Aristotle’s *Posterior Analytics* makes a single project out of two things which present-day philosophy segregates into distinct areas of inquiry. On the one hand, there is a theory of the structure of a science, an account of the conditions for a proposition to belong to a body of systematic knowledge like geometry, physics or botany. For us this would be a contribution to the philosophy of science. On the other hand, Aristotle presents his theory from the outset in terms we would take to be epistemological, as an account of the cognitive state of the individual person who has mastered a body of systematic knowledge.

Aristotle’s own term for what he is analysing is ἑπιστήμη, and this, like our word ‘knowledge’, can refer either to the cognitive state of the knowing person or to a body of knowledge, a science – a system of propositions which can be learned and known. English translators of the *Analytics* have traditionally rendered ἑπιστήμη as ‘scientific knowledge’, but the results this produces can be ambiguous and puzzling. Here, to take a prime example, is the important section from 1.2 where Aristotle first formulates his general project, as rendered by G. R. G. Mure in the Oxford translation.¹

We suppose ourselves to possess unqualified scientific knowledge of a thing, as opposed to knowing it in the accidental way in which the sophist knows, when we think that we know the cause on which the fact depends, as the cause of that fact and of no other, and, further, that the fact could not be other than it is. Now that scientific knowing is something of this sort is evident – witness both those who falsely claim it and those who actually possess it, since the former merely imagine themselves to be, while the latter are also actually, in the condition described. Consequently the proper object of unqualified scientific knowledge is something which cannot be other than it is.

¹ Mure (1928).
There may be another manner of knowing as well – that will be discussed later. What I now assert is that at all events we do know by demonstration. By demonstration I mean a syllogism productive of scientific knowledge, a syllogism, that is, the grasp of which is eo ipso such knowledge.

Assuming then that my thesis as to the nature of scientific knowing is correct, the premises of demonstrated knowledge must be true, primary, immediate, better known than and prior to the conclusion, which is further related to them as effect to cause. Unless these conditions are satisfied, the basic truths will not be ‘appropriate’ to the conclusion. Syllogism there may indeed be without these conditions, but such syllogism, not being productive of scientific knowledge, will not be demonstration. (71b9–25)

It is not unimportant that no separate word in the Greek corresponds to the qualifying epithet ‘scientific’. Aristotle first advances a quite general thesis about a cognitive state he calls ἐπιστήμη, to the effect that in its unqualified version it involves knowing the cause or explanation of something and knowing its necessity, and from this he concludes that what one can have ἐπιστήμη of is that which cannot be otherwise. He then gives a further characterisation of the cognitive state: it centrally involves the possession of apodeictic proof or demonstration (cf. 1.2, 71b28–9, 72a25–6; 1.4, 73a21–3) – centrally, because Aristotle leaves aside for later discussion the question whether there is another mode of ἐπιστήμη (sc. for the first principles on which demonstration rests) – and from this comes a second conclusion about the objects of ἐπιστήμη.2 Demonstrative ἐπιστήμη depends on things which are true, primary, immediate, better known than and prior to and explanatory of the conclusion.

At this point Mure’s translation falls apart. He speaks of ‘the premises of demonstrated knowledge’, but a cognitive state cannot be said to be demonstrated, nor does it have premises; these attributes belong to knowledge in the other sense of what is known, to the propositions making up the body of a science. The things which are true, primary, etc. are indeed expressed as the premises of demonstration, but the dependence in question here is the epistemological relation of a cognitive state (demonstrative ἐπιστήμη) to its grounds, not the logical relation of conclusion to premises. Because ἐπιστήμη involves grasping the demonstration of necessary conclusions, it is grounded epistemologically on the premises of that demonstration.

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2 The structure of the argument is made plain by καὶ at 71b20. This emphasises not the immediately following τὴν ἀποδεικτικὴν ἐπιστήμην, which merely resumes τὸ ἐπιστημονή and the point that this must be of necessary truths, but rather the whole subsequent specification of the premises from which these necessary truths are derived. (Here I am indebted to Jacques Brunschwig.) Cf. Verdenius (1976).
Nevertheless, Mure’s mistranslation is instructive. He evidently felt the pressure of the thought that Aristotle’s conditions for demonstrative ἐπιστήμη are more naturally read as conditions for a proposition to be a proven theorem within a science.\(^3\) It sounds natural enough to say that a proposition counts as an item of scientific knowledge (in the objective sense of that phrase) only if it is demonstrable from the first principles of a science. It seems || less credible that a person has knowledge of the proposition only if he has derived it from first principles. By that demanding standard most of us who are not professional mathematicians do not know simple truths of arithmetic or Pythagoras’ theorem. The ambiguous phrase ‘scientific knowledge’ covers, and reveals, an understandable embarrassment.

There is, of course, that use of the phrase in which a man said to possess scientific knowledge is a man who knows, is familiar with, a whole science or branch of knowledge: ‘He knows mechanics’, ‘He knows calculus’. But Aristotle is concerned with the cognitive state such a man has to particular propositions within the science, as comes out when he distinguishes unqualified ἐπιστήμη with respect to a theorem of a science from various qualified or accidental versions of ἐπιστήμη in relation to the same theorem (1.2 as quoted, 1.5; cf. Eth. Nic. vi.3, 1139b34–5).\(^4\) Take, for example, the theorem that every isosceles triangle has angles equal to two right angles. According to An. post. 1.5, if a man knows this in virtue of knowing that it belongs to every triangle as such to have angles equal to two right angles, then he has ἐπιστήμη unqualified. But if he has not grasped the more general fact, and knows only that the property belongs to all isosceles triangles, then, even if he has a perfectly sound proof of the more particular proposition, he does not count for Aristotle as possessing unqualified ἐπιστήμη. He knows the fact but not the reason why it is a fact (cf. ii.1,698b19–24).

Clearly, Aristotle does not mean that his state is one of mere belief rather than knowledge.\(^5\) It is ἐπιστήμη, but || not of the favoured kind (compare

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\(^3\) The conditions are explicitly so read by Scholz (1930) 266–7 = Barnes, Schofield and Sorabji (1975) 56. But the argument and the context in 1.2 require that ἐπιστήμη be in the first instance the cognitive state of a person (as also at 71b15, 25, 72a37–8); we see shortly that the ἀπλῶς/κατὰ συμβεβηκὸς contrast on which the discussion depends is epistemic rather than logical, to do with a person’s relation to a proposition, not the proposition’s relation to other propositions.

\(^4\) 1.5, 74a28, recalls 1.2’s reference to a ‘sophistical mode’ of ἐπιστάσαι. The term ‘sophistical’ here adds nothing (except abuse) to ‘accidental’, since the accidental is the sphere in which the sophist plies his trade (Metaph. E. 2, 1026b15–16); ‘sophistical mode’ does not tie Aristotle to any one case of accidental ἐπιστάσαι.

\(^5\) Contra Bolton (1977) 564–5. Neither of the passages to which Bolton refers (1.2, 71b10–25; ii.8, 93a21–6) contrasts non-accidental ἐπιστήμη with mere belief. 93a25–6 passes from κατὰ συμβεβηκὸς οἴδομεν to οὐδὲ γὰρ . . . ἵσμεν, but for that very reason ἵσμεν must mean ἵσμεν ἀπλῶς.
the lengthy discussion of the isosceles example in 1.24). To which we may be inclined to object, echoing a well-known Platonic theme, that either one knows a thing or one does not. How can there be room for the notion of a favoured mode of knowing a proposition, to be termed (in Mure’s phrase) ‘scientific knowing’, alongside ordinary knowing on the one hand and believing on the other?

