975. For important studies on Aristotle's methods in biological research emphasizing his empiricism and naturalism, see Gotthelf and Lennox (1987).

<sup>25</sup>There are many passages in Aristotelian corpus that are indeed surprisingly close to modern scientific methodology. To cite a few, see *De Generatione Animalium* III 10 760b28-33; *Historia* I 6 491a10-15; *De Partibus* I 1 640a13-18; *APr* I 30 46a17-27; *De Caelo* III 7 306a6-18; *Ethica Nicomachea* I 7-8 1098b1-11; *De Generatione et Corruptione* I 2 316a5-12, 8 325a13-24. To some of these passages we will return in due course. That Aristotle also did quite a lot of experimentation has been well known: for a documentation of the extensive

In light of this, many scholars have been led to re-examine the *Posterior Analytics* in a much deeper and more detailed manner. Although I am very sympathetic to these studies, I believe, they encounter one common problem that arises from certain well-known passages especially in the last chapter of the *Posterior Analytics*, as we will see shortly. But more importantly, the source of the difficulty they face can again be traced back to certain epistemological assumptions made with respect to Aristotle's main programme in the *Posterior Analytics*. It will be important for what I am going to say later on to see how the difficulty arises and what its relation to the orthodox and traditional view is. So let us briefly examine these recent studies in more detail.

The common theme in these studies is to examine in some detail those passages where Aristotle discusses the role of the senses and phenomena in general in the inductive process in reaching the universal and explanatory principles, and then to find a naturalistic role for *nous* to play. For instance, Leshner, in his influential article, after having briefly summarized the traditional view, characterizes his aim as follows:

Too much is known about... the relations between perception, induction, and universal principles to summarily dismiss Aristotle's account for want of cogency; and the terms 'intuition' and 'intellectual intuition' have too varied a history to be thought of as simple equivalents of *nous* or *noesis*. It is my contention that a more detailed examination of *nous*, *noein* and related notions supports a rather different understanding of their significance and of Aristotle's account of our knowledge of first principles. ...[B]y pointing out the ways in which *nous* relates to *aisthesis*, *epagoge*, and *kathalou* principles, I hope to show that *nous* is not properly thought of as intuition or intellectual intuition, at least in any sense of these terms which would force us to distinguish *nous* from ordinary empirical knowledge. (1973, p.45)

The last sentence here is somewhat surprising. If "empirical knowledge" is to be construed as factual knowledge, i.e. as knowledge of the world interpreted realistically, then there is no doubt that Aristotle's first principles are empirical in this sense. So Leshner must have had something else in mind. Indeed, as his article makes clear, the contrast here is between the knowledge of the world obtained through ordinary empirical methods, i.e. on the basis of perception, and factual knowledge obtained *a priori*, i.e. without any recourse to perception. However, even in this contrast there is a certain ambiguity. For again the orthodox view does not deny that perception plays a necessary role in obtaining knowledge of the principles.<sup>26</sup> The question is whether this role has any justificatory bearing on our grasp of first principles. So what Leshner must be really saying is that what turns our belief in first principles into knowledge proper is not some *a priori* act of intuition that operates independently of perception, as the or-

---

range of the experiments and their nature, see Ross (1945), pp.112–14.

<sup>26</sup> Indeed, Aristotle is very explicit on this point. See *APo* I 18; *De Anima* III 8 432a3–10.

thodox view has it, but rather the ordinary empirical and inductive justificatory grounds that are also involved in the very obtaining of those beliefs.

Leshner argues for this conclusion in a rather sweeping and indirect way. His main strategy is to single out the bases for rejecting the traditional idea that *nous* is operative *only* in grasping the first principles. For this reason, he turns his focus to those passages where Aristotle seems to describe the process by which we reach the universal in general and, in particular cases, the first principles. By indicating the obviously empirical character of this process toward the first principles, and, in the light of this, by showing how an alternative interpretation is possible of certain passages traditionally interpreted to the contrary, Leshner concludes that *nous* is what we have of the universal empirical proposition at every stage whenever induction takes us from what is prior relative to us to what is prior by nature, whether this proposition be a first principle or not. From this he immediately infers that speaking of acts of *noesis* is just a way of describing how we inductively reach universal conclusions that exceed their initial data. In other words, he concludes that “[t]he account of *nous* of first principles which concludes the *Posterior Analytics* is therefore neither *ad hoc* nor inconsistent with Aristotle’s empiricism; on the contrary, it is a consequence of it.”<sup>27</sup>

Let us see what Aristotle says in the concluding paragraph:

Since of the intellectual states [*peri ten dianoian hexeon*] by which we grasp truth some are always true and some admit falsehood (e.g. *doxa* and *logismos* — whereas *episteme* and *nous* are always true), and no kind other than *nous* is more accurate [*akribesteron*] than *episteme*, and the principles of demonstrations are better known [*gnorimoterai*], and all *episteme* involves an account — there will not be *episteme* of the principles; and since it is not possible for anything to be truer [*alethesteron*] than *episteme*, except *nous*, there will be *nous* of the principles — both if we inquire from these facts and because demonstration is not a principle of demonstration so that *episteme* is not <a principle> of *episteme* either — so if we have no other true [*alethes*] kind apart from *episteme*, *nous* will be the principle of *episteme*. And the principle will be of the principle, and <*episteme*> as a whole will be similarly related to the whole object. (*APo* II 19 100b5–17)<sup>28</sup>

Now, as far as the epistemological problems in the *Posterior Analytics* are concerned, this passage is the most important passage on which the orthodox account of *nous*, understood as an infallible, certain and most accurate faculty, is based. (Notice, however, Aristotle is not talking about a faculty here.) For the eliminative argument involved here — to the effect that it is *nous* by which we

---

<sup>27</sup> Leshner (1973), p.65.

<sup>28</sup> Throughout in the paper I used various translations most often making some slight modifications. Barnes’ (1975, 1994) and Tredennick’s (Loeb Edition) translations, however, are the basis of almost all my quotations from the *Posterior Analytics*. For the rest, I often used the Oxford translation.

grasp first principles or that we have the *nous*, and not the *episteme*, of the first principles — to work, *at least* the following should be true:

(iii)  $\square (S \text{ noei that } P \rightarrow P \text{ is true}),$

which seems to be the basis of attributing infallibility to *nous*. Aristotle also says that *nous* is truer and more accurate than *episteme*. Now it is also true that

(iv)  $\square (S \text{ epistatai that } P \rightarrow P \text{ is true}),$

and since *episteme* is demonstrated knowledge whereas first principles are indemonstrable and *only nous* and *episteme* are always true, it is *nous* by which we apprehend first principles.

As Barnes points out, the eliminative argument can actually be filled out in more than one way.<sup>29</sup> But the basic idea is clear: what we have of the first principles is *nous*, which is always true. This passage has been the main supporting ground for the orthodox view,<sup>30</sup> and many have thought that it constitutes a major block for the Lesher-type non-orthodox broadly empiricist interpretations. But, this being so, what is most curious is that Lesher is the only writer I know of who elaborately addresses this difficulty while arguing for a non-orthodox interpretation of *nous*:<sup>31</sup>

---

<sup>29</sup>Barnes (1994), p.270. For a similar eliminative argument to the same effect, see *Ethica Nicomachea* VI 6. Also cf. *APo* I 33 89a1–3.

<sup>30</sup>However, notice also that there is nothing in this passage that supports (ii). Also, although (i) entails (iii), the converse is not true.

<sup>31</sup>Engberg-Pedersen (1979) says with respect to II 19 that: "...*nous*, in addition to denoting the *faculty* that is responsible for the universal principle's being seen as a result of 'epagogic' attention being given to particular cases, is now stated to denote the *state* that obtains when the principle is seen. ...*Epagoge* is attending to particular cases with the consequence that a universal point is seen, for which the faculty of *nous* taken as a generalizing ability is responsible... In Aristotle *epagoge* raises no question as to the certainty of the universal proposition... nor does he wish to introduce *nous* as an ability that guarantees the truth of the universal proposition (this much for one traditional interpretation of *Posterior Analytics* II 19)" (pp.317–18). But Engberg-Pedersen, somewhat surprisingly, says nothing about the last paragraph of II 19. He does not even discuss how it can be made to fit into his general account. This is very curious especially given that that paragraph has traditionally been taken to be the main support against the kind of interpretation he is pushing for.

Kosman, in his quite insightful paper (1973), argues that *nous* is to be properly viewed as the insight we gain when we see and understand certain universal propositions in the light of the explanatory capacity they have with respect to phenomena which makes us grasp the propositions as *the* principles. *Nous* is just the kind of ordinary insight when we understand the scientific explanatory power of certain universal propositions, and we come to this understanding by ordinary inductive and empirical means, i.e. while we are actually doing empirical science. However, Kosman explicitly declines to discuss II 19: "...there are many

But some difficulties remain. In the final paragraph of II, 19, it is argued that it is *nous* (and nothing else) which we possess of first principles, but there are some features of Aristotle's argument which make it hard to reconcile with the empiricism of the preceding genetic account. *Nous* is characterized as being *akribesteron* than any other kind of knowledge... and even *alethesteron* than *episteme*, and these qualities of unsurpassed 'accuracy' and 'infallibility' have been seen as the marks of a faculty of intuition... (1973, pp.62–3)

Subsequently, Leshner gives a series of arguments intended to show that Aristotle did not mean in that passage that *nous* is the most accurate and infallible state of mind as these epithets are understood in their ordinary senses. In brief, Leshner seems to reject (iii). His alternative interpretation is not actually without force, and I tend to believe that it is in fact true. But it falls short of establishing *his* main point.<sup>32</sup> If there is any argument in Aristotle's passage, then it requires (iii) without which it is not clear what to make out of that very passage.<sup>33</sup>

---

things I don't understand about that chapter and its relation to the rest of the *Analytics*. So with many other questions which I've left unanswered, only a part of the reason for which has been the intentionally broad scope of my discussion" (p.391).

Burnyeat's (1981) line of argument against the orthodox view is very similar to Kosman's. He thinks that *episteme* is to be understood not as scientific knowledge but as scientific understanding that comes with the nomological explanation of the phenomena. With respect to II 19, he writes: "A faculty of intuitive discovery is not needed because discovering... first principles is a matter for induction... Aristotle sees no Humean problem about a leap from inductive evidence to *knowledge*. ...Hence, as *he* sees the problem of our grasp of first principles, the difficulty is not a lack of evidence to transform inductive belief into certain knowledge. That inductive belief is already knowledge. What it is not yet is understanding and that kind of *gnosis* which goes with understanding. To acquire this at the level of first principles what we need is greater familiarity, perhaps some more dialectical practice; in short, intellectual habituation" (p.131). This habituation, he says, finds its home in Aristotle's conception of *nous*. But this sounds like we should make ourselves believe that we got what we want. In any case, this will not do. Aristotle seems clear about the nature of inductive evidence: "[In division] it never becomes necessary that the thing is necessary when such and such holds, but [division] proves in the way in which a person who does an induction proves" (*APo* II 5 91b15–17). See also *APo* II 5 91b35–36; *APo* II 7 92a38–b3. Cf. *APo* I 4 73a32–34; I 24 86a11–14; I 31 87b30–35; *Top* V 3 131b19–39 and VII 5. In this connection, Engberg-Pedersen's (1979) discussion of Aristotelian induction is very helpful. Aristotle is also very cautious about hasty scientific generalizations. In *De Generatione Animalium* III 5 756a2–6, for instance, he says: "The cause of the ignorance of those who take that view is that, while the differences among animals with regard to copulation and procreation are manifold and obvious, those people observe a few cases and think that things must be the same in all cases." For similar remarks, see also *Physica* VIII 1 252a22–b4.

<sup>32</sup>Furthermore, his suggestions about how to properly understand the alleged characteristics of *nous* are not incompatible with the truth of (iii).