This objection can be pressed by anyone who holds a version of the now traditional analysis of knowledge as justified true belief. The point is that justification need not be in terms of first principles. Justification is expressed in argument to show that a proposition is true. The argument need not be deductive, and even if it is, it need not meet Aristotle’s requirement of explaining from first principles why the proposition is true. That, of course, is part of what Aristotle is saying in 1.2 when he distinguishes between syllogism and demonstration, and in 1.5 when he distinguishes between qualified and unqualified ἐπιστήμη, and again in 1.13 when he distinguishes between having a deduction which establishes a fact and having a deduction which also explains the fact, calling both of these (in a broad sense) ἐπιστωσθαι. In other words, Aristotle both knows and emphasises that his requirement that demonstration proceed from first principles is not a requirement of justification but of scientific explanation.\footnote{Note that in the examples of 1.13 the non-explanatory deduction is through the more familiar term, where this means the term that is more familiar to us. I take this as evidence (if evidence be needed) that in Aristotle’s view the non-explanatory deductions would be satisfactory enough in a justificatory role. For confirmation, cf. II.16, 98b19–21.}

But in 1.2 he also says that syllogism which is not demonstration does not yield ἐπιστήμη. It follows that Aristotle’s ἐπιστήμη is not knowledge as knowledge is standardly conceived in philosophy.

Is it, then, understanding? Explanation and understanding go together in a way that explanation and knowledge do not.\footnote{This remark was intended to be non-controversial, and I have found that, by and large, English speaking philosophers accept the point at once. Interestingly, however, the conference made clear that it does not sound right, let alone obviously right, to some scholars working in other languages and/or different philosophical traditions. I will address this problem of communication later (p. 122 and n. 22 below), after first developing my theme in my own terms.} Look at Jonathan Barnes’s translation of the passage from 1.2:\footnote{Barnes (1975).}

We think we understand a thing simpliciter (and not in the sophistic fashion incidentally) whenever we think we are aware both that the explanation because of which the object is is its explanation, and that it is not possible for this to be otherwise. It is clear, then, that to understand is something of this sort; for both

\[\text{1. Knowledge}\]
those who do not understand and those who do understand – the former think they are themselves in such a state, and those who do understand actually are. Hence that of which there is understanding simpliciter cannot be otherwise.

Now whether there is also another type of understanding we shall say later; but we say now that we do know through demonstration. By demonstration I mean a scientific deduction; and by scientific I mean one in virtue of which, by having it, we understand something.

If, then, understanding is as we posited, it is necessary for demonstrative understanding in particular\(^9\) to depend on things which are true and primitive and immediate and more familiar than and 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 deduction even without these, but there will not be demonstration; for it will not produce understanding.

It was worth motivating the reader to embrace this translation because Barnes himself seems reluctant to make philosophical use of the contrast between knowledge and understanding. Not only does he offer the traditional phrase ‘scientific knowledge’ as an alternative equivalent to ‘understanding’ (pp. 89, 90),\(^10\) but he encourages us (p. 90) to read ‘understanding’ as no more than a way of tagging the occurrence in Aristotle’s Greek of the verb ἐπιστασθαί in contradistinction to εἰδέναι, which Barnes translates ‘to know’, and γιγνώσκειν, for which he uses ‘to be(come) aware of’. To distinguish the three verbs thus tagged Barnes relies on the lexical schema which Lyons found to hold for Plato,\(^11\) namely,

\[
\begin{array}{c}
\text{εἰδέναι} \\
(\text{know}) \\
\end{array}
\quad \begin{array}{c}
\text{ἐπιστασθαί} \\
(\text{understand}) \\
\end{array}
\quad \begin{array}{c}
\text{γιγνώσκειν} \\
(\text{be aware of}) \\
\end{array}
\]

This schema gives contrasting senses for ἐπιστασθαί and γιγνώσκειν, which has the welcome result that circularity is avoided when Aristotle at the beginning of i.2 uses γιγνώσκειν to elucidate ἐπιστασθαί.\(^12\) At the same time εἰδέναι, the widest verb of the family, is taken to be, according to context, convertible and synonymous with ἐπιστασθαί or convertible and synonymous with γιγνώσκειν; there is no contrast of senses along the

\(^9\) ‘In particular’ gets the emphasis wrong: see n. 2 above.

\(^10\) Cf. also ‘scientific’ for ἐπιστημονικός in his translation of 71b18.

\(^11\) Lyons (1965) 177.

\(^12\) Cf. Barnes (1975) 97.
vertical dimension of the schema. This fits the Greek,\textsuperscript{13} but unfortunately, when translated into Barnes’s English, it has the result that we are deprived of any contrast of sense between ‘know’ and ‘understand’; the translator has to ask us to pay no attention to the colloquial nuances of our verbs (p. 90). But we need that contrast. It has philosophical work to do in making sense of Aristotle’s enterprise.

We may indeed be tempted to associate the contrast directly with the horizontal dimension of the schema, setting our verb ‘understand’ to represent ἔπιστασθαι, our verb ‘know’ to represent γιγνώσκειν (and also γνωρίζειν). Not only have we no third verb which functions like εἶδέναι, but it would in any case be misleading to think of εἶδέναι as the expression of a third, generic concept to which the other two verbs are subordinated as species to a common genus; rather, εἶδέναι is to be regarded, according to context, as a synonymous replacement for ἔπιστασθαι or for γιγνώσκειν.\textsuperscript{14} In a sense, therefore, the Greek trio provides only two concepts to match up with our verbs, so that, while exact translation is no doubt impossible, the schema to use is the following:

\[
\begin{array}{c}
\text{εἶδέναι} \\
\text{ἔπιστασθαι} \\
\text{γιγνώσκειν} (\text{γνωρίζειν})
\end{array}
\]

This proposal should not be taken to cover more than the use of the verb ἔπιστασθαι which Aristotle studies in the \textit{Posterior Analytics}. By comparison with Plato, Aristotle has specialised the verb considerably, even more so the cognate noun ἐπιστήμη. (i) The most characteristic Platonic constructions for ἔπιστασθαι do not appear at all, \textit{viz.} ἔπιστασθαι plus infinitive, ἔπιστασθαι plus the accusative \textit{of} a noun denoting a τέχνη or its domain.\textsuperscript{15} Aristotle is also more hospitable to the construction ἔπιστασθαι ὅτι (e.g., 1.1, 71a27–9; 1.2, 71b26; 1.6, 75a14; 1.13, 78a22; 1.33, 89a21; 11.1, 89a23–4) than one would expect from Platonic

\textsuperscript{13} E.g., within 1.2 itself εἶδέναι stands in for ἔπιστασθαι at 71b17 (cf. 1.3, 72b30), for γιγνώσκειν at 71b31.

\textsuperscript{14} Even this is a simplification (cf. Lyons (1963) 177, 183), but it holds, I think, for the Aristotelian constructions we need to consider.

\textsuperscript{15} Cf. Lyons (1963) 183, 188. It is worth noting that although the infinitive construction is the nearest match to the English ‘knowing how to . . . ’, both these constructions could often be translated by ‘understand’.
precedent. (ii) Where Plato’s usage of the epistemic nouns is given by the schema

\[
\begin{array}{c}
\text{ἐπιστήμη} \\
\text{τέχνη} \\
\gammaνώσις
\end{array}
\]

with ἐπιστήμη in the superordinate position corresponding to ἐιδέναι among the verbs, in the Posterior Analytics ἐπιστήμη is co-ordinate with ἐπιστασθαι and denotes either the cognitive state of the ἐπιστάμενος (e.g., 1.2, 71b13–16; 1.4, 73a21; 1.6, 74b5–6) or the body of knowledge (science) he has mastered (e.g., 1.10, 1.27). Nevertheless, Aristotle in 1.2 does take himself to be starting his analysis from a base in ordinary thought, and this may serve as a first test of our proposal to take seriously the idea of rendering ἐπιστασθαι/ἐπιστήμη in terms of understanding. 

Aristotle’s claim is ἐπιστασθαι is ordinarily so conceived that

\[
X \text{ ἐπιστασθαι } Y \text{ if and only if (a) } X \gammaνώσκει \text{ what the explanation of } Y \text{ is and (b) } X \gammaνώσκει \text{ that } Y \text{ cannot be otherwise than it is.}
\]

There can be little doubt, surely, that this is a much better definition of ‘X understands Y’ than of ‘X knows Y’. Not that one could not read the definiendum as ‘X knows Y’ – but the effect would be to select a use of our verb ‘know’ in which it means to be well acquainted or thoroughly familiar with something in an intellectually principled way; as when a man is said to have expert knowledge of, say, mononucleosis or the turnip. We have such a sense of ‘knowing’, but it is much closer to understanding than to the concept which contrasts with mere belief and which philosophers analyse in terms of justification.