<sup>33</sup>Perhaps this is the reason why Leshner seems also to reject, tacitly, a reading of the passage as containing an eliminative argument, see p.64, n.54. But this is unconvincing, we have a parallel of the argument in *Ethica Nicomachea* VI 6 that obviously requires (iii). Cf. also

Barnes' interpretation of II 19 is somewhat similar to Lesher's but less clear and rather brusque. According to Barnes, Aristotle makes a verbal point about *nous* at 100b5ff. in response to one of two questions he raises in the beginning of II 19: how do the principles become known and what is the state that knows them? (99b17–9) Aristotle's answer to the first question, according to Barnes, is "by means of induction," as given in the genetic account of II 19 (99b30–100b4). And the whole purpose of the last paragraph of II 19 is just to answer the second question and nothing more. Just as *episteme* can be said to be the state we arrive at through demonstrative syllogism, *nous* is just the state we are in at the end of an inductive process. Barnes says, "*Nous* has no philosophical importance in *APst.*" (1994, p.270). But this is, to say the least, puzzling. If *nous* is the end state of an inductive process, then the propositional content of the end state one is in any time one happens to engage in an inductive process will be true, since this end state is claimed to be *nous*, and thus, is, by (iii), always true. But not every end state of an inductive process is a state whose content is true. Induction is a fallible process.<sup>34</sup> Barnes does not say much on the issue even though he gives the impression that he claims to have solved the mystery of *nous* in *APo* II 19.

To recap: why is an empiricist interpretation of *nous* as the ordinary grasp of the deliverances — as the end state — of induction supposed to be somehow problematic? The reason, I submit, is this: Aristotle is explicit about (iii), but how can anything remotely like (iii) be true given the notorious frailty of induction? If *nous* of *P* is what we have when we infer or justify (or, somehow arrive at) *P* on the basis of inductive and empirical evidence, then there is no epistemic guarantee that *P* is true, no matter how good our evidence is; hence, there is apparently no necessity that when someone *noei* that *P*, *P* is true — if *nous* is related to induction in the way Lesher and many others have thought. So, the traditional embarrassment seems to be still with us.

The traditional and orthodox view has put the emphasis on the *nous* as an infallible intuitive faculty and tried to solve the epistemological problems raised in the *Posterior Analytics*, as it understood them, by means of this *nous*. This was overkill. Indeed, what is known about Aristotle's empiricism and his scientific practice makes it very hard to swallow such an interpretation of *nous*,

---

*APo* I 33 89a1–3.

<sup>34</sup>This argument works better against Lesher since he is, unlike Barnes, very clear about the relation between *nous* and Aristotelian induction: "The relation between *nous* and *epagoge* turns out to be a typically Aristotelian one: there is one activity, grasping the universal principle, but it admits of various descriptions; to speak of it as an act of *noesis* is to give an epistemological characterization, while to characterize it as *epagoge* is to speak of methodology. This account of *nous* and *epagoge* coincides with Aristotle's view that experience provides us with principles which we then endeavor to structure within syllogistic form, and it makes perfectly good sense of *nous* as the 'source of scientific knowledge' since it is *nous* which supplies us in general with such principles" (1973, p.58).

especially with respect to the kind of knowledge of the first principles required for *episteme*. The non-orthodox view, on the other hand, has emphasized the empiricism of Aristotle, and viewed him as almost a thorough-going empiricist.<sup>35</sup> But, as we have seen, it also faces difficulties. I agree with Couloubaritsis (1980) that Aristotle's thread of thought seems to have somehow escaped us so far. So what to do?

In fact, I tend to believe that the non-orthodox interpretation of Aristotle's epistemology is very close to truth, if any such there be. Not that I view Aristotle as an empiricist in, say, a Lockean or Humean sense; but I think, Aristotle has adopted a *scientific methodology* which is empiricist in a broad sense. But what about the general epistemological problems that seem to be raised by what Aristotle says about *nous*?

Why exactly can we not grant (iii) to Aristotle while holding at the same time that the only evidence we can have for our knowledge of the first principles is empirical and inductive without postulating an intuitive and *a priori* justifying faculty? Now it is true that inductive evidence by its very nature falls short of establishing the truth of our beliefs. But our inductive beliefs are *sometimes* knowledge, only that we cannot always *correctly tell* when our beliefs are knowledge. In other words, we cannot necessarily know for sure when (and generally what) we know when our all and only evidence is inductive. To put it slightly differently, we may not necessarily be able to *conclusively defend* our inductively grounded *knowledge claims* when challenged. But why should a conclusive defence of our knowledge claims be a necessary condition on the possibility of our having knowledge? Such a demand has been made by the traditional and notorious skeptic we are all familiar with through the history of epistemology.<sup>36</sup> What

---

<sup>35</sup>Barnes, for instance, writes: "the answer Aristotle gives to the first question is wholeheartedly empiricist; and only a failure to distinguish between the two questions of B 19 will permit a rationalistic interpretation. *Nous* is an answer to the second question, not a rival, rationalistic, answer to the first: 'intuition' as a mode of discovery is absent from *APst*." (1994, p.270).

<sup>36</sup>Although the conception of knowledge as justified true belief (JTB) has been tacit throughout the history of traditional epistemology, the almost universal interpretation of the justification clause, until recently, was such that it required complete/conclusive justification that was subjective in the sense that all the grounds for complete justification are meant to be accessible to the one who has knowledge — this is what made the traditional account of epistemic justification *internalist*. But this complete justification was also meant to be objective in that it would guarantee the *truth* of what is claimed to be known: this is what made it complete and conclusive. With this alleged certainty, the traditional account of *knowledge* was also internalist (see fn.18 above). To my mind, one of the great discoveries of epistemology in this century was the realization that proper epistemic justification need not be complete and conclusive. Gettier (1963) partly owes his success to the account of knowledge that was the result of dropping the requirement of complete justification: one does have knowledge as long as the three conditions given for knowledge are *in fact* true even if one's (incomplete) justification depends on actually false beliefs. The decision to allow for incomplete justifica-

reason is there to think that Aristotle is trying to respond to such a skeptic, rather than giving an account of what the *nature* of scientific knowledge is? Part of my argument in what follows will consist in an attempt to show that there is little, if any, reason.<sup>37</sup>

We may remember that Aristotle begins the *Posterior Analytics* by defining *episteme* as demonstrated knowledge. Now demonstrated knowledge is not just a kind of justified true belief whose justification happens to be deductive. It must be demonstrative, and Aristotle, to a great extent, can be seen to be cashing out in the first book of the *Posterior Analytics* just what is involved in demonstration. In such a context, (iv), given above, is not found problematic: necessarily, we have knowledge only if what we believe is true. What else could be less problematic? Truth is a definitional characteristic of any kind of knowledge. But also, necessarily, we have scientific knowledge that *P* only if we have the demonstration of *P* from principles that we also know. What is the nature of our knowledge of principles? We are told that it is not demonstrated knowledge, hence it cannot be *episteme*. Aristotle tells us that one has the *nous* of principles. One does not, strictly speaking, *epistastai* a principle, but *noei* it. So one can agree with Barnes that *nous* is just the name of the *hexis* we are in when we apprehend the principles. But this *hexis* is a knowledge state. Why then should (iii) be thought to be problematic in this context? It is thought to be problematic, I submit, only if one fails to distinguish between two different issues: establishing one's claims to knowledge which has primarily to do with internal epistemic justification on the one hand, and on the other, giving an explicative account of the nature of knowledge which has to do with capturing those conditions whose satisfaction is both necessary and sufficient for one to have knowledge. Now these two issues collapse into one, of course, if the satisfaction of those conditions is to be infallibly accessible to one who knows. Apart from the general question of the very possibility of such an access ever (especially in the cases where the objects of knowledge are universal and empirical facts), is there any evidence that Aristotle assumes, or requires, or even makes an attempt to show, that the satisfaction of the conditions he specifies for scientific knowledge are accessible in this way to one

---

tion resulted in externalist accounts of *knowledge*. However, the enormous difficulties involved in the attempts to solve Gettier problems soon forced many researchers in the direction of developing externalist theories of epistemic *justification* too. One way of seeing my project in this paper is as an attempt to combine Aristotle's general and well-known naturalism regarding his scientific methodology with a naturalist interpretation of his epistemology, more specifically, with an externalist interpretation of his account of scientific knowledge. It would be an interesting exercise to see just to what extent his psychological account of *nous* in *De Anima* (especially the Active Intellect of III 5) can be seen as, *inter alia*, a version of a generalized externalist account of epistemic justification. See §VII below.

<sup>37</sup>See C.C.W. Taylor (1990) who also claims that Aristotle in his epistemology was not concerned with responding to a Cartesian-style skeptic. However, he nevertheless expresses surprise about Aristotle's alleged understanding of the relation between *nous* and induction.

who has scientific knowledge? I do not think that there is. It seems to me that Aristotle is innocent of the problem that his interpreters have found in his writings, especially in the *Posterior Analytics*.

- III -

I think, it is time to see in more detail what the conditions of having scientific knowledge are as specified by Aristotle. In this and the next section (§§III–IV), I will reconstruct Aristotle’s understanding of demonstration as discussed especially in *APo* I 2–9. For, as we will see, this is the key notion in having scientific knowledge. My aim is to be very clear and explicit about exactly what it is to have scientific knowledge according to Aristotle, i.e. about the necessary and sufficient conditions of an explicative analysis of scientific knowledge. I will recast Aristotle’s discussion in a reconstructive fashion and, at the end, suggest a definition of scientific knowledge. Along the way, we will recover many themes essential for a proper understanding of Aristotle’s epistemology. Once we do that, how to fit *nous* in the emerging picture, its role and place, will become apparent. This is the job of sections §§VI–VII, prior to which, in §V, I will briefly return to the orthodox interpretation of *nous* for more criticism.

In the very beginning of the second chapter of Book I of the *Posterior Analytics*, Aristotle gives his first formulation of the conditions on having *episteme*:<sup>38</sup>

We think we s-know [*epistasthai*] a thing in the unqualified sense [*haplos*] (and not in the sophistic manner, i.e. incidentally) when we think [1] that we know [*gignoskein*] the cause from which the fact results, and [2] that the fact cannot be otherwise. (71b9–13)

In the rest of the chapter and in Chapter 3, Aristotle seems to elaborate on clause [1]. And then, in Chapters 4–6, he takes up the other clause [2]. But as we will see, what he says here about the first clause is preliminary and not very illuminating. This is not very surprising, since, as I will argue, Aristotle needs what he has to say about second clause in a proper characterization of clause [1] which is the core of having scientific knowledge.

One interesting feature of this passage is the “we think we know” construction. Aristotle is very clear and explicit about this construction, and his use of it in many other passages<sup>39</sup> where he wants to reformulate the one or the other

---

<sup>38</sup>In what follows I will use the somewhat barbaric ‘s-know’ and ‘s-knowledge’ for ‘*epistasthai*’ and ‘*episteme*’ respectively just to mark them off from other cognate expressions such as ‘*gignoskein*’ and ‘*eidenai*’ for which I will most of the time use just ‘know.’ For the relation between these three verbs as they occur in Aristotle’s writings, see Burnyeat (1981).

<sup>39</sup>For instance, cf. *APo* I 6 75a15–18, 9 76a28–29, 33 89a5–9, II 11 94a20–21; *Met* I 3 983a24–25; *Ethica Nicomachea* VI 3 1139b20–21, 1139b33–34; *Physica* I 1 184a12–13, II 3 194b19–20.

clause in some fashion makes it clear that such a construction is not accidental or stylistic here. What might its import be? Barnes first considers the idea that Aristotle gives a ‘consensus’ argument for his definition: “we think [*episteme*] to be so-and-so; therefore [*episteme*] is so-and-so” (1994, p.91). Although he seems to think that there is some force in this interpretation, he, at the end, rejects it on the basis that “so interpreted, Aristotle’s argument... is factually mistaken; for [the passage] does not represent a correct analysis of the actual use of the Greek verb *epistasthai*” (p.91). He says that this construction should be taken to indicate that the passage gives a ‘stipulative’ definition of *episteme*. I think this is basically right. But there is more to it especially when viewed in the light of some other passages as we will see later on. Suffice it to say, for the moment, that if the definition is intended to be more or less stipulative, it must be relatively clear that Aristotle sets his project in terms suitable for giving an *explicative* account of *episteme*, and not necessarily with an eye to show against the skeptic the possibility of having scientific knowledge as the traditional commentators have thought it.