Parallel considerations would suggest that it is a similar, implicitly graded sense of the Greek γιγνώσκειν which Aristotle has in mind in the Physics when he echoes the definition we are discussing but with γιγνώσκειν in place of ἐπιστασθαι and with γνωρίζειν in the analysans in place of γιγνώσκειν:

16 7 cases in the entire corpus – Lyons (1963) 205. 17 Lyons (1963) 177.
18 τέχνη occurs only twice in An. post.: once in the broad (Platonic) use in which it can stand with ἐπιστήμη in contrast to γνώσις (1.1, 71a2–4; cf. An. pr. 46a22), once in contrast with ἐπιστήμη (1.19, 100a9), but a contrast created by philosophical legislation.
19 The proposal (and some of the results to which it will lead) may claim the support of Kosman (1973), and of Moravcsik (1973).
We think we γινώσκειν a thing when we γνωρίσωμεν its primary causes and primary principles, right back to the elements (Ph. 1.1, 184a12–14, elucidating a claim about ἐπίστασθαι).

In both passages, the definition of ἐπίστασθαι in the || Posterior Analytics and the definition of γινώσκειν in the Physics, our verb ‘know’ is needed in the analysans not in the analysandum. Aristotle is analysing a cognitive state which is achieved by knowing explanations, and whether he is currently calling it ἐπίστασθαι or γινώσκειν the corresponding term for that state in philosophical English is ‘understand’.

Other languages, other philosophical traditions, may speak differently. They must find their own means of signalling the non-circularity of the definitions just quoted. For the claim that two distinguishable notions are involved is not a claim about a particular language or jargon. It is equally || true that English could supply alternative ways of registering Aristotle’s contrast between ἐπίστασθαι and γινώσκειν or γιγυνώσκειν and γνωρίζειν: for instance, suitably introduced and circumscribed, a contrast between a richer and a more ordinary concept of knowledge, for the first of which the label ‘scientific knowledge’ might do after all. It is not the words that matter, but the thought. Provided that is understood, each of us may best proceed in terms that are γνώριμα ήμιν. For these

20 Cf. Ph. II.3, 194b17–20; Metaph. A 3, 983a25–6, where the definiendum is ἐλεύθερος and Metaph. A 2, 994b29–30, where the definiendum is ἐλεύθερος standing in for γιγυνώσκειν and yet γιγυνώσκειν still contrasts with ἐπίστασθαι (994b20–3). ἐλεύθερος again stands in for γιγυνώσκειν in the repeat definition of ἐπίστασθαι at An. post. II.11, 94a20. On the other hand, at Metaph. B 2, 996b14–16, ἐλεύθερος stands in for ἐπίστασθαι in contrast to γνωρίζειν.

21 With γιγυνώσκειν at Phs. 1.1 loc. cit. compare e.g., De caelo III.3, 302a11–12: in everything ἡ γνώσις is through first principles. Likewise, Gen. an. II.6, 742b3–4 has undemonstrated γνώσις of a first principle in place of An. post. s undemonstrated ἐπιστήμη/νοῦς of it (An. post. I.2, 71b16; I.3, 72b18–20; I.9, 76a18; II.19, 100b12), and Part. an. 1.1, 641a36–b2, uses ἡ φυσική γνώσις as a replacement for ἡ φυσική ἐπιστήμη in the sense of natural science. It will become clearer below that to use γνώσις for the state of understanding is not necessarily to obliterate the contrast between γνώσις and ἐπιστήμη.

22 Cf. n. 7 above. Most conspicuously, there is an important tradition, associated with the name of Dilthey, which contrasts explanation (Erklären) and understanding (Verstehen) and assigns the former to the natural sciences, the latter to the ‘Geisteswissenschaften’. As I am using ‘understanding’, it has no special connection with intentionality or with particular human/social phenomena: these are not for Aristotle objects of ἐπιστήμη, and it is quite misleading of von Wright (1971) ch. 1, to count Dilthey part of the Aristotelian tradition in Western thought on the grounds simply of a shared preoccupation with teleology. Von Wright himself says (p. 6), ‘Practically every explanation, be it causal or teleological or of some other kind, can be said to further our understanding of things’ – and that broad, non-specialised use of ‘understanding’ is the use I was starting from when I remarked (above, pp. 106–8) that explanation and understanding go together in a way that explanation and knowledge do not. Aristotle’s ἐπιστήμη is not identical with that understanding either, but the reasons why it is not go beyond the divergencies in the ways different languages carve up the lexical field of cognition. I shall be arguing that the interesting restrictions on ἐπιστήμη come from substantive theses on the nature and scope of explanation.
linguistic considerations have philosophical consequences which go to the heart of Aristotle’s enterprise.

II

To start with an issue of basic importance, consider the claim at the beginning of Posterior Analytics i.2 (71b12, 15–16) that ἐπιστήμη is of what cannot be otherwise. As a claim about knowledge, this invites (and has received) the criticism that it is simply mistaken, the product of modal confusion. In reflecting on the principle that what I know must be true, Aristotle has construed necessitas consequentiae (‘It is necessary that, if I know that p, then p’) as necessitas consequentis (‘If I know that p, then it is necessary that p’). But if Aristotle is making a claim about understanding, his point will be that understanding depends on explanation and what gets explained in the sciences (ἐπιστήμαι in the objective sense) which produce that understanding (ἐπιστήμη in the subjective sense) is general regularities and connections: lawlike regularities in the modern jargon, necessary connections in Aristotle’s (cf. Eth. Nic. vi.6, 1140b31–2). Scientific explanation answers to such questions as ‘Why is the sun eclipsed?’ (i.1), ‘Why is it that a pair of lines cutting a third line at right angles to it do not meet?’ (i.5, 74a13–14), ‘Why do vines shed their leaves?’ (ii.16). Aristotle does think one can apply the explanation of a recurring type of phenomenon to a particular instance of it, e.g., today’s eclipse, but what this yields is accidental or qualified ἐπιστήμη, not ἐπιστήμη ἐπιλῶς (1.8). He thus sides with those modern philosophers of science who hold that scientific explanation is in the first instance explanation of generalities (laws) rather than the explanation of particular events. He wants to know why the sun is eclipsed

23 This notorious fallacy is what Barnes (1975) 97 (cf. p. 112 ad 73a21), is referring to when he says that the mistake involved in restricting ἐπιστήμη to what cannot be otherwise is made every five years in Mind. In truth, the mistake perpetrated every five years in that journal and elsewhere is the mistake of attributing the fallacy to other philosophers (usually unspecified figures from the past) as the root explanation of their epistemological position. I doubt the explanation is ever that simple, nor would the fallacy suffice to explain the inference Aristotle actually endorses, which is ‘If I have ἐπιστήμη of the fact that p, then I know that it is necessary that p’ (I agree with Barnes (1975) 97, that μὴ διδάχθησαι is governed by γίγνομαι). To be sure, Barnes suggests that Aristotle may be innocent of mistake if his account of ἐπιστήμη is intended as a stipulative definition. But this expedient requires an implausibly narrow reference for the ‘we’ whose thinking the account expounds. It is particularly implausible for the version in Ph. ii.3, 194b17–20 where Aristotle proceeds at once to collect up a number of patterns of explanation from both ordinary and scientific speech (cf. esp. 194b34–5). Notice also Eth. Nic. vi.3, 1139b20–1: we all suppose that what we ἐπιστήμη cannot be otherwise (cf. An. post. 1.33, 89a6–10).

24 For an admirable statement of this view, which is not as widespread as it should be, see Friedman (1974). Note that this interpretation makes intelligible, as the diagnosis of modal confusion does
at all, i.e. why there are solar eclipses, rather than why it is eclipsed today. When, therefore, he says that ἐπιστήμη is of what cannot be otherwise, his claim should be read, not as the product of modal confusion, nor as the stipulation of some specialised concept of his own, nor again as an unexamined legacy from Plato, but as a substantive thesis designed to elucidate a current concept of understanding. That understanding is constituted by knowing the explanation of necessary connections in nature.