Let us recast the essence of Aristotle’s definition in more explicit terms:<sup>40</sup>

S s-knows that *P* if, and only if,

[1] S knows that  $\Pi$  is the explanation of *P*, and

[2] S knows that *P* cannot be otherwise.

How should we analyze [1] and [2]? In particular, what should we include in an account of the ordinary knowledge (*gignoskein* in Aristotle’s passage) in [1] and [2]? The best thing to do in the way of answering these questions, I think, is to proceed as Aristotle does in the subsequent chapters. So, then, let us begin with Aristotle’s preliminary discussion of clause [1] in Chapter 2.

It is instructive to see that Aristotle’s first allusion to *nous* in the *Posterior Analytics* is found almost right after his definition of *episteme*. He says at 71b16–9:

Now whether there is also another type of s-knowing we shall say later; but we say now that we do know [*eidenaî*] through demonstration. By demonstration I mean a scientific syllogism [*sullogismôn epistemonikôn*]; and by scientific I mean one in virtue of which, by having it, we s-know something.

It is clear that the reference here in the first sentence is to *nous*. It is interesting to see Aristotle using ‘*epistasthai*’ in alluding to *nous* especially as he immediately

---

<sup>40</sup>Since a free variable occurs in the *definiens*, the following definition, strictly speaking, is technically flawed. But I will leave it this way, since I do not want to bother the reader with unnecessary complications that the quantificational issues might produce. I think the definition as given is intuitively clear enough to do its job for what follows.

proceeds to specify that *episteme* is just what we have in virtue of having a demonstration. I think Aristotle is writing here somewhat loosely (but see fn.1 above). In clause [1] of his definition of *episteme* above, Aristotle does not mention demonstration, but this passage and the one immediately following this make it fairly clear that to have the explanation of *P* is just to have the appropriate demonstration of *P*:

If, then, s-knowledge is as we posited, it is necessary for demonstrative s-knowledge in particular to depend on things which are true, primitive, immediate, better known than, prior to, and explanatory of the conclusion (for in this way the principles will also be appropriate to what is being proved). For there will be syllogism even without these, but there will not be demonstration; for it will not produce s-knowledge. Now <the premises> must be true because one cannot s-know what is not the case... And <they must> be primitive and non-demonstrable because <otherwise> you will not s-know if you do not have a demonstration of them; for to s-know non-incidentally that of which there is a demonstration is to have a demonstration. They must be both explanatory and better known and prior — explanatory because we only s-know when we know the explanation; and prior, if they are explanatory; and already known not only in the sense of understanding their meaning but also of knowing that they are. (71b20–34)

So to know the explanation of *P* is just to have the demonstration of it. We learn that demonstration is a special sort of syllogism, but its specialness is not characterized by means of some sort of formal properties. A syllogism is a demonstration because of non-formal properties of its premises. We have the *episteme* of *P* in so far as we syllogistically infer it from premises that are true, primitive, immediate, better known than, prior to, and explanatory of *P*.

However, this is not a rigorous characterization. For it is not necessary that each premise in the syllogism be immediate and primitive for its conclusion to be *episteme*. Aristotle elsewhere allows that already demonstrated premises, whenever required, should be used in the demonstration of a conclusion.<sup>41</sup> So there can be a chain of demonstrations. But *episteme* should ultimately depend on demonstration from premises that are primitive and immediate. Aristotle probably does not consider this complication for the ease of his initial characterization.

Given this initial picture, the allusion to *nous* almost right after the characterization of *episteme* should come as no surprise. For 71b9–13 defines only the *demonstrative* scientific knowledge which ultimately depends on non-demonstrable

---

<sup>41</sup> “Reasoning is *demonstration* when it proceeds from premises which are true and primitive or of such a kind that we have derived our original knowledge of them through premises which are primitive and true” (*Top* I 1 100a27–30). See also *APo* I 10 76b10 and *Rhetorica* I 2 1357a7. The whole structure of the discussion in *APo* I 3 to the effect that infinite regress in demonstration is inadmissible also makes it clear that Aristotle allows for finite chains of demonstrations.

but somehow known premises. It is only when this definition is construed as a (or, “the”) *general* definition of what it is to have knowledge that the possibility of having non-demonstrable knowledge is prone to become an epistemological puzzle. This, of course, does not remove, at least in our eyes, the existence of certain *prima facie* epistemological problems in Aristotle’s conception of scientific knowledge, but seems to suggest that they are not, at least in the *Posterior Analytics*, within the scope of Aristotle’s philosophical worries, at least not directly anyway. When viewed in this way, Aristotle’s discussion and rejection of circular and infinitely regressive demonstration in the subsequent chapter becomes polemical in its purpose. I believe Aristotle uses this polemical discussion for expository purposes, in order to better convey what he thinks scientific knowledge involves. Indeed he says, “neither of these views is true or logically unavoidable” (72b8–9). His primary aim is not to show against the skeptic the possibility of scientific knowledge in general. In this respect, that Aristotle does not even attempt to give an argument for his claim that “not all knowledge is demonstrative” (72b19) has always been a source of puzzlement.<sup>42</sup> For how could Aristotle so lightly pass over such an important point, “which is the very point at issue”?! But on my reading this is not a puzzle at all, because this is not Aristotle’s worry.<sup>43</sup> He simply gives an explicative account of a certain sort of knowledge, namely, the kind of knowledge we have when we have a demonstration. That is *all* he wants to clarify.

Let us examine the properties Aristotle cites that the premises of a proper demonstration should possess; namely, that they must be true, primitive, immediate, better known than, prior to, and explanatory of their conclusion. That the premises should be true needs, I think, hardly commenting on. But as a bare minimum, we can say that *episteme* is a kind of knowledge, what is known must be true, and — since *episteme* is a sort of derived knowledge — what it is derived from must also be known, hence must be true.

What about immediacy and primitiveness of the premises? In general, ac-

---

<sup>42</sup> Again, see, for instance, the quotes from Grene (1963) and Morrow (1970) above.

<sup>43</sup> Not that this *cannot* constitute a legitimate philosophical worry in general, but it is not the worry Aristotle is attending to there. Apart from the *Posterior Analytics*, Aristotle, throughout all his writings, is indeed known to be notorious in balking at skeptical questions. He just does not seem take the skeptic seriously at all. See, for instance, *Met* IV 6 where he writes: “There are, both among those who have these convictions and among those who merely profess these views, some who raise a difficulty by asking, who is to be the judge of the healthy man, and in general who is likely to judge rightly on each class of questions. But such inquiries are like puzzling over the question whether we are now asleep or awake. ...These people demand that a reason shall be given for everything; for they seek a starting-point, and they seek to get this by demonstration, while it is obvious from their actions that they have no conviction. But their mistake is what we have stated it to be; they seek a reason for things for which no reason can be given; for the starting-point of demonstration is not demonstration” (1011a2–14). Also, cf. *Physica* II 1 193aff.

According to Aristotle, a proposition of the subject-predicate form, 'all  $S$  is  $P$ ' (let us abbreviate this into ' $SaP$ '),<sup>44</sup> is immediate just in case there is no middle term,  $M$ , such that ' $MaP, SaM \vdash SaP$ ' is a demonstration. This way of characterizing immediacy is of course circular if we are inquiring, as we are, into what makes a syllogism a demonstration. Notice that in the above quotation, where Aristotle briefly glosses each of the characteristics after having cited them, 'immediate' is replaced by 'non-demonstrable.' Perhaps this is why he later on does not give the obvious definition of 'immediate':

To argue from primitive premises is to argue from appropriate principles; for I call the same thing primitive and principle. A principle of a demonstration is an immediate proposition, and an immediate proposition is one to which there is no other prior. (*APo* I 2 72a6–9)

This passage, and indeed the whole chapter, gives the impression that Aristotle uses 'immediate,' 'primitive,' and 'non-demonstrable' in the same sense. If  $P$  is primitive, then there is no  $Q$  prior to  $P$  such that  $P$  is derivable from  $Q$  (where  $Q$  may be a set of true propositions). But, of course, for this characterization to work appropriately, i.e. in the sense Aristotle intends primitiveness to be a feature of premises *in* a demonstration, the sense of derivation should be specified. And the obvious and intuitive candidate for it is demonstrative derivation. For as Aristotle is well aware, there can be many sound deductive arguments establishing  $P$ , where  $P$  happens to be in fact demonstrable, that are not demonstration in the strict sense. Hence we have again the same sort of circularity. So we are still in dark about what demonstration is, in the strict sense.

In fact, Aristotle gives his first hint in the direction of breaking the circularity when he says that the premises of a demonstration must be prior as much as they are explanatory. Indeed, as we will see more clearly in a moment, explanation from naturally prior and necessary premises *is* the key idea for Aristotelian demonstration. At 71b35–72a5 Aristotle writes:

Things are prior and better known [*gnorimotera*] in two ways; for it is not the same to be prior and better known by nature and prior and better know in relation to us. I call prior and better known in relation to us what is nearer to perception, prior and better known absolutely [*haplos*] what is further away <from perception>. What is most universal is furthest away, and the particulars are nearest; and these are opposite to each other.

---

<sup>44</sup>It is not necessary for an immediate premise to be of a universal affirmative form. Aristotle allows them to assume universal negative form, see *APo* I 15. Aristotle in many of his examples uses also singular statements where it is clear that he intends them to be taken as immediate. But Aristotle is quite explicit that the proper form for scientific discourse is universal affirmative premises and demonstrations based on them, see *APo* I 14.

Although Aristotle can naturally be taken to be talking about premises, his distinction is not restricted only to propositions. In fact, it is clear from other passages that the distinction finds its natural place among concepts. A concept is prior by nature to another in so far as it is more general and abstract. For example, “animal” is naturally prior to and better known than “man,” “animate being” is prior to and better known by nature than “animal,” and so on. Accordingly, premises, at least in some rough and intuitive way, can be so graded according to their generality and the abstract level of the terms they contain, as long as they are true and universal. But even if much of this is intuitively clear, we are still in dark about why what is thus further away from perception is called prior *by nature* and what its relevance is to demonstration.

In Chapter 2 Aristotle does not elaborate on the requirement that the premises of a demonstration should be explanatory of its conclusion. And this is no surprise. For in a certain sense, this is going to be one of the main focuses of Aristotle in the remainder of his treatise. In fact Aristotle needs to address the necessity requirement in the definition of *episteme* in order to elaborate on explanation. And this is exactly what he does beginning in Chapter 4.

- IV -

After quickly stating at 73a21–4 that demonstration is syllogism from what cannot be otherwise, and hence, implying that necessity of *episteme* is transferred from the premises of demonstration, he says at 73a25–6 that “therefore we must comprehend the nature and character of the premises from which demonstrations proceed” as if this was not what he has been examining so far. But in a sense, this is not surprising: we have seen so far from our brief examination of what Aristotle says about the first conjunct in the definition of *episteme*, that his characterizations of the features of demonstrative premises are either implicitly circular or not genuinely illuminating. Indeed, that the real issue begins here and the foregoing discussion was a kind of warm-up becomes immediately clear from what Aristotle embarks on in the remaining part of the chapter. What he does is to introduce three technical terms: ‘predicated of all’ (*kata pantos*), ‘per se’ (*kath’auto*), and ‘<commensurate> universal’ (*katholou*).

Although Aristotle’s definition (73a28–34) of ‘predicated of all’ is slightly ambiguous, the general idea is fairly simple and clear: the predicate *A* is predicated of all *B* if, and only if, the universal affirmative sentence ‘*AaB*’ is asserted to be (timelessly) true. It is clear that Aristotle here tries to capture what we are committed to when we universally quantify over something without any reference to a particular time and place.