We too possess a concept of this kind: a quite ordinary concept, though it is the concept of a specialised type of understanding which is sought in the sciences. We may disagree with Aristotle – philosophers still disagree with each other – about the sense and function to be assigned to the idea of necessity in this context. We may have qualms about the restrictions which are imposed on the scope of understanding when Aristotle goes beyond ordinary thought to build the idea of an axiomatised science which will ideally satisfy his stated requirements for ἐπιστήμη. But it is important to see that the issues at stake here have much more to do with considerations about explanation than with considerations about what we can know or be certain of.

First, it is because ἐπιστῶσθαι involves explanation that Aristotle insists on proceeding from principles which are true, primitive, immediate, more familiar than and prior to and explanatory of the conclusion (1.2, 71b29–31). Second, he argues in 1.6 that necessity in the premises, transmitting to the conclusion, is a requirement of explanatoriness. Aristotle does not express himself very clearly on why this is so, but he is clear that he is not saying, for he does not believe, that a necessary conclusion can only be derived from premises which are necessary (75a1–4). His most substantial claim (74b26ff.) is that to explain the holding of a conclusion which is necessary one must demonstrate it through a necessary middle term. If the middle term is not necessary, the premise-set could in principle be false while the conclusion, being necessary, would still be true, and a conclusion which holds whether or not the premises hold does not hold because those premises hold; it is not explained by them, nor are they prior to the conclusion in the sense Aristotle intends them to be.

It appears that in a properly ordered science necessity would be transmitted to the theorems from above. To understand a theorem you must not, how Aristotle could anticipate developing the logical resources for admitting ‘for the most part’ propositions as objects of demonstration and hence of ἐπιστήμη (1.30, with Barnes (1975) ad loc.). It is characteristic of general regularities in the sublunary world to hold only for the most part. For discussion, see Mignucci (1981).


For the difficulties, see Barnes (1975), notes on the chapter and on 1.4, 73a21.
understand (ἐπιστασθαι) not only that it is necessary, but also why it is necessary (1.6, 75a12–17). It is necessary because it is demonstrable from prior principles which are themselves necessary. These principles in turn are to be not merely necessary but necessary because they are per se predications expressing a definitional connection (1.6, 74b5–12 with 1.4). What is required is a predication $AaB$ where either $A$ belongs in the definition of $B$ or $B$ belongs in the definition of $A$. Once again there is unclarity in Aristotle's detailed discussion, not least as regards which features of the principles he thinks are transmitted also to the theorems, but it seems fair to say that he is trying to give substance to the idea that the fundamental predications of a science ought to be self-explanatory. They should be not merely immediate, in the sense of not admitting explanation through a middle term (1.2, 71b21, 26–7), but should actually explain themselves (cf. 1.4, 73b16–18, with 1.24, 85b24–5). Their necessity will be directly intelligible from or in the fundamental definitions of the science (cf. 1.3, 72b24–5; Top. viii.3, 158b2–4). And it should be remembered here that what Aristotle looks for in a scientific definition is not an analytic truism but substantive knowledge of the essence of something.

These chapters (An. post 1.2–6) are typical of the process whereby Aristotle builds on the ordinary conception of ἐπιστασθαι to articulate the idea of an axiomatised science. At each step the main motivating consideration has to do with explanation, hence understanding. The man who achieves unqualified ἐπιστήμη in accordance with Aristotle’s prescriptions is a man for whom every ‘Why?’ question in a given domain has its correct and appropriate answer. (It transpires from 1.19–20 that Aristotle is prepared to argue that the number of such questions is certain to be finite.) Explanation, and so understanding, is then complete (cf. 1.24, 85b27 –86a3). The man of understanding has a grasp of the answers which is both systematic and synoptic, in that everything in the domain of his science is explained in the light of first principles which explain themselves. If this sounds like the

27 This refinement is not mentioned elsewhere, but I do not see why it should not be included. διότι <ἀνάγκη ἐκείνο εἶναι> is a more natural way of construing the Greek than either <τὸ> διότι or διότι <ἐκείνο ἐστίν> – it is the construal of Ross (1949) 529, as against Mure and Barnes – even though, as Barnes points out to me, διότι <ἐκείνο ἐστίν> would yield a neat reprise of 1.2’s twin conditions on ἐπιστήμη.

28 This may suggest that in 1.4 the fourth case of καθ’ αὐτὸ = δι’ αὐτῷ ὑπάρχον (73b10–11) is not so irrelevant to the general discussion as it has seemed, e.g., to Barnes (1975) 114. 1.10, 76b23–4 is also relevant, but with Barnes (1975) ad loc.

29 See the several difficulties canvassed in Barnes (1975), notes on 1.4; also Ross (1949) 521–2.


31 This is of course compatible with the (admittedly curious) suggestion at Soph. el. 9, 170a22 that the number of ἐπιστήμης may be infinite.
grand vision of Plato’s *Republic* transferred to the individual sciences, well and good: 1.33 contrasts ἐπιστήμη and δόξα (meaning ‘(mere) opinion’, not ‘belief’ or ‘judgement’ in general, for which the chapter uses other terms⁴²), and discusses problems arising out of the contrast, in a manner unmistakably reminiscent of *Republic* v. Aristotle too has his vision of a complete understanding, and it is this that finally supports his claim that one can have ἐπιστήμη only of things universal, necessary and everlasting, not of things particular, perishable or accidental (1.6, 75a18–37; 1.8, 1.30, 1.31, *Metaph.* E 2).

Aristotle is not saying, for example, that we cannot know what accidental states of affairs obtain in the world. His contention is that the accidental falls outside the reach of systematic explanation and understanding. ‘Of things which are or come about accidentally the cause also is [the cause] accidentally’ (*Metaph.* E 2, 1027a6–7), where ‘accidentally’ is defined as ‘neither always/necessarily nor for the most part’ (1026b31–3; cf. Δ 30). There is no general or generalisable explanation of a pale man’s being musical or of a builder effecting a cure; at best, the individual cases may be traced each to their own cause.⁴³ But since the causes of the accidental are in this sense indeterminate or irregular (*Ph.* ii.5, 196b23 ff.; *Metaph.* Δ 30, 1025a24–5; K 8, 1069a32–5), knowing them is not ἐπιστήμη. It is not understanding a recurring type of phenomenon from first principles. It is not even the accidental or qualified ἐπιστήμη which we have when we apply the explanation of a recurring type of phenomenon to a particular instance of it, e.g., a particular eclipse (*An. post.* 1.8).⁴⁴
Again, the reason why according to Aristotle there is no ἐπιστήμη through perception of particular things or events is that one does not in perception discover why something is as it is. Explanation imports generality, which is beyond the scope of perception (1.18, 81b6–7; 1.31; Metaph. A 1, 981b10–13). But this is not to say that perception does not yield knowledge. ἀισθήσεις is not ἐπιστήμη but it is (one type of) γνώσεις (11.19, 99b38–9; Metaph. A 1, 980a21–7; 981b11–13; Gen. an. 1.23, 731a30–4; Mem. 1, 449b13–14; cf. Top. 1.12, 105a17–18; v.3, 131b23–8; viii.1, 156a7–8; An. post. 1.2, 72a2–3; Ph. 1.5, 188b32; 189a5–9).

Now remember that these restrictions on what there can be of are not just restrictions on the types of proposition which can find a place within an axiomatised body of knowledge (ἐπιστήμη in the objective sense) or on the types of thing which can be made the object of systematic science. They are also restrictions on the possible objects of ἐπιστήμη/ἐπιστάσσει as a cognitive state of a person. If that state is taken to be knowledge in the sense connected with justified true belief, Aristotle comes out with a remarkably sceptical view about our knowledge of mundane matters of fact involving perceptible physical objects and their contingent (accidental) properties. Roughly, we have no knowledge of such things, or none in the stricter sense of the word. If, on the other hand, we are serious about taking ἐπιστήμη/ἐπιστάσσει as understanding, the restrictions are intelligible (which is not to say they are uncontroversial) and Aristotle can be seen to be arguing for them in an intelligible and appropriate manner from considerations about explanation.