For our purposes, the definition of ‘per se predication’ is more important. In fact, it is the key to our reconstruction. Aristotle gives four senses in which one thing is *per se* predicated of another thing (73a35–73b25). However, for us only

three of them are relevant: 'AaB' is a *per se* predication if, and only if, (1) 'B' is an element in the definition of 'A,' or (2) 'A' is an element in the definition of 'B,' where the definitions of 'A' and 'B' state the essences or essential natures of their denotations. Although many commentators tend to dismiss the other two specifications of '*per se*' as irrelevant to Aristotle's purpose, I think that one of them (the forth in Aristotle's ordering) is relevant. This has to do, it seems, with events or happenings:

[4] Again, in another way what holds of something because of itself holds of it in itself [*kath'auto*], and what does not hold because of itself is incidental. E.g. if there was lightning while he was walking, that was incidental: it was not because of his walking that there was lightning — that, we say, was incidental. But what holds because of itself holds in itself — e.g. if something died because of being sacrificed, it died *in* the sacrifice since it died because of being sacrificed, and it was not incidental that it died while being sacrificed. (73b10–16)

This passage (and many others like it), and Aristotle's discussion of *per se* predication in general, make clear where the necessity comes from and how it is related to explanation and priority in nature. Aristotle is an essentialist. He thinks that certain things and events in nature naturally classify themselves into certain necessary kinds and patterns independently of our practical or theoretical concerns. On his view, certain things in nature have certain common characteristics that are the basis for their being of the same kind. These characteristics are essential to them: they are together what is basically responsible for them to be the *kind* of things they are. There is a natural and necessary order among things in the world. This order is objective and naturally hierarchical: something cannot be a man without also being an animal. Animalhood is essential for manhood as well as, say, for being a horse, but not vice versa. That man is an animal is an essential, and thus, a *per se* predication. For it is part of what it is to be a man that it be an animal. In other words, being an animal is part of the natural and objective essence of being man. But, if so, there is no more fundamental, natural fact other than that all men are animal that would explain to us why all men are animal. In a sense, that all men are animal is self-explanatory, and naturally and objectively so. It is a basic *principle*, so to speak, that all men are animal. The objective taxonomic order found in nature is what determines the ordering of our concepts in terms of priority by nature. It is in so far as our concepts carve nature at its joints that they exhibit these priorities. When we look, what we directly see is not animal as such, nor is it man, but Callias the man — even still incidentally at that.<sup>45</sup> But it is only when we see Callias in the light of the essential attributes of the natural kind of which he is a member that we come to understand why Callias exhibits certain features that he does. It is only when

---

<sup>45</sup>See *De Anima* II 6; cf. *APo* I 31.

we relate what is prior in relation to us to what is prior by nature that we come to understand why certain things “behave” in certain ways. For instance, we may wonder why *these* things have four stomachs; we may be answered that it is because they are cows. But what is it about cows that they have four stomachs? Well, because they are ruminants. And presumably that is the end of the story. Cows have four stomachs, because they are ruminant animals and all ruminant animals have four stomachs. This is simply but essentially how things are in nature. And to find out this is the business of the Aristotelian scientist.

Similarly with events and happenings in the world. Certain kinds of events occur only after or simultaneously with certain kinds of other events. There is a regularity and pattern in the natural phenomena. For instance, we observe that the moon always exhibits phases, and we come to realize that it is not an accident that this is so; there is a principle involved here, something is responsible for the phases of the moon. In brief, we realize that that the moon exhibits phases has a cause. And when we discover the cause, we understand the reason why of the phenomenon. The moon exhibits phases, because it is spherical, and that which is spherical always exhibits phases under such and such conditions. Our understanding of the phenomenon is complete when we know the ultimate explanatory principles at work. Here, that that which exhibits phases is spherical either is a principle that needs no further explanation or can be explained on the basis of further and more ultimate principles, like those of optics for instance. But it is only when we have the ultimate *per se* connections in nature is our explanation, and thus our understanding, complete.

I think that we may now begin to see the relations among necessity, explanation, and priority by nature. For Aristotle, to explain why *A* is *C* is to find out a middle term which expresses the cause of *A*'s being *C*:<sup>46</sup> it is because *A* is *B* and *B* is *C* that *A* is *C*. This may *prima facie* seem odd, but we should remember that the concept of cause (*aition*), for Aristotle, is a really broad one: it stands just for a number of factors that are responsible (partly or wholly) for a fact or phenomenon being just the fact or phenomenon it is. When we wonder why *A* is *C*, we are actually wondering about what it is about *A* that as such it is *C*. We are looking in fact for a description (middle term) such that when we see *A* under it we hope to understand why *A* is *C*. Explanation is an intentional activity, and how we describe that which we try to understand matters very much. We may not recognize why this thing has four stomachs even if we independently know that having four stomachs is a *per se* attribute of all ruminant animals. It is only when we see

---

<sup>46</sup>For an explicit statement of this in *APo*, see II 1–2 and 7–10. Many commentators like Ross and Tredennick claim that Aristotle's concern in these and the following chapters is attributes of substances, rather than substances. But Aristotle's examples, which are obviously very carefully chosen in this case, defy them. See especially *APo* II 8 93a22–25. For the import of these examples and their role in Aristotle's discussion, see Bolton's insightful discussion in his (1987).

this thing *qua* cow, and thereby recognize it *as* a ruminant animal that we come to understand why this thing in front of us has four stomachs.<sup>47</sup>

The necessity of *episteme* comes from *per se* connections. *Per se* connections constitute the ultimate principles on the basis of which we explain that which is explainable. They are ultimate because they lack middle terms and are self-explanatory. They are prior by nature both because nature is the way it is and because they are the common grounds under which many apparently diverse phenomena can be subsumed and explained. This requires that they be universal, general, and abstract in the sense envisioned by Aristotle. That which we subsume cannot be more general than that under which we subsume it. Explanation requires law-like relations that are by their very nature universal, and laws in turn can be explained by more general laws. I think, that is what Aristotle has in mind when he says “the universal is more of the nature of a cause” (85b23).

Now we can see why the implicit circularity in the characterizations of immediacy and primitiveness of the premises of a demonstration is no problem. For there is in fact no circularity. What Aristotle means by an immediate premise is equivalent to a *per se* predication.<sup>48</sup> An immediate premise is one that lacks a middle term that would explain the predication involved in it on the basis of more ultimate explanatory premises. Lacking such a middle, it is self-explanatory, thus a *per se* predication. Similarly, a premise is primitive just in so far it is not further explainable in terms of more basic explanatory principles. What we see here is the most basic element in having scientific knowledge. This element is *explanation* carried out in a certain manner. So in a sense we are back to the original definition of *episteme*. Syllogism from true self-explanatory premises that contain the reason why of a certain particular phenomenon is the scientific explanation of this phenomenon.<sup>49</sup> The essence of being a *first principle* is to be genuinely explanatory of phenomena while at the same time to have no need of being further explained. For Aristotle, *per se* predications state the ultimate causal (in the Aristotelian sense) structure of the world. There are simply no more basic connections in the world: they are the primary connections *by nature*. And everything else which is posterior by nature, or prior in relation to us, is to be explained on the basis of them, if they are explainable at all. This is virtually what makes them first principles. And it is the business of each science to find out those principles peculiar to itself so that when they are *in situ* the phenomena falling under its scope could be completely explained. But as we will see,

---

<sup>47</sup>See *APo* I 1 71a19–29 and *APr* II 21 67a ff. For an excellent discussion of the issue of explanation in Aristotle, see Kosman (1973) to which I am much indebted.

<sup>48</sup>See Barnes (1994), p.119.

<sup>49</sup>In *APo* I 24 85b25–27, Aristotle writes: “For a subject which possesses an attribute *per se* is itself the cause of its own possession of that attribute; and the universal is primitive; therefore the universal is the cause,” i.e. the explanation.

discovering the principles and explaining the phenomena from them are not unconnected procedures.

Let us now return to the last item Aristotle characterizes in Chapter 4, namely ‘<commensurate> universal’ (*katholou*). Aristotle uses ‘universal’ in a specialized sense here as becomes clear from how he defines it: “By a ‘universal’ attribute I mean one which belongs as ‘predicated of all’ to its subject, and belongs to that subject *per se* and as such” (73b26–9). Many commentators prefer to use the term ‘commensurate universal’ in order to denote what Aristotle means here. A commensurate attribute is one that belongs to all of its subject (thus universal in the ordinary sense),<sup>50</sup> and is a *per se* attribute of it (thus essential), and belongs to its subject *as such*, which means that it is co-extensive, and thus convertible, with its subject. What is the significance of commensurate universal?

Aristotle also uses ‘primitive’ in this and the following two chapters, but it seems that what he means by it here is an attribute co-extensive with its subject.<sup>51</sup> This becomes clear especially in Chapter 6. In discussing the accidental knowledge that the sophists have (I 5 74a20–33), he says that one has to have the proper commensurate universal as the basis of one’s scientific knowledge. And a little further, he says, “the starting-point is not that which is generally accepted or the reverse, but that which is primitively true of the genus to which the demonstration relates” (I 6 74b23–25). But what is the starting-point that is primitively true of its genus? It seems clear that Aristotle here talks about the definitions that state the full essences of each class of things within the genus, or about the definition of the essence that constitutes the subject-matter of the genus, which presumably defines in turn the scope of the science in question. Only definitions in this sense are universal, *per se* predications, and convertible.<sup>52</sup> In other words, only the (presumably) complex predicate in a definition that denotes the essence of a kind is a commensurate universal.

When viewed this way, the tripartite division of predicates makes perfect sense. For, according to Aristotle, not every predicate which is co-extensive with its subject, though obviously universal, is a *per se* predicate. For example, ‘capable of learning grammar’ is presumably co-extensive with ‘man’ even though capable of learning grammar is in no way part of the essence of man.<sup>53</sup> What the

---

<sup>50</sup>I will use ‘universal’ henceforth to denote ‘predicated of all’ or use it in its ordinary sense in relation to propositions. I will use ‘commensurate’ in the special sense in which Aristotle uses ‘*katholou*’ in Chapter 4.

<sup>51</sup>See Barnes’ discussion of the “doctrine of the Commensurate Universal,” (1994), pp.258–59. See also *APo* II 17.

<sup>52</sup>See *APo* II 4 91a15–18; 6 92a8–12.

<sup>53</sup>Aristotle sometimes calls this kind of attributes “properties” (*Top* I 5 102a18–31; see also Tredennick’s notes on *APo* II 13 96a24–28 in his translation). Aristotle’s terminology and doctrine about properties, or as is sometimes called ‘necessary incidentals,’ are not clear and stable. He seems to claim that properties, even though they do not form part of the es-

tripartite division of kinds of predication suggests is clear enough, as is also revealed by the whole discussion of chapters 4–6. Aristotle is proceeding in an orderly fashion. He first starts with the universality (“predicated of all”), proceeds to necessity (*per se* predication), and ends up with the form the first principles of each science must presumably take, i.e. the definitions (commensurate universal).

*Episteme* is of what cannot be otherwise, thus it is necessary. Its necessity comes from the *per se* necessity of the principles. A valid syllogism can have as its conclusion something necessary without its premises being necessary at all, just as a true conclusion can be validly inferred from false premises.<sup>54</sup> But in a genuine demonstration, the necessity of *episteme* should come from the *per se* premises.

Aristotle, however, is not clear about the exact nature of the principles that should be used in demonstrations. Should they always be full definitions, or simply immediate premises? For although definitions state *per se*, and thus are primitive/immediate, predications, not all *per se* predications are definitions. And apart from the difficulty of incorporating full definitions into syllogistic form, it seems that in most cases merely *per se* predications would be enough for explanatory purposes at hand. There is also the further difficulty that if properties are to be demonstrated, it seems a formidable job to demonstrate them without employing some new premises that should presumably be immediate but whose status with respect to definitions is moot.<sup>55</sup> Aristotle sometimes seems to claim that principles are just *per se* predications or just immediate premises in this sense.<sup>56</sup> But more often, as Barnes points out, he speaks as though the only

---

sence, are nevertheless necessary for their subject. And he says, they may even be eternal (*Met* V 30 1025a30–34). Things get really messier upon close inspection and there is much interpretive controversy around these issues. For instance, *Met* 5 30 1025a31–33 indicates that having angles equal to two right angles is universally true of and co-extensive with triangle, but apparently is not an essential attribute of triangles, although it is necessary. See also *Physica* VIII 252b1–4. But in *APo* I 4, Aristotle says it is a *per se* predicate of triangles; yet, a couple of lines later, he talks about the proof that triangles have 2R (*APo* I 4 73b30–40). For a nice discussion of these issues, see Barnes (1994), p.112–4. This is indeed puzzling. Perhaps properties are what gets demonstrated in sciences, as seems to have been suggested by some commentators. (If that is what Aristotle has in mind, then the second sense of *per se* predication given above can plausibly be taken to include cases where the predicate is a property. But see Barnes (1975), p.113.) But that would be overly restrictive, and probably is not intended by Aristotle. Why should only the convertible predications be demonstrable?

<sup>54</sup> *APo* I 6 75a1–11.

<sup>55</sup> Think, for instance, of some of the properties of man suggested by Aristotle: capable of learning grammar, of laughter, of having scientific knowledge. It is not clear at all how they are to be syllogistically derived from the first principles.

<sup>56</sup> E.g., *APo* I 2 72a7–10 (above), 10 76a31, 32 88b16–20; II 19 in general.

principles are the definitions.<sup>57</sup> *APo* I 10, where Aristotle is most explicit about the nature of the principles of sciences, does not much help to settle the important issues. For beginning from Book II, for instance, we see that one of the basic distinctions Aristotle draws in I 10 just disappears,<sup>58</sup> namely, that definitions do not have existential import like hypotheses.

But, fortunately, for the purposes of this paper, we need not settle these issues. It is clear that principles are at least *per se* predications, and this will suffice.<sup>59</sup> To be sure, Aristotelian sciences are in pursuit of all the full definitions there are which are peculiar to them. These definitions are the peculiar first principles of each science. But perhaps for particular explanatory purposes merely immediate premises stating an essential connection would do. In any case, in what follows I will often not distinguish between principles as full definitions and as merely *per se* or immediate premises.

We saw that the key to understanding *episteme* is demonstration. When we looked into what demonstration is, we saw that it is a syllogism from certain kinds of premises. And when we inquired into what the nature of these premises were, we saw that they were essentially such that they secured scientific explanation in an Aristotelian essentialist framework.

In the light of this, we may put the definition of *episteme* explicitly thus:

- (A) *S* s-knows (*epistatai*) that *P* if, and only if,  
       *S* knows the scientific explanation of *P*.

It is obvious that if one knows the proper scientific explanation of *P* in the required way then one knows that *P* cannot be otherwise.<sup>60</sup> What is involved in a scientific explanation? Our discussion so far suggests that its essence can be captured in the following way:

- (B) *P* is scientifically explained by a set of premises  $\Pi$  if, and only if,

---

<sup>57</sup>Barnes (1994), p.107. See *APo* 90b27; *Top* 158a33, b4, b34; *De Anima* 402b16–26; *Met* 998b5, 1034a30–34, 1078b23; *Ethica Nicomachea* 1142a26, 1143a26–b2.

<sup>58</sup>See also *APo* I 2 72a15–25.

<sup>59</sup>There is a sense in which principles can also be mediated: as long as an already demonstrated premise, when used in another demonstration, is explanatory of the conclusion, it is also a principle, though not a *per se* one. It is not clear whether it is appropriate to call such premises “principles.” However, they are perfectly explanatory of the phenomena, although not self-explanatory. In any case this issue is not of much importance, as long as the distinctions and requirements are clear. Most of the time (but not in §VII), I will continue to use ‘principle’ as at least a *per se* predication. The context will make it clear when I use it more broadly. For a beautiful discussion of the nature and number of principles, see Le Blond (1939), pp.109–120. See also Hintikka (1971).

<sup>60</sup>Cf. *APo* II 8 93a14–29.

*P* is syllogistically derived from  $\Pi$ :

- (1) that are true,
- (2) that are *per se* predications (or *episteme*),<sup>61</sup> and
- (3) that contain the appropriate middle term(s) that reveal the reason why of *P*.

Here, obviously, (2) entails (1), but we had better write (1) separately as its knowledge does not presuppose that of (2). Now (2) can be taken to state that the premises are (ultimately) *principles*: they are genuinely *explanatory* of other things, but not explainable on the basis of other things; as Aristotle says, they are self-caused, thus *self-explanatory*. This, I take it, is the essence of (2). And, clearly, principles, being *per se* predications, are immediate, primitive,<sup>62</sup> necessary, and prior by nature, as we saw. Also, equally clearly, something can be a principle in general but would not explain a given particular fact, if it does not contain the middle term that states *the* proper cause of the fact in question. Hence we have (3).

Now we may plausibly put (A) and (B) together in the following way:

- (C) *S* s-knows that *P* if, and only if,  
*S* syllogistically derives *P* from  $\Pi$  such that
- (1) *S* knows that  $\Pi$  are true,
  - (2) *S* knows that  $\Pi$  are principles, and
  - (3) *S* knows that  $\Pi$  contain the appropriate middle terms that reveal the reason why of *P*.

Of course, strictly speaking, *S* should also know that her derivation is correct, but I take this to be relatively less problematic. Aristotle's *Prior Analytics* can be seen to contain a fairly complete set of rules for checking the correctness of a syllogistic derivation.<sup>63</sup> So I will skip considering this extra complication in what follows.<sup>64</sup>

---

<sup>61</sup>As I have said before, Aristotle allows that already demonstrated, i.e. scientifically explained, premises may be used in a demonstration. As long as we keep in mind that (2) can be read recursively, there is no harm, I think, in not being so explicit and rigorous about the given conditions.

<sup>62</sup>If principles are full definitions, then they are primitive also in the more technical sense of being convertible (see above), since definitions give the commensurate universal.

<sup>63</sup>There are also many passages in the *Posterior Analytics* and in the *Topics* where Aristotle discusses the sources of often made errors in scientific explanations that relate to formal issues.

<sup>64</sup>Also, as is clear, I am taking Aristotle's word at its face value and assuming that explanations can be set into syllogistic forms. It is, however, very hard to see how, even in the cases of examples Aristotle himself gives in his entire corpus. But that is another issue.

I claim that (C) captures in a capsule but fairly complete way Aristotle's explicative analysis of *episteme* at least as it occurs in the *Posterior Analytics*: the simultaneous satisfaction of the three clauses are both necessary and sufficient for one to have scientific knowledge, whether or not one knows it. One virtue of (C) is that it makes fairly obvious what the next job is: how should we analyze the "S knows that..." in the three clauses? This is where we should expect to see how *nous* is supposed to fit in this scheme. At least two conditions are obvious: S knows that Q only if

- Q is true
- S believes that Q.

What else is required in order to make the analysis also sufficient? The obvious candidate that suggests itself is some sort of justification clause in the epistemically relevant and required sense. But what is that sense?

- V -

In this section, I want to go back to the orthodox understanding of Aristotelian *nous* and its job in Aristotle's epistemology. I want to show conclusively why the orthodox view was overkill. According to orthodoxy, as we have seen in §I, Aristotle is forced to require that the grasp of first principles be immediate and infallible if he is to show the possibility of scientific knowledge and secure its epistemic certainty. Let us call this the "Infallible Awareness Requirement" (IAR) and state it thus:

(IAR) Unless S is immediately and infallibly aware of the truth of B(1)–(3), S cannot be said to s-know that P.

Since any justification clause that appeals to ordinary inductive and empirical evidence will not do for such an infallible awareness, what is needed is a kind of non-inferential and complete justification that infallibly guarantees the truth of its object. And since, according to orthodoxy, such an awareness (call it "Intuiting" with a capital 'I') is what Aristotle means by *nous*, there is no need for a suitable justification condition as a third clause in the analysis of C(1)–(3): replacing 'knows that...' by '*noei* that...' will do perfectly.

So, according to the orthodox view, the "epistemically relevant and required sense" is determined by IAR, which may in fact be taken to revoke in turn any need of giving a detailed analysis of ordinary knowledge in (C). S just knows (when she does) what is required to be known in a way that she also immediately and infallibly knows that she knows. It is only when the truth of C(1)–(3) is transparent to S that S has scientific knowledge, according to the orthodox view.

Is there any evidence to believe that Aristotle holds IAR? We are referred

to II 19. But II 19 says nothing about having the *nous* of B(2) and B(3), let alone Intuiting their truth. In fact, there is plenty of evidence to the contrary. Aristotle worries much about C(3) especially in Chapters 7–9 of Book I of the *Posterior Analytics*. After discussing various relations that hold among the principles of different sciences, some of which are hierarchically structured, he at the end concludes that

It is difficult to know [*gnonai*] whether one knows or not; for it is difficult to know whether our knowledge [*eidenai*] is based upon the principles appropriate to each case — it is this that constitutes true knowledge — or not. We suppose that we have s-knowledge if we draw an inference from some true and primitive premises, but it is not so; the inference must be homogeneous with the primitive truths of the science. (*APo* I 9 76a26–31)

Although Aristotle uses ‘*eidenai*’, as sometimes he does when he means *episteme*, it is clear from the context that what he has in mind is scientific knowledge. Now, if, as the orthodox interpretation has it, we were to Intuit that we have the appropriate principles for a given case, the difficulty of knowing, or of being certain, whether or not we know that we have the right principles would not even arise. That would be totally out of question. On the other hand, there is no suggestion in the passage that since we cannot be certain whether we know or not, we cannot scientifically know. On the contrary, the passage and the context suggest that Aristotle does not require something like IAR at least for C(3). But if this is correct, it means that he almost certainly does not require it for other clauses either. For, according to the orthodox view, one s-knows that *P* only if one can conclusively defend one’s claim that the explanation of *P* is from the appropriate principles. Otherwise, one does not s-know that *P*. In other words, the whole point, the main motivation, of interpreting *nous* as Intuition would be lost if the skeptic’s challenge cannot be successfully met with respect to each and every clause of (B). For Aristotle is very explicit about the conditions of having *episteme* as reconstructed by (C).

When we Intuit that a principle *Q* holds, according to the orthodox view, our conviction that *Q* is true is, as it were, at its full strength; we not only know that *Q*, but also, necessarily, our belief that we know that *Q* is always true in such a way that its truth is transparent to us. In other words, we are incorrigible about our belief that we Intuit that *Q*. This means that we cannot come to believe that we Intuit that *Q* without actually Intuiting that *Q*. As Kosman puts it,<sup>65</sup> we would be able to tell always correctly whether or not we know in relevant particular cases simply by internally examining our state of mind. This is what Intuiting basically is. Now suppose two Aristotelian scientists, both of whom claim to scientifically know that *P*, completely agree that having scientific knowledge

---

<sup>65</sup> Kosman (1973), p.385.

is what Aristotle defines it to be. However, suppose further that they explain  $P$  by (correctly) inferring it from different and incompatible principles they claim to Intuit (since they agree with the orthodox's Aristotle that we have scientific knowledge only if we Intuit the principles). If such a situation is possible, as clearly seems to be, then something has gone wrong: it seems that one of the scientists is wrong in her sincere claim (thus in her belief) that she Intuits a certain principle. But then she is after all corrigible in her belief that she Intuits a certain principle (either as true or *qua* principle or as appropriate for  $P$ ). But if so, IAR is just false!

Instead of concluding that there is something wrong with such an interpretation of *nous*, it is, of course, always open to the orthodox to claim that the objection begs the question by assuming the possibility of something that is *ex hypothesi* not allowed. But this move is ill-advised.<sup>66</sup>

Clearly, s-knowledge [*episteme*] is something of this sort; for both those who do not s-know and those who do s-know agree on the subject; but whereas the former merely think they are themselves in such a state described above, the latter are actually in it. (*APo* I 2 71b13–5)

...some people when in a state of opinion do not hesitate, but think they know exactly. ...there need be no difference between knowledge and opinion in this respect; for some men are no less convinced of what they think than others of what they know; as is shown by the case of Heraclitus. (*Ethica Nicomachea* VII 3 1146b27–9)

Since s-knowing  $P$  depends on knowing the principles  $Q$ , from which  $P$  is inferred, falsely thinking that  $S$  s-knows that  $P$  involves, by (C), falsely thinking that  $S$  knows that  $Q$ . But then it is possible to be mistaken about one's sincere claim that one Intuits  $Q$ , if we are to believe that Intuiting  $Q$  is (partly) what turns belief in  $P$  into s-knowledge. We should remember that Intuiting is a psychological state which is intended to be somehow internally marked off from other similar states or from its "fakes." When you are in it your belief that you are in it is infallibly transparent. The second passage, however, seems to deny that there is any internal psychological difference between thinking one s-knows that  $P$  and s-knowing  $P$ , hence by implication — if (C) is correct — between thinking one knows that  $Q$  and knowing  $Q$ . And, it seems, this is indeed as it should be.<sup>67</sup>

<sup>66</sup> See also *APo* I 6 75a12–18, and Barnes' comments on this passage in his (1994), p.129. Cf. *APo* I 33 89a17–30 and *Met* II 1 993a30–b12.