It is equally important to notice what considerations Aristotle does not appeal to in these contexts. Evidence, certainty, justification – these central and unchanging for the reason that we cannot be assured of the continuing truth of contingent propositions: Eth. Nic. vi.3, 1139b21–3 (brief and summary); Metaph. Z 15, 1039b27–1040a7 (cited by Hintikka, pp. 75–6). But from two passages which Hintikka does not notice (Metaph. Z 10, 1036a3–8; Top. v.3, 131b19–33), it appears that the argument is chiefly about singular propositions. If you have a proposition predicating a necessary property of a contingently existing subject, e.g., ‘This bronze circle is \(F\)’ or, for that matter, ‘This mathematical circle is \(F\),’ or a proposition predicating a contingent property of a necessarily existing subject, e.g., ‘The sun is the brightest body moving above the earth,’ then you cannot be certain of their continuing truth once the subject has passed out of your ken (be this by way of ἀισθήσεις or of νόσημα). But for all that there remain necessary properties of the sun and general theorems on circles, and these you can continue to know (cf. Metaph. Z 10, 1036a6–8). So the argument is in any case not sufficient to divide off circles and the sun, which are proper objects of ἐπιστήμη, from pale men, who are not. For this there is no better justification than the justification in terms of explanation which is given in An. post. itself.
concepts of the theory of knowledge have little or no place in his present concerns. This is reason, of course, for disavowing the once prevalent idea that the *Posterior Analytics* advocates demonstration as the method of scientific discovery. But it is also reason for entering a *caveat*, or at least a corrective, || to the view, which promises to become a new orthodoxy, that the *Posterior Analytics* advocates demonstration as the method of teaching or imparting knowledge.

This view has been ably argued by Jonathan Barnes, and I will proceed from his formulation of it:

. . . the theory of demonstrative science was never meant to guide or formalize research: it is concerned exclusively with the teaching of facts already won; it does not describe how scientists do, or ought to, *acquire* knowledge: it offers a formal model of how teachers should *present and impart* knowledge.

Let us agree that Aristotle, very sensibly, does not present demonstration from first principles as the way to find new facts or to excogitate and confirm new explanations. That disposes of the old view that demonstration is the method of research. But now suppose I am a teacher who must impart to my pupil facts and explanations which are *new to him*. Does Aristotle think that demonstration from first principles is the way to get him to know what he did not know before? That would be poor pedagogy, and a surprising lapse from the enlightened educational traditions of the Academy. It would be contrary also to Aristotle’s repeated indications that, so far at least as first principles are concerned, the pupil must be led to them, by non-formal methods, from what is more familiar to him (e.g., *Top. i.2, 101a36–b4; vi.4, 141b17–19; Ph. i.1; Eth. Nic. i.7, 1098a33–b4; vi.3, 1139b28–31; vii.8, 1151a16–18*). But it would be only slightly better pedagogical practice, at least in the non-mathematical sciences, if I tried to take my pupil straight to the first principles and, once there, launched into a remorseless chain of syllogistic deduction. || That would mean expecting the novice to come to know, for the first time, the theorems of the science on the evidence solely of their having been demonstrated from first principles; I would not concern myself with the evidential support that particular theorems might

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35 Consequently I think it misleading of Barnes (1975) to use ‘*certain*’ to translate ἀκριβῆς, e.g., in i.27, even with the elucidation offered in his notes ad loc. The clarity which Aristotle associates with ἀκριβεία at *Top. ii.4, 1119a* should be the clarity of precision and simplicity (*Metaph. A 2, 982a25–8; M 3, 1078a9–13*), not epistemological certainty. It is especially misleading to introduce suggestions of epistemological certainty into 11.19 at 99b27, 100b8; as we shall see, that is not the emphasis needed to make sense of Aristotle’s doctrine of *νοος*.

36 Barnes (1969/1975) 77. The points I want to concentrate on can be signalled by redistributing the italics: ‘. . . how teachers *should* present and *impart* knowledge’. 
find closer to the pupil's own experience. But in Aristotle's own treatises he is constantly, one might almost say obsessively, reaching for evidential support from any reputable (ἐνδοξον) source he can cite. It is one great drawback of Barnes's interpretation that the treatises, since they are plainly not 'pieces of formal instruction' on the demonstrative model, have to be discounted as not having 'pedagogic form':

A series of demonstrations is appropriate to the setting out of knowledge securely achieved; it is inappropriate to the sharing of tentative philosophical or scientific explorations.  

Barnes has to describe the treatises as tentative throughout because he has committed Aristotle to the unenlightened pedagogical view that once he was sure of his results he ought to teach them in demonstrative form.

It seems to me that this is one more place where a distinction between knowledge and understanding can be helpful. Teaching in the sense of imparting knowledge to people who did not have it before must normally include the citing of evidence and justification. The path by which the pupil is led to knowledge which is new to him cannot be wholly unconnected with the path by which the teacher won that knowledge in the first place. (I am referring here to the evidential base for a scientific discovery, not to the methods used in the search.) From this point of view Aristotle's treatises can perfectly well be regarded as instruments of teaching, which indeed they often claim to be. But teaching may also be designed to impart understanding of knowledge which the pupils already have, or a deeper understanding of a science which they already have some acquaintance with but in an unsystematic way. I do not think that the concerns of the *Posterior Analytics* are exclusively pedagogical: understanding is first worth having for oneself, because of what it is in itself, namely, an excellence of the intellectual part of the soul (*Metaph.* A 1–2; *Eth. Nic.* vi.1, 1139a27–9; vi.2, 1139b12–13; vi.12, 1144a1–3), and that is why, derivatively, it is worth communicating to another. But to the extent that Aristotle is moved by an educational interest, one should think of this not in terms of a teacher imparting new knowledge to virgin minds but in terms of an advanced university course in mathematics or biology. The scientist aims to display and share his principled understanding of the field – an enterprise which pre-supposes a good deal of pre-existing knowledge on the part of his audience. And this in turn allows the informal efforts of the treatises to be

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37 Barnes (1969/1975) 84.  
38 For evidence on this, see Barnes (1969/1975) 77–80.
directed at the securing and communicating of knowledge newly won by Aristotle himself.

We must not be misled here by the parallelism between demonstration and induction (ἐπιστήμη) expressed in such statements as ‘We learn either by induction or by demonstration’ (1.18, 81a40; cf. 1.1, 71a5–9; Eth. Nic. vi.3, 1139b26–8). Barnes argues: demonstration and induction are paired here with regard to their function; the function of induction is given as making things known (1.3, 72b29–30; 1.18, 81b2–4) or revealing things to someone (11.5, 91b32–5), i.e. instruction; therefore, the function of demonstration also is to instruct.39 The Greek for what induction does in these passages is γνώριμον ποιεῖν, γνωρίζειν ποιεῖν. Certainly demonstration could do this too (some of the deductions taught in the advanced university course will bring new information). Aristotle describes a case of coming to know something by deductive inference || in i.1, 71a17ff., using γνώσεις γνωρίζειν. Knowing already that every triangle has angles equal to two right angles, I see that this figure in the semicircle is a triangle and immediately infer that it has angles equal to two right angles. The case illustrated involves perception of a particular and simultaneous inference to new information, but the thesis behind it, that deduction can bring new knowledge need not be so restricted (compare ii.8, 93a17–19: sometimes the fact becomes clear/known at the same time as its explanation), and elsewhere we meet the somewhat incautious statement that all conviction is the result either of syllogism or of induction;40 Aristotle presumably means that where conviction has reasons, these reasons must be either deductive or inductive. So there undoubtedly is the parallel between demonstration and induction as regards their imparting knowledge. Nonetheless, there remains an asymmetry between the two which is more important for the aims of the Posterior Analytics than the parallelism: demonstration can and induction cannot ἐπιστήμην ποιεῖν. And ἐπιστήμη, not simply γνώσις, is what the Posterior Analytics wants demonstration for (1.2, 71b25).