<sup>67</sup> It may be thought that the traditional answer to the problem would be that one of the "scientists" is not a scientist, i.e., does not have *episteme*, and all the traditional interpretation requires is that if one has *nous*, then one knows it, and if one correctly introspects one will determine whether or not one has *nous*. In other words, the traditional view need not be committed to the view that if one sincerely believes one has *nous* one does. But this seems to misunderstand the dialectics of the relevant conditionals. The belief-states of the two scientists are supposed to be internally type-identical when they both sincerely believe that they

It is also important to realize that the former passage comes immediately after Aristotle gives his first formulation of *episteme* at 71b9–13 (see above). Given our discussion so far, we should be in a better position to make sense of the “we think we know” construction I have mentioned earlier. It seems to me that the first of the above passages and the form of Aristotle’s formulation of *episteme* make it amply clear what Aristotle is up to in the remainder of his treatise: he is primarily concerned with giving a basically externalist<sup>68</sup> explicative characterization of the *nature* of *episteme*, with analyzing what is involved in having *episteme* without much worrying whether, or how, or to what extent we can *tell* whether we have *episteme* (when we do) or not. As he says, among those who agree on the initial account of what *episteme* is, some falsely think they have it while others actually have it. He is not concerned with well-known skeptical questions that arise in situations where we attempt to *defend* our knowledge claims in epistemologically relevant and appropriate ways.<sup>69</sup>

---

have *nous*. There is supposed to be no internal psychological difference between the states they are in. If so, to suggest that one of the scientists’ belief is correct if she has the *nous* and the other’s incorrect since she doesn’t, is to revert to an externalist picture. For the relevant conditional is this: necessarily, if one has *nous* of *Q* then one sincerely believes that one has *nous* of *Q*. To suppose that the belief state in the consequent is a different state from the one in the antecedent and that the consequent could be true without the antecedent being true is just to suppose that there is no internal psychological difference between the states of the two scientists. But if so, it is not clear how the polemic against the skeptic is supposed to go *vis-à-vis* the challenge to show that one *s*-knows that *P*. Also, how is one to tell that one is correctly introspecting? (Thanks to Ian Mueller for bringing this point to my attention.)

<sup>68</sup>It is externalist in so far as Aristotle rejects, as he does if I am right, a complete and conclusive justification (*a priori* or not) that is transparent to the one who *s*-knows. This follows from the general fact that one is an externalist in one’s account of *knowledge* when one rejects a complete internalist *justification* clause in one’s account of knowledge. See fn.37 above.

<sup>69</sup>There is a sense, I think, in which the *Topics* can be seen to describe how to defend our knowledge claims. Some authors, however, apparently depending on some such considerations, seem to hold that the proper methodology Aristotle both employs actually and defends theoretically for natural sciences is, for the most part, dialectic. Cf. Brunschwig (1990), Devereux (1987, 1988), Irwin (1978, 1979), Nussbaum (1982), Owen (1986), Evans (1977). I believe this view is too extreme. To be sure, dialectic has some important role to play, but to specify exactly how is quite tricky. For a beautiful discussion of the role dialectic plays both in the context of discovery and in the context of justification, see Bolton (1987, 1990). The distinction I draw between defending knowledge claims and analyzing what knowledge is can be, I believe, quite helpful in this connection. To the extent to which *phainomena* can be seen to constitute a subset of *endoxa*, it is not difficult to guess their role in discovery and in justificatory processes proper to Aristotelian sciences. For defending one’s knowledge claims actually amounts to giving an epistemic justification for one’s belief. And that the situation in which this is done is a dialectical one does not necessarily mean that it is not proper for scientific purposes. The *Topics* is full of recipes about how to construct and defend, for instance, the proposed definitions that state essences. See especially *Top* IV, VI 12, VII 5, where Aristotle explicitly refers a couple of times back to the *Posterior Analytics*, espe-

Consider also the following passage from *De Caelo*:

speaking of the phenomena, they say things that do not agree with the phenomena... They are so fond of their first principles that they seem to behave like those who defend these in dialectical arguments; for they accept any consequence, thinking that they have true first principles — as though principles should not be judged by their consequences, and especially by their goal. And the goal in productive science is the product, but in natural science it is whatever properly appears to perception. (306a6–18)

This passage gives the clear sense that is required for a proper justification clause in the analysis of C(1)–(3).<sup>70</sup> Aristotle here explicitly makes an appeal to observable phenomena: this appeal is clearly for epistemic justification, or for evidential support both for the truth of principles and for their explanatory power. In the first place, the truth of anything, hence our knowledge claims, should be evaluated on the basis of the phenomena that stand for it, hence on the basis of empirical evidence. Secondly, Aristotle says, principles should be evaluated by their consequences and goal. But the ultimate goal of natural sciences is to explain explainable phenomena by demonstrating them from the proper principles, to show that phenomena are natural consequences of such and such principles. In other words, the evidence for certain propositions' being principles is, among other things, that they have enough explanatory power.

Now, again, suppose we were to Intuit B(1)–(3), then the appeal to empirical evidence in the way Aristotle explicitly makes above would be absurd indeed. The very nature of Intuition is not to make such an epistemic appeal.

I therefore conclude that the orthodox view is irremediably false and that if we are to substitute '*noei*' for 'knows' in C(1)–(3), we had better have a different understanding of *nous*, which would not commit us to IAR in our search for a

---

cially to Book II. These passages have clearly epistemological import.

<sup>70</sup>See also *Ethica Nicomachea* I 7–8 1098b1–11. To what extent Aristotle is indeed intolerable about any claimed principle that does not agree with the phenomena can also be seen from the following: "Reasoning in this way, therefore, they were led to transcend sense-perception, and to disregard it on the ground that 'one ought to follow the argument': and so they assert that the universe is 'one' and immovable... There were, then, certain thinkers who, for the reasons we have stated, enunciated views of this kind as their theory of 'The Truth'... Moreover, although these opinions appear to follow logically in a dialectical discussion, yet to believe them seems next door to madness when one considers the facts. For indeed no lunatic seems to be so far out of his senses as to suppose that fire and ice are 'one': it is only between what *is* right, and what *seems* right from habit, that some people are mad enough to see no difference" (*De Generatione et Corruptione* I 8 325a13–24). For the role certain kinds of dialectical premises play in the epistemic evaluation of principles, see Bolton (1987, 1990) who argues that they are not in conflict with the empirical methodology of Aristotelian sciences that are in pursuit of empirically true principles and explanations. See also Kosman (1973) and Burnyeat (1981) on the issue of scientific explanation in Aristotle.

proper justification clause.

- VI -

If we are to reject the orthodox demand for certainty, for complete internal epistemic justification in the analysis of knowledge in C(1)–(3), then we are left with only one obvious option as Aristotle himself seems to indicate in the last quotation above from *De Caelo*. What we need is ordinary empirical evidence, inductive justification, in order to transform true beliefs in B(1)–(3) into knowledge as required by (C), even if this empirical evidence falls short of guaranteeing the truth of the beliefs, as it typically does. In other words, there is nothing mysterious or extraordinary about the sense of the epistemic justification clause we are looking for in our analysis of the knowledge involved in C(1)–(3). That sense is determined by the utterly pedestrian form that ordinary empirical/inductive evidence takes. Before further elaborating on this, let me state how I propose to view the place and nature of *nous* as it appears in the *Posterior Analytics*.

I agree with Barnes that *nous* is Aristotle's answer to the second question when he asks at the beginning of II 19: how do the principles become known and what is the state that knows them? (99b17–9) *Nous* is the state that knows them. So, it is not surprising that Aristotle introduces *nous* as a *hexis* in the last paragraph of II 19. I further agree with Barnes that Aristotle's answer to the first question is induction, however, understood in a broad sense. What I deny is the claim that one ends up with *nous* each and every time one engages in an inductive process and arrives at a *hexis* at the end. The *hexis* is *nous* only when its propositional content is true, universal, and appropriately explanatory. So let me state more explicitly how I propose to analyse *nous* as it occurs in the *Posterior Analytics*:

(D) *S* has the *nous* of *Q* (*S noei* that *Q*) if, and only if,

- (1) *Q* is universal and explanatory,
- (2) *Q* is true,
- (3) *S* believes that *Q*,
- (4) *S* has adequate inductive (empirical) justification/evidence for *Q*.

As should be clear, I follow Lesher (1973) in not restricting the scope of *nous* only to first principles. I am convinced by his argument that "induction is the means by which we reach first principles because it is induction which in general supplies us with our [noetic] knowledge of [the universal]" (p.62) — when it does, I should add.<sup>71</sup> Also, that *Q* must be explanatory hardly needs commenting on —

---

<sup>71</sup>Cf. *APo* II 19 100b3–4: "Clearly then it must be by induction that we acquire the

but I will nevertheless say a few words on it below. Just as we have *episteme* only of that of which we have the scientific explanation, we have *nous* of that with which we can scientifically explain.

What needs emphasizing about this account of *nous* is that it is externalist as its fourth clause does not require any complete and conclusive epistemic justification or any sort of epistemic certainty: one has the *nous* of *Q* just in case the four clauses are simultaneously satisfied whether or not their satisfaction conditions are directly accessible to the one who *noei*.

Now if (D) is right about *nous*, we should expect to see, as is rather clear, that we can have the *nous* of a universal proposition that can be demonstrated. In other words, we should be able to have the *episteme* of that of which we also have the *nous*. Is there an evidence for this? It seems that there is. First, consider the following passage:

But even here the holder of the theory ought not only assert the fact: he ought also to explain the cause of it... thus from the observed fact that this occurs in certain cases comes the assumption that it occurs also in the universe... But it is a wrong assumption to suppose universally that we have an adequate first principle in virtue of the fact that something always is so or always happens so. Thus Democritus reduces the causes that explain nature to the fact that things happened in the past in the same way as they happen now: but he does not think fit to seek for a first principle to explain this 'always': so, while his theory is right in so far as it is applied to certain individual cases, he is wrong in making it of universal application. Thus, a triangle always has its angles equal to two right angles, but there is nevertheless an ulterior cause of the eternity of this truth, whereas first principles are eternal and have no ulterior cause. (*Physica* VIII 1 252a22–252b4)

What Aristotle basically says here is that we do not always end up with a *per se* principle when we inductively infer the truth of a universal proposition. Now consider this:

If, however, by observing repeated instances we had succeeded in grasping the universal, we should have our proof; because it is from the repetition of particular experiences that we obtain our view of the universal. The value of the universal is that it exhibits the cause. Thus in considering facts of this kind which have a cause other than themselves, knowledge of the universal is more valuable than perception by the senses or *noesis*. (*APo* I 31 88a2–8)

All in all, we are told that some sort of knowledge is more valuable than *nous*. What could it be? And, how? Here is how I propose to understand the passage (cf. Leshner 1973, pp.53–4, to which I am much indebted). In the cases in which there is a middle, *B*, of a connection of the sort '*AaC*,' the universal knowledge of the middle as the cause of '*AaC*' is more valuable, because we then have our

---

knowledge of the principles, for perception too instills the universal in this way."

proof of 'AaC.' In other words, we have the *episteme* of 'AaC' rather than the *nous* of it. And since our knowledge of 'AaC' in this case involves the explanation of it, that is, we know 'AaC' *qua* demonstrated, *episteme* is more valuable than *nous* in this case. The same would be true, if our knowledge of the universal cause, 'BaC,' has a further explanation, i.e., if 'BaC' has a middle, *D*. In this case too, our knowledge of 'BaC' *qua* demonstrated would be superior to the *nous* of it, until we get the ultimate non-demonstrable principles. Since these do not admit of any middle, they cannot be, strictly speaking, the object of *episteme*. We can have only the *nous* of them, in which case *nous* will be the *archei* of what follows from it, thus more valuable than *episteme*. I do not see how any other reading would give a better sense to there being a kind of knowledge more valuable than *nous*.

In this connection, consider also the following passage where Aristotle discusses the non-accidental *awareness that* something is the case:

What is thunder? The extinguishing of fire in a cloud. Why does it thunder? Because the fire in a cloud is being extinguished. Let *C* be a cloud, *A* thunder and *B* extinguishing of fire. Then *B* applies to *C* (to the cloud), since the fire is being extinguished in it; and *A* (a noise) applies to *B*. So *B* is an account of *A*, the major term, and if there should be in turn another middle term of this, it will be one among the remaining accounts. (*APo* II 8 93b7–14)

The account of thunder is the extinguishing of fire in a cloud. But Aristotle does not stop there, he allows that the extinguishing of fire *could* have further accounts which would give the more basic definition of 'thunder.'<sup>72</sup> It is obvious that this process can go on until we get the ultimate definition which will give us the ultimate essence of what thunder is. Aristotle later on tells us that "the middle term <in a demonstration> is a definition of the major term; this is why all the sciences are built up through the process of definition" (II 17 99a21–3). What we see here is a paradigm case of ongoing scientific research.<sup>73</sup> How do we come up with a new and further account of thunder which will give us the more basic definition of it? Whatever this further account is, we know what it must do: it must explain the reason why the fire is extinguished in the clouds. So, that which best explains this fact will be the most likely true account. This is, again, a clear and explicit epistemological appeal to their explanatory power in the very discovery of principles.

How do we get this "further" account? In a very short chapter at the end of Book I of the *Posterior Analytics*, Aristotle calls our ability to see the explanatory middle term "quickness of wit" or "acumen":

---

<sup>72</sup>See his division of definitions into three kinds in *APo* II 10. Cf. also *APo* I 8.

<sup>73</sup>For a powerful discussion of Chapters 7–10 of Book II in this light, see Bolton (1987) to which I am much indebted.

Quickness of wit is a sort of flair for hitting upon the middle term in an imperceptible time. A man sees that the moon always has its bright side facing the sun and immediately realizes the reason: that it is because the moon derives its brightness from the sun; or he sees someone talking to a rich man, and decides that it is because he is trying to borrow money; or he understands why people are friends, because they have a common enemy. In all these cases, perception of the extreme terms enables him to recognize the cause or the middle term. (*APo* I 34 89b10–6)

*Nous* is not mentioned in this chapter. Indeed what Aristotle describes here seems to be just the ordinary insight we have of the possible explanations of phenomena about which we wonder. Furthermore, given the nature of Aristotle's examples here, this insight can hardly be infallible. It is also instructive to see that this chapter comes right before Aristotle undertakes, in Book II, examination of the process of finding out the cause and definition of natural phenomena and kinds; in other words, before addressing the problems of scientific discovery.<sup>74</sup>

Again, Aristotle's justificatory use of explanatory power in the very inductive process of discovering universal laws clearly suggests the kind of knowledge we should have in C(1)–(3): it is knowledge obtained and justified by ordinary inductive empirical methods.

But when do we get *nous* into the picture? I think, it is only when we see the particular middle appropriate to the case at hand *as an instance of a general universal connection*, or when we generalize from the particular cause to a universal connection *that is independently confirmable on inductive observable grounds*, that we have (when we do) *nous* of the universal so that we can demonstrate the particular phenomenon we originally began with. Consider, for example, the above case: what might the principle be in the explanation of the moon's bright side always facing the sun? Presumably something like this: that which derives its brightness from a light source always has its bright side facing the light source. Or consider the principle that all that which is near does not twinkle. They are universal propositions stating general and necessary connections in nature. As such they can be instantiated by a number of particular phenomena relevantly describable. Thus, they can be independently and inductively confirmed by a number of particular cases that are *observable*.<sup>75</sup> I take it this is why we need

---

<sup>74</sup>So I do not agree with Owen (1967) and Barnes (1969) that the *Posterior Analytics* is exclusively an exercise in pedagogical interests about how the findings of sciences should be taught and learned in a systematic way. I believe that especially Book II of the *Posterior Analytics* does involve many substantial points concerning the problems of discovery and justification.

<sup>75</sup>So, for instance, we may come to know that 'all that which is near does not twinkle' is true without realizing that it is a principle, that is, without realizing that it is explanatory of certain phenomena. Likewise, we may know that it is a principle, but we may not realize

D(1): we have the *nous* only of that which is genuinely explanatory (hence universal) in the Aristotelian sense. But the inductive evidence for it should come from its power to explain more than its initial inductive/evidential base: this is the connection between D(1) and D(4).

On the other hand, Aristotle's insistence that the confirmatory base be observable is noteworthy. That Aristotle has this much "positivism" seems to be clear from the following passage:

Yet some of our problems are referred to want of perception; for in some cases if we saw we should not seek — not on the ground that we knew by seeing, but that we grasped the universal from seeing. E.g. if we saw the glass to be perforated and the light coming through it, it would also be clear why it does, even if seeing occurs separately for each <piece of glass> while comprehending [*noesai*] <grasps> at one time that it is thus in every case. (*APo* I 31 88a11–8)

Even though we know the fact that light comes through the glass, we cannot have the *episteme* of it, because we cannot have the *nous* of the relevant universal principle. Why? Because we cannot confirm it on the basis of *observable* (inductive) evidence: the pores in the glass are supposed to be so small that we cannot perceive them. Hence in such a case we cannot generalize either.<sup>76</sup> Notice also what Aristotle says: we would *see* separately for each piece of glass that the light comes through the small pores. But we would *noesai* that *every* case is like this.

In the light of our discussion so far, I think it would be appropriate to replace 'S knows that...' in C(1) with 'S *noei* that...'. However, given D(1) and its connection to D(4), as I understand them, and given Aristotle's "positivism," it is not clear that such a substitution would be appropriate for C(2)–(3). I don't think it would if we are serious and strict about D(1) since B(2) and B(3) are in a certain sense meta-theoretical. On the other hand, D(1) is the clause I am least sanguine about, at least as far as the purposes of this paper are concerned. What I am, however, sanguine about (D) and what has been at the core of my polemic against the orthodox view is clause D(4).

Although the kind of justification by explanatory power is, very broadly

---

that it is explanatory of *this* particular fact, for example, of the fact that all the planets do not twinkle. Hence, our knowledge in C(1)–(3) can differ considerably in different cases .

<sup>76</sup>For similar passages, see also *APo* I 18, *De Anima* III 8 432a7–9. However, Aristotle can hardly be said to conform in his scientific treatises to what he preaches here. I think the reason for this is the force he sees of the analogy and similarities among certain types of cases: even though we may not, strictly speaking, perceive something that would best explain certain phenomena, we may still hold it to be the case on the basis of the similarity of the case to certain observable ones. The evidence the analogy or the similarity provides for the relevant universal would still be within the boundaries of Aristotelian induction. Cf. *APo* II 17. Argument by example or by analogy is a type of induction for Aristotle.

speaking, inductive in a sense, it is not clear whether it is inductive in an Aristotelian sense. But Aristotle clearly does make justificatory use of explanatory power of principles both for their truth and for their being (the right) principles. Here I do not want to discuss the technicalities of how Aristotle conceives of induction, which is, by itself, a very controversial issue.

Nor do I want to insist that, on Aristotle's view, one does not *noein* B(2)–(3). Perhaps, there is a way of interpreting D(1), or revising (D) more generally, such that one can *noein* B(2)–(3). The point I want to stress, however, is that there is nothing mysterious in the analysis of the kind of knowledge we are supposed to have in C(1)–(3). They all confine more or less to the justified true belief analysis of knowledge, where justification is obviously empirical and inductive and thus typically incomplete. Is this a sort of philosophical anachronism? I do not think so. As long as the JTB analysis can be seen to capture our most basic intuitions about what knowledge should be like, it is in a sense unavoidable that we seek to understand Aristotle in these terms.<sup>77</sup>

To recap, here is, then, the proposal:

- (C\*) *S* s-knows (*epistatai*) that *P* if, and only if,  
*S* syllogistically derives *P* from  $\Pi$  such that
- (1) *S* *noei* that  $\Pi$  (are true),
  - (2) *S* knows that  $\Pi$  are principles, and
  - (3) *S* knows that  $\Pi$  contain the appropriate middle terms that reveal the reason why of *P*.

Here the analysis of '*S* *noei*...' in (1) is given by (D). And the knowledge we have in (2) and (3) is ordinary knowledge (JTB) obtained by ordinary empirical inductive methods. One has *episteme* just in case the analysis is satisfied, whether or not one has access to its satisfaction conditions.

## - VII -

Let me consider one more point in this connection before concluding the paper. That a universal fact is explanatory may be a good reason for us to believe it is a principle. But Aristotle says we have scientific knowledge only when our explanation is from self-explanatory principles, i.e. from immediate or *per se* connections. What kind of justification might make our true belief that *Q* is a *per se* predication knowledge? Put differently, since a premise may well be genuinely

---

<sup>77</sup>Indeed the history of the JTB analysis, as is commonly said, seems to go back to Plato. See *Theaetetus* 201c–210d. So, if this is right (though I am not sure whether it is), trying to understand Aristotle's account of knowledge in terms of JTB analysis may not after all be so anachronistic!

explanatory without being a first principle,<sup>78</sup> justification by explanatory power is equivocal for the premise that *Q* is a first principle. But it is the proper justification of this kind of premises that is ultimately needed for the *episteme* of propositions demonstrated from them. So what might the proper justification of B(2) be regarding *per se* predications? At one point, Aristotle comes very close to saying that true belief in these cases is enough:

How, then, is it possible for the same thing to be an object of both opinion and s-knowledge? ...Both the man who knows and the man who opines will proceed by means of the middle terms until they reach the immediate premises: so that if the former knows, so does the latter; because it is equally possible to opine the fact and the reason for it.i.e., the middle term. The solution is probably this. If you apprehend propositions which cannot be otherwise in the same way as you apprehend the definitions through which demonstrations are effected, you will have not opinion, but s-knowledge; but if you only apprehend that the attributes are true and not that they apply in virtue of the essence and specific nature of their subject, you will have not true knowledge but an opinion, of both the fact and the reason for it, — that is, if you have reached your opinion through the immediate premises; otherwise you will have an opinion only of the fact. (*APo* I 33 89a12–25)

As Barnes points out,<sup>79</sup> Aristotle's suggestion comes down to this. If '*AaB*' is a *per se* predication and *S* believes that *AaB*, then *S* knows that *AaB* if, and only if, *S* believes that '*AaB*' is a *per se* predication; however, *S* opines that *AaB* if, and only if, *S* does not believe that '*AaB*' is a *per se* predication.<sup>80</sup> Barnes complains that Aristotle "omits the essential trait of knowledge," that it must have an adequate justification.

But we should remember the peculiar ontology of Aristotelian sciences. Aristotle believes that there are ultimate causes or kinds in nature for which a further account cannot be given. The Aristotelian scientist may have to go a long way to reach these ultimate causes whose specific nature presumably defines a

---

<sup>78</sup>This would be the case if *P* is demonstrable but nevertheless is also used in a demonstration. In this case, *P* would be genuinely explanatory without being a first principle, hence without being self-explanatory: one could have both the *nous* and *episteme* of *P*. See above.

<sup>79</sup>Barnes (1994), p.199.

<sup>80</sup>So, it seems that we can partly analyze '*S* opines that *P*' in the following way: *S* opines that *P* only if

- i. *S* truly believes that *P* can be otherwise, or
- ii. *S* falsely believes that *P* can be otherwise, or
- iii. *S* falsely believes that *P* cannot be otherwise.