I conclude that the pedagogical interests of the Posterior Analytics are concentrated on teaching as the imparting of understanding, rather than as the imparting of knowledge. ‘Those who teach are those who state the explanations about each thing’ (Metaph. A 2, 982a29–30). This is a remark about ordinary language, given (in characteristic fashion) as evidential support for a doctrine to the effect that one science or branch of knowledge (ἐπιστήμη) is more διδασκαλική than another if it is more concerned with

40 An. pr. ii.23, 68b13–14: ἀπαντα γὰρ πιστεύομεν ἢ διὰ συλλογισμοῦ ἢ ἐξ ἐπαγωγῆς.
explanations. It is more instructive if it is more explanatorily illuminating. (Examples to illustrate the doctrine can be culled from the account of higher and lower sciences in An. post. 1.13). Teaching, διδασκαλία, in the sense Aristotle is chiefly interested in, is explanatory illumination, the conveying of understanding.

IV

At this point the question may be raised whether my account of Aristotle’s pedagogical philosophy really improves the claims of demonstration to be an enlightened instrument of teaching. The answer, it seems to me, depends on whether we agree with Aristotle on the answers to certain prior philosophical questions about understanding.

The key to understanding is demonstration, and in the Posterior Analytics as we have it the demonstration Aristotle has in mind is, above all, demonstration by (apodeictic) syllogisms in Barbara (1.14). Against this we can set a broad notion of demonstration matching the broad notion of syllogism laid down at An. pr. 1.1, 24b18–20. As Aristotle puts it in the Topics (1.1, 100a25–30): syllogism is an argument in which, certain things being laid down, something else follows of necessity from the things laid down, because of the things laid down, while demonstration is a syllogism (as so defined) which proceeds from things primary and true or from things known on the basis of things primary and true. So which demonstration, broad or narrow, do we have to confront on the issue of teaching? Both. It is a substantive thesis of Aristotle’s logic (An. pr. 1.23) that all syllogism in the broad sense, and hence all demonstration in the associated broad sense, can be reduced to syllogistic form in the narrow sense defined by the figures. And that noble mistake becomes in turn a thesis of Aristotle’s philosophy of science. An. post. 1.14 states roundly that the first figure is the most productive of understanding, that it is the paradigm vehicle of explanation, and that it is already exemplified in the mathematical sciences. Even if, as Jonathan Barnes so persuasively argues in his contribution to this symposium (see Barnes 1981), this is to be viewed as a syllogistic reconstruction of a theoretically, and perhaps also chronologically, prior theory of demonstration (broad sense), it is clear that Aristotle did not think syllogistic incompatible with the claims he wanted to make on behalf of demonstration. The remarks in 1.14 rather suggest that he

41 ‘Deduction’ in the terminology used by Barnes in his translation (1975) and in Barnes (1981).
thought his claims were strengthened by the supposed availability of a formally rigorous reduction for all explanatory demonstration.

Suppose, then, we accept that there is a kind of understanding that is to be gained, and is only to be gained, from relating and organising knowledge which has so far been acquired in an informal or unsystematic way. It by no means follows that understanding is to be sought from putting the knowledge into Aristotle's demonstrative mould, with or without the syllogistic reduction. It is possible to use language quite close to Aristotle's in the service of a conception of understanding far removed from his; as in the following specimen of eighteenth-century philosophical English, which is in fact — and this fact will concern us later — an attempt to sum up the lessons to be learned from Plato's proof in Part 1 of the *Theaetetus* that perception is not ἐπιστήμη.

We know a thing when we understand it: and we understand it when we can interpret or tell what it signifies. Strictly, the sense knows nothing. We perceive indeed sounds by hearing, and characters by sight; but we are not therefore said to understand them. After the same manner, the phenomena of nature are alike visible to all; but all have not alike learned the connexion of natural things, or understand what they signify, or know how to vaticinate by them. There is no question, saith Socrates in *Theaeteto*, concerning that which is agreeable to each person, but concerning what will in time come to be agreeable, of which all men are not equally judges. He who forekneweth what will be in each kind is the wisest. According to Socrates, you and the cook may judge of a dish on the table equally well, but while the dish is in the making, the cook can better foretell what will ensue from this or that manner of composing it. Nor is this manner of reasoning confined only to morals or politics, but extends also to natural science.

Thus Bishop Berkeley, expressing his vision of science as 'a grammar for the understanding of nature', where 'grammar' and 'understanding' mean no more than a systematic grasp of general rules over observables enabling us to 'vaticinate' or predict the course of nature, which for Berkeley is God's language to us. Berkeley agrees that understanding requires a systematic connecting and organising of phenomena independently known, but his conception of science as a set of predictive devices connecting observables is as far removed from Aristotle's as any could be.

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42 George Berkeley, *Siris* §253 with §252. For his interpretation of the *Theaetetus* see also §§304–5 and my further remarks below. Note that 'Strictly, the sense knows nothing' uses 'knows' in the meaning just defined for it, *viz.* 'understands', not in the meaning in which Berkeley held that the esse of sensible things is their being 'perceived or known' (*Principles of Human Knowledge* §6). Note also that what Berkeley is defining here is what I earlier (above, pp. 121–2) called a richer sense of the English verb 'to know'.
Now one reason for the distance between Berkeleyan and Aristotelian understanding is, of course, that Berkeley has no room for a conception of explanation which goes further than the subsumption of phenomena under predictive generalisations. Whereas Aristotle, notoriously, demands much more. But we must be careful here. Some enthusiastic recent writing has commended Aristotle for seeing the deficiencies in the covering law (deductive-nomological) model of scientific explanation. The prize exhibit is the example in *An. post* 1.13: ‘The planets do not twinkle; all objects that do not twinkle are near the earth; therefore, the planets are near the earth.’ About this example (and likewise about the similar examples in II.16) Aristotle states, perhaps rightly, that it is not explanatory. The fact that the planets do not twinkle does not explain why they are near the earth, but rather their being near the earth explains why they do not twinkle. Hempel says of a similar case (the pendulum, whose period can be inferred from its length and vice versa) that ‘the common sense conception of explanation appears to provide no clear grounds on which to decide whether a given argument that deductively subsumes an occurrence under laws is to qualify as an explanation’. Thus, insofar as Hempel – like Aristotle – is not seeking a descriptive analysis of the ordinary notion of explanation but (in the technical jargon) an explication of it, leading to a more precise and fruitful characterisation of explanatory procedures in natural science, it is not clear that it is a deeply serious matter for him if his criteria count the planets example as explanatory. Further, Hempel’s Aristotelian critics should tell us whether they favour a position as strong as Aristotle’s, which is that no pair of converting terms is such that explanation can run both ways (*An. post* II, 16–17, esp. 98b16–24). For example,

43 Cf. Berkeley, *De Motu* §37: ‘A thing can be said to be explained mechanically then indeed when it is reduced to those most simple and universal principles, and shown by accurate reasoning to be in agreement and connection with them. For once the laws of nature have been found out, then it is the philosopher’s task to show that each phenomenon is in constant conformity with those laws, that is, necessarily follows from those principles. In that consist the explanation and solution of phenomena and the assigning their cause, i.e. the reason why they take place.’ §39: ‘And just as geometers for the sake of their art make use of many devices which they themselves cannot describe nor find in the nature of things, even so the mechanician makes use of certain abstract and general terms, imagining in bodies force, action, attraction, solicitation, etc. which are of first utility for theories and formulations, as also for computations about motion, even if in the truth of things, and in bodies actually existing, they would be looked for in vain, just like the geometers’ fictions made by mathematical abstraction’ (trans. Luce).

44 Brody (1972); Sorabji (1980) ch. 3; Barnes (1975) 150 is more cautious, as is Patzig (1981).


47 They do not, of course, count it explanatory unless ‘All objects that do not twinkle are near the earth’ is taken to be true, testable and above all lawlike (that is, entailing counterfactuals of the form ‘If \( x \) did not twinkle, \( x \) would be near the earth’). For some cautionary remarks about apparent counter-examples which trade on doubts about the lawlikeness condition, see Hempel (1965) 374–5.
Aristotle would not accept that one could explain why a certain substance is gold by reference to its atomic number and also explain why it has a certain atomic number by reference to its being gold. But now, I suggest, it is Aristotle who is at variance with our ordinary notion of explanation. Even if in some important sense one of the converting terms in the gold example is prior to the other (and Aristotle might take a different view from us about which is which), this is only relevant against Hempel if the priority in question can be elucidated independently of ideas about explanation. Here Aristotle can rest on a metaphysical system which posits real priority and posteriority in nature (see below), but it would be a bold follower who sought to revive that option today. And it is in any case important – far more important – to add that it is only Berkeley’s instrumentalism, not Hempel’s covering law theory, which must admit that the planets example is as good an explanation, as good a case of understanding, as any we can have.

On Hempel’s view, explanation becomes more powerful as it is incorporated into wider, more embracing systems of theory. This gives him middle ground between Berkeley and Aristotle for his account of the kind of understanding that we get from systematically organised explanation; he has quite a lot to say about what it takes for one explanation to give us deeper insight and understanding than another. This middle ground is important. It allows us to think that the conditions for understanding are interdependent, if not with the conditions for explanation, then at least with the conditions for good (illuminating) explanation. A rejection of the Berkeleyan picture of scientific understanding is by no means sufficient to push us all the way to Aristotle’s account of understanding in terms of demonstration from first principles in a fully axiomatised system. What it would take to get us that far is nothing less, but also nothing more, than a whole-hearted Aristotelian conception of the possibilities for complete explanation. And the existence of middle ground makes a difference also to the issue of teaching. To the extent that we doubt that understanding, or

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48 Why should our intuitions be different (if I am right that they are different) in the gold and in the planets/pendulum examples? Patzig (1981) makes some interesting suggestions about temporal genesis which would fit the planets and the pendulum but not the gold example. This inclines me to think his suggestions are on the right lines. See also Grünbaum (1963) 90–1.

49 Brody (1972) 20–1, discounts this non-Berkeleyan element in Hempel before proceeding to his critique; but the discounting rests on little but the rhetorical question ‘Why should laws that explain more explain better?’, a question which Hempel had certainly tried to answer (see next note).

50 Hempel (1966) 278ff., 345–7, 444; cf. also Hempel (1966) 75–7, where he states clearly that explanatory import is only a minimal necessary condition for illumination and scientific interest.

51 Compare Friedman (1974) 14ff.
the most important type of understanding, is the fruit only of axiomatisation, to that extent we shall doubt that demonstration is the mode in which to impart understanding. But equally, to the extent that we believe that full understanding requires axiomatisation, || to that extent we shall propose demonstration, even (were we to accept the reduction thesis) syllogistic demonstration, as the means to convey understanding. If we agree with Aristotle about the benefits of axiomatisation, our pedagogy will follow suit.

I conclude that a teacher can sensibly aspire to conduct Aristotelian demonstrations if it is right to claim that, where we can achieve the full axiomatisation of a science, that axiomatisation will provide us with a completed structure of explanation which should be the ideal fulfilment of a common conception of understanding. Whether or not a modern proponent of axiomatisation could believe this, it is well nigh compelling if (as Aristotle does) you believe, what is now usually held to be false, that for any science there is just one adequate set of axioms and if, further, you believe (as Aristotle does) that these axioms are true, primitive, immediate, more familiar than and prior to and explanatory of a complete and finite set of theorems. If such axiom sets are possible, they are surely necessary for a wholly adequate understanding. The inference whereby Aristotle at An. post. 1.2, 71b19–20, argues that, if τὸ ἑπιστῶς has the character it is commonly conceived to have, then it is necessary that (ἀνάγκη) apodeictic ἑπιστήμη be grounded upon an axiom set of the specified kind, would be outrageous if it was an inference about knowledge in the sense we are used to in philosophy, but it has every justification as an inference about understanding, given Aristotle’s belief that there is real priority and posteriority in nature. For Aristotle, an axiomatic system is not just a preferred ordering of humanly constructed knowledge, but a mapping of the structure of the real.

From this metaphysically vertiginous thought let us pull back to the cognitive state of the ἑπιστῶς. I have || emphasised Aristotle’s lack of concern with evidence, certainty and justification, concepts which for us are central to the theory of knowledge, and I have used this point to help shift our focus to the notion of understanding. But it is time to backtrack with some qualifications and concessions.

It may be objected to the account I have been giving that in An. post. 1.2 itself, at 72a25ff., Aristotle states it as a requirement of ἑπιστήμη that
I both know (εἰδέναι, προγνωσκεῖν, γνωρίζειν) and am convinced of (πιστεύειν) the first principles more than the theorems, and the reason he gives for making this requirement is that it is because (we know and are convinced) of the first principles that we know and are convinced of what is demonstrated from them (72a30–2). May this not show that he does, after all, think of the first principles as grounds or evidence for knowledge of what comes later, serving as such in virtue of the fact that deductive argument transmits certainty as well as necessity to its conclusions?

There is a sense, I think, in which this objection is correct, but it is not a sense that would normally interest philosophers who analyse knowledge as justified true belief. None of these could say, what Aristotle blandly says in 1.25 without hesitation or clarification, that the explanation of something (τὸ δὲ ὁ où) is more convincing (πιστότερον) than its explanandum (86b5, 27, 30). Aristotle takes this to be obvious. He cannot mean that an explanation is easier to believe than the fact it explains, or that the evidence for it is more accessible to us. On the contrary, being more universal it is more remote from our experience, as Aristotle himself indicates in the previous chapter (1.24) and elsewhere (1.2, 72a4–5). His point is that the explanation, being prior to what it explains, is more knowable or familiar in the order of nature (γνωριμώτερον τῇ φύσει), and if it is more knowable, then (he assumes or infers) it is more believable and convincing (πιστόν) as well (cf. 1.25, 86a38–9; b27, 29–30). This connection between the knowable || (familiar) and the convincing is significant. It shows that the distinction which has governed the treatise since 1.2 (71b33–72a5), the celebrated and all-pervasive Aristotelian distinction between what is more knowable or familiar in the order of nature and what is more knowable or familiar to us, is intended quite literally. It points not only to a natural order of explanation – an order of explanation which is not relative to the knowledge and needs of particular persons52 – but also, in view of the remarks about conviction, to a corresponding difference of cognitive state between the man who has the conviction which comes from a grasp of first principles and the man whose conviction rests on experience (cf. Top. vi.4). Both types of conviction must rank as knowledge (γνώσις), but this is not inconsistent with the interpretation I have been giving. Aristotle says in the very context we are considering that demonstration produces γνῶσις (1.25, 86a36; cf. 11.16, 98b19–24), and he says it in the course of an argument which implies that demonstration always produces γνῶσις; for

52 On this point compare Moravcsik (1975) 625.
his point is that the more knowable (familiar) and the fewer the premises, the better the demonstration and the quicker and more effectively \( \gammaνόνσει \) comes. Even so we may still and should still allow \( \gammaνόνσκειν \) to contrast with \( \varepsilonπιστασθαι \) in the usual way. But this time it is knowledge as a grasp of what is knowable by nature. This is knowledge which comes with understanding, not knowledge as contrasted with mere true belief, which is the concept now analysed in terms of true belief plus justification or evidence. It is \( \gammaνόνσκειν \) as that notion is defined in the *Physics* account I quoted earlier.53

To vindicate this distinction between knowledge with and knowledge without full understanding, we ought to see whether, in Aristotle’s view, it would in principle be possible for a man to know all or a large part of the propositions of a science in the sense of having grasped them with the knowledge we have of things familiar to us, and yet not to have achieved full understanding. A passage in the *Nicomachean Ethics* (vi.3, 1139b33–5) tells us that it is indeed possible. It is possible if you still find the conclusions more knowable (familiar) and more convincing than the first principles. Then you have \( \varepsilonπιστήμη \) only in an accidental or qualified way.

Another passage from the same work (vii.3, 1147a21–2) suggests that something like this might be the condition of apprentice learners, \( \omicron \piρό\-\tauον \muαθόντες \). These must be our university students, not schoolkids, for they can connect \( \parallel \) together the propositions of a science in an orderly

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53 The \( \gammaνόριμον\)–\( \piστόν \) parallel also helps with the old problem of whether to translate \( \gammaνόριμον \) ‘known’ or ‘knowable’. For a good statement of the issue, see Wieland (1962) 71, n. 2, who prefers ‘known’ and argues impressively (71ff.) for the thesis that the \( \gammaνόριμα \) \( \tauή \) \( \phiϋσι \) are actually known by us all along, but implicitly. We have an implicit grasp of the principles in the light of which the things known to us are also known (by us, implicitly) in the order of nature. Rather than raise questions about whether this would work plausibly for the biological sciences, say, I simply suggest (a) that the \( \gammaνόριμον \) is no more that which is actually known than the \( \piστόν \) is that which is actually believed, (b) that, by the same token, it would be as wrong to say that the \( \gammaνόριμον \) is merely what \( \textit{can be} \) known as to say that the \( \gammaνόριμον \) is merely that which \( \textit{can be} \) believed. ‘Can be’ is too weak (for the reasons Wieland gives), ‘is actually’ too strong (as implying that every \( \acute{\epsilon}ρχη \) is known, at least implicitly), but \( \textit{tertium datur} \). A convincing story is not one that actually convinces, but rather one that will \( \textit{tend} \) to convince unless some further factor (e.g., contrary evidence) interferes to prevent it. Likewise, the \( \gammaνόριμον \) may be taken as that which is of a nature to be known (\( \text{An. pr.} \) 11.16, 64b34–5: \( \piέργει \) \( \gammaνορίζεσθαι \)): it has, as it were, a tendency to be known and it will actually be known if you attend to it or think about it in the appropriate way. What the appropriate way is will be different for \( \gammaνόριμα \) \( \tauή \) \( \phiϋσι \) and \( \gammaνόριμα \) \( \nuμιν \) (cf. \( \text{Top.} \) vi.4, 1422ff.), but in either case the condition is non-trivial and finds support at *Eth. Nic.* 1.4, 109b7–9, where Aristotle says of the well-brought up beginner that he has or \( \text{can easily get bold of} \) \( \acute{\epsilon}ρχη \) (= \( \tauό \acute{\delta} \tauι \) = \( \tauό \gammaνόριμον \) \( \nuμιν \)). The essential point (\( \text{Top.}, \) loc. cit.; cf. *Metaph.* 2, 983a21–21) is that to \( \acute{\epsilon}πιλός \) \( \gammaνόριμον \) is not \( \gammaνόριμον \) to all men, but to those whose thought is properly disposed (\( \tauοίς \) \( \varepsilonν \) \( \deltaικακείμενοις \) \( \tauήν \) \( \\text{διάνοιαν} \)) as a result of training (\( \acute{\delta}κριβεστέροις \) \( \deltaι \) \( \gammaενομένοις \)).
way,54 but have not yet mastered them (ἰσομέτρησι δ’ ὄντως).55 For that the propositions must become second nature to them, and this takes time. There is good reason to think that these apprentice learners are on the way to making what is knowable in nature be what is knowable to them, that being the formula Aristotle uses to specify the goal of learning (Metaph. Z 3, 1029b3–12; cf. Ph. 1.1; Eth. Nic. 1.4, 1095a30–b4). If so, then the passage suggests that what is needed to complete the process may not be more evidence – οἱ πρῶτον μαθόντες can quite well be imagined to have enough evidence already – but intellectual practice and familiarity. There is such a thing as intellectual habituation as well as moral habituation, and in Aristotle’s view both take us beyond mere knowing to types of contemplative and practical activity which are possible only when something is so internalised as to have become one’s second nature.56

This conclusion is in keeping with recent studies of An. post. II.19 which have emphasised that Aristotle does not envisage the νοῦς which is our grasp of first principles as a faculty || for intuitive discovery.57 Aristotle calls νοῦς both γνώσις (99b22; cf. b18) and ἐπιστήμη (99b24; cf. 1.2, 71b16; 1.3, 72b18–21; 1.9, 76a16–22; 1.33, 88b36), and does so in a manner which implies that these are different designations of it.58 So they are, but I have explained how they coincide when the cognitive goal is achieved. A faculty for intuitive discovery is not needed because discovering or coming to know (γνωρίζειν, 100b4) first principles is a matter for induction: on this II.19 is in agreement with pronouncements Aristotle makes elsewhere (Ph. 1.2, 185a12–14; Eth. Nic. 1.7, 1098b3; vi.3, 1139b27–31). Aristotle sees no Humean problem about a leap from inductive evidence to knowledge (γνώσις). He simply thinks, as we saw earlier, that induction can give us knowledge, γνώσις. 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 (γνώσις).

54 Ross in the Oxford translation renders σομβρίζειν ‘string together’, and at the time of writing may not have intended the disparaging note the phrase now sounds. The fact is, the verb is not invariably, or even usually, disparaging in Aristotle’s vocabulary. It is disparaging at Metaph. N 3, 1090b30; Div. somn. 2, 464b4, but not at Soph. el. 16, 175a30; Metaph. A 5, 989a7; α 3, 995a10; N 6, 1093b27; Gen. corr. 1.2, 316a8; II.10, 316b33; Gen. an. 1.2, 716a4; II.5, 741b9; Pr. XI.54, 905a19. Especially relevant to the present discussion is Top. viii.3, 158a36–7.

55 In the context εἰδοῖαi stands in for ἐπιστήμως, however ‘lightly’ that verb may be used.

56 The parallel between the intellectual and the moral spheres is hinted in several places by Kosman (1973), and by Aristotle at Metaph. Z 3, 1029b3–12; cf. Top. vi.1.4, 142a9–12; Eth. Nic. vii.8, 1151a15–19. I try to build up a picture of Aristotelian moral habituation, of this becoming one’s second nature (a process which itself is partly cognitive, a genuine learning) in chapter 13, below.

57 Kosman (1973); Lesher (1973); Barnes (1975) 248–60; Hamlyn (1976).

58 Barnes however does not translate the καὶ at 22 and his note on p. 249 paraphrases it ‘i.e.’
What it is not yet is understanding and that kind of γνώσις 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. For remember that the first principles are self-explanatory. Further, just as the first principles explain themselves, so too they are knowable through themselves (δι’ αὐτῶν πέφυκε γνωρίζωσιν) and convincing in themselves (Top. 1.1, 100b18–21; An. pr. 11.16, 64b32ff.; cf. Ph. 11.1, 193a4–6). They stand in no need of anything else to convince you of their truth or to allow you to grasp their truth: that is, to know them in the way that goes with understanding. Faced with propositions which one has come to know perfectly well on || inductive grounds and which are convincing and, moreover, knowable in themselves, all one needs to do is: become fully and completely familiar and convinced. That conviction and understanding is νοῦς, the γνωρίζουσα ἔξις which grasps the things which are most knowable and familiar in themselves (100b9–10; cf. 1.3, 72b24–5).

Thus it turns out that the remarks in An. post. 1.1 about conviction or certainty deriving from conviction or certainty with respect to first principles do have to do with securing knowledge, but not because absolutely certain first principles are needed to turn mere true belief into knowledge. What they are needed for is to turn something which is already knowledge into that type of knowledge which is secured by understanding. In one sense or from one point of view γιγνώσκειν is pre-supposed by ἐπισταθαι, in another sense or from another point of view it comes with ἐπισταθαι, where the two senses or points of view are those defined by the contrast between what is γνώριμον in the order of nature and what is γνώριμον to us (cf. Top. vi.4). That being so, I may as well admit that in the end it will not do too much damage to go back to the traditional rendering of ἐπιστήμη as ‘scientific knowledge’.

But only in the end. If we are not to be badly misled, we need first to think away a welter of assumptions about the aims of the theory of knowledge as a philosophical enterprise. It is remarkable