For the last disjunct, see *Ethica Nicomachea* VII 3 1146b27–29 (above). This analysis, together with that *S* s-knows that *P* only if *S* truly believes that *P* cannot be otherwise, entails what Aristotle is after in I 33, namely, it is not the case that: *S* scientifically knows that *P* and *S* opines that *P*.

given branch of science. But given her belief that they are reachable, she would still think that one has a *complete* explanation, and thus scientific knowledge, of a particular phenomenon only if one's explanation is from the (appropriate) *ultimate* causes. Such a requirement would be a very natural one for an explicative and externalist analysis of what scientific knowledge is. Moreover, if a set of principles of a given science seems to have enough explanatory power to explain appropriately all or almost all of the particular phenomena that seem to fall under its scope, if they seem to resist further explanation, if they are general enough (prior by nature), and most importantly, if they cohere with each other, then there seems to be good epistemic justification — in the proper and relevant sense —, empirical evidence, in short, perfectly good reason for an Aristotelian scientist to come to believe that she either is nearing the ultimate principles or has already got them. It seems that Aristotle has something like this picture in mind when he writes:

Lack of experience diminishes our power of taking a comprehensive view of the admitted facts. Hence those who dwell in intimate association with nature and its phenomena grow more and more able to formulate, as the foundations of their theories, principles such as to admit of a wide and coherent development: while those whom devotion to abstract discussions has rendered unobservant of the facts are too ready to dogmatize on the basis of a few observations.<sup>81</sup> (*De Generatione et Corruptione* I 2 316a5–12)

Aristotle believes that human mind is capable of having knowledge. The intellect, or *nous* as a *dunamis*, or as a faculty, is just the pure capacity of receiving the objective forms, patterns of nature. As he says, the human soul is so constituted that it is capable of this process.<sup>82</sup> He seems to maintain that there is even a metaphysical guarantee for our knowledge of the world.<sup>83</sup> But these are mostly “naturalistic” (à la Aristotle) or psychological considerations in response to many wonders of human mind. I believe the genetic account of II 19 should be also taken in this way. There Aristotle gives a psychological account of the process by which we reach the universal in general. It has little or no justificatory import (which is, of course, not to say that Aristotle doesn't make justificatory use of induction elsewhere). But that he describes this process as inductive is no surprise. For it *is* a wonder for us *how* we come to know *anything* inductively — in both the psychological and epistemological senses of “how”; because we do, as Aristotle also believed. This “how” can therefore be given an account from two different perspectives, as is very nicely described by a contemporary philosopher of mind:

---

<sup>81</sup> See also *APr* I 30 46a17–27; *Historia* I 6 491a10–15; *Physica* I 1 184a16–b14.

<sup>82</sup> *APo* II 19 100a12; *De Anima* III 4.

<sup>83</sup> The notorious Active Intellect of *De Anima* III 5.

I am reading the typical empiricist theory of perception as doing double duty: as an account of the justification of perceptual beliefs and as a psychology of the integration of percepts. I think it is clear that many of the empiricists took their views this way. But it is also pretty clear that when a conflict arose between what the psychology required and what the epistemology appeared to, it was the demands of the latter that shaped the theory. (Fodor 1975, p.44)

In the genetic account and in *De Anima*, Aristotle tries to explain the psychological “how” of inductive processes. And the introduction of the Active Intellect in *De Anima* III 5 makes it pretty clear that Aristotle is not an empiricist in a Lockean or Humean sense. But he is not a rationalist either, at least in its ordinary sense. I think his position is very peculiar. If an epistemological sense is wanted, his Active Intellect might be likened, I think, very cautiously, to the reliable belief generation mechanisms of the contemporary externalist epistemologists. But that is another issue to be elaborated elsewhere.<sup>84</sup> Suffice it to say that the Active Intellect is of no help to the Aristotelian scientist when she wonders whether what she believes to be a principle is indeed so. The Active Intellect does not assist the scientist when it comes to internal epistemic justification of one’s scientific beliefs.<sup>85</sup> It has a metaphysical/psychological role, or *perhaps*, an epistemological role, but only in something like an externalist sense.

So far in this paper, I have tried to show that Aristotle is, however, an empiricist about the *methodology* of scientific inquiry, as he conceived it. If my analysis is correct, then there is no need to interpret Aristotle’s *nous* (at least as it occurs in the *Posterior Analytics*) as an infallible faculty, as Intuition. The primary source of the reading of the orthodox view, namely, the last paragraph of II 19, is nicely handled by my account: *nous* is always true, because *nous* is the knowledge we have of the universal empirical truths on the basis of inductive evidence; however, we cannot always conclusively defend our knowledge claims, and I do not think that Aristotle has claimed otherwise. Let me end this paper by quoting Aristotle for the last time:<sup>86</sup>

<sup>84</sup>See Kahn (1981), Modrak (1987). Cf. Wedin (1988).

<sup>85</sup>Here is how Kahn makes much the same point: “...this [inductive] process of learning and exercising science, although it has a metaphysical cause and even a metaphysical guarantee in the super-rationalism of the active intellect, must be achieved in our own experience by the ordinary processes of induction and hard work: there is no epistemic button we can push in order to tune in on the infallible contemplation of noetic forms by the active intellect... And for us the training begins in sense perception and in reflection upon our perceptual experience” (1981, p.411).

<sup>86</sup>I would like to thank James Lesher for his kind encouragement, support, and help. I learned quite a lot from him. I would also like to thank Robert Bolton, James Celarier, Teo Grünberg, Ali Karatay, Raymond Martin, Ian Mueller, Philip Robins, Robin Smith and Lars Svenonius for their helpful comments on earlier drafts of this paper and/or for their encouragement.

The investigation of the truth is in one way hard, in another easy. An indication of this is found in the fact that no one is able to attain the truth adequately, while, on the other hand, we do not collectively fail, but every one says something true about the nature of things, and while individually we contribute little or nothing to the truth, by the union of all a considerable amount is amassed. Therefore, since the truth seems to be like the proverbial door, which no one can fail to hit, in this respect it must be easy, but to be able to hit the door and unable to hit the keyhole illustrates the difficulty. Perhaps, too, as difficulties are of two kinds, the cause of the present difficulty is not in the facts but in us. For as the eyes of bats are to the blaze of the day, so is the reason [*nous*] in our soul to the things which are by nature most evident of all. (*Met* II 1 993a30–993b12)

## REFERENCES

- Aristotle, *Posterior Analytics*, Loeb Edition, translated by Hugh Tredennick, 1960.
- Aristotle, *Complete Works of Aristotle*, The Revised Oxford Translation, edited by J. Barnes, Princeton University Press, Princeton: N.J., 1984.
- Barnes, J. (1969), "Aristotle's Theory of Demonstration" in *Articles on Aristotle, vol.1: Science*, Barnes, J., Schofield, M., and Sorabji, R. (Eds.), London, 1975.
- Barnes, J. (1975), *Aristotle: Posterior Analytics*, 1st Edition, Clarendon Press, Oxford.
- Barnes, J. (1994), *Aristotle: Posterior Analytics*, 2nd Edition, Clarendon Press, Oxford.
- Berti, E. (Ed.), (1981), *Aristotle on Science: The POSTERIOR ANALYTICS, Proceedings of the Eight Symposium Aristotelicum*, Padua and New York.
- Bolton, R. (1987), "Definition and Scientific Method in Aristotle's *Posterior Analytics* and *Generation of Animals*" in Gotthelf and Lennox (1987).
- Bolton, R. (1990), "The Epistemological Basis of Aristotelian Dialectic" in *Biologie, Logique, et Métaphysique chez Aristote*, Éditions du Centre National de la Recherche Scientifique.
- Brunschwig, J. (1990), "Remarques sur la Communication de Robert Bolton" in *Biologie, Logique, et Métaphysique chez Aristote*, Paris: Éditions du Centre National de la Recherche Scientifique.
- Burnyeat, M.F. (1981), "Aristotle on Understanding Knowledge" in Berti (1981).
- Couloubaritsis, L. (1980), "Y-a-t-il une Intuition des Principes chez Aristote?", *Revue Internationale de Philosophie*, No.133–134, pp.440–71.
- Devereux, D.T. (1987), "Dialectic, the 'Method of *Endoxa*,' and Scientific Inquiry," Ms.
- Devereux, D.T. (1988), "Ethical Method in Aristotle: Setting out the *Phainomena*," Ms.
- Engberg-Pedersen, T. (1979), "More on Aristotelian *Epagoge*," *Phronesis*, v.24, No.3, pp.301–19.
- Evans, D. (1977), *Aristotle's Concept of Dialectic*, Cambridge University Press.

- Fodor, J.A. (1975), *The Language of Thought*, Harvard University Press.
- Gettier, E. (1963), "Is Justified True Belief Knowledge?" *Analysis* 23, pp.121–23.
- Gotthelf, A. and J.G. Lennox (Eds.), (1987), *Philosophical Issues in Aristotle's Biology*, Cambridge University Press.
- Grene, M.G. (1963), *A Portrait of Aristotle*, Chicago: Chicago Un. Press.
- Grote, G. (1872), *Aristotle*, Vol.2, London: John Murray, Albemarle Street.
- Hamlyn, D.W. (1976), "Aristotelian *Epagoge*," *Phronesis*, v.21, pp.167–84.
- Hintikka, J. (1962), *Knowledge and Belief*, Ithaca: Cornell University Press.
- Hintikka, J. (1971), *On the Ingredients of an Aristotelian Science*, Helsinki, University of Helsinki.
- Hintikka, J. (1980), "Aristotelian Induction," *Revue Internationale de Philosophie*, No.133–134, pp.422–39.
- Irwin, T.H. (1978), "Aristotle's Discovery of Metaphysics," *Review of Metaphysics*, pp.211–29, 1977–8.
- Irwin, T.H. (1988), *Aristotle's First Principles*, Clarendon Press, Oxford.
- Kahn, C.H. (1981), "The Role of *Nous* in the Cognition of First Principles in *Posterior Analytics* II 19" in Berti (1981).
- Kal, V. (1988), *On Intuition and Discursive Reasoning in Aristotle*, Leiden, NY: Philosophia Antiqua: E.J. Brill.
- Kosman, L.A. (1973), "Understanding, Explanation, and Insight in Aristotle's *Posterior Analytics*" in *Exegesis and Argument*, Lee, E.N., Mourelatos, A.P.D., and Rorty, R.M. (Eds.), *Phronesis* Supplementary Vol. 1, Assen 1973.
- Le Blond, J.M. (1939), *Logique et Méthode chez Aristote*, Librairie Philosophique J. Vrin, Paris.
- Lee, H.D.P. (1935), "Geometrical Method and Aristotle's Account of First Principles," *Classical Quarterly*, 29, pp.113–24.
- Leshner, J.H. (1973), "The Meaning of  $\text{NOY}\Sigma$  in the POSTERIOR ANALYTICS," *Phronesis*, v.18, pp.44–68.
- Long, A.A. (1981). "Aristotle and the History of Greek Scepticism" in *Studies in Aristotle*, D.J. O'Meara (ed.), Washington D.C.: The Catholic University of America Press.
- Modrak, D.K.W. (1987), *Aristotle: The Power of Perception*, The University of Chicago Press.
- Morrow, G.R. (1970), "Plato and the Mathematicians: An Interpretation of Socrates' Dream in the *Theaetetus*," *The Philosophical Review*, Vol.LXXIX, No.3.
- Nussbaum, M.C. (1982), "Saving Aristotle's Appearances" in *Language and Logos*, edited by Schofield, M. and M.C. Nussbaum, Cambridge, 1982.
- Owen, G.E.L. (1967), "*Tithenai ta Phainomena*" in Owen (1986).
- Owen, G.E.L. (1986), *Logic, Science and Dialectic: Collected Papers in Greek Philosophy* / G.E.L. Owen, edited by M. Nussbaum, Ithaca, NY: Cornell Un. Press.
- Ross, W.D. (1945), *Aristotle*, Methuen&Co. Ltd. London.

- Ross, W.D. (1965), *Aristotle's Prior and Posterior Analytics*, Oxford at the Clarendon Press.
- Taylor, A.E. (1955), *Aristotle*, Dover Publications, Inc., New York.
- Taylor, C.C.W. (1990), "Aristotle's Epistemology" in *Epistemology* (Companions to ancient thought 1) edited by Stephen Everson, Cambridge University Press, 1990.
- van Fraassen, B.C. (1980), "A Re-examination of Aristotle's Philosophy of Science," *Dialogue*, v.XIX, No.1, pp.20–49.
- Wedin, Michael V. (1988), *Mind and Imagination in Aristotle*, New Haven: Yale University Press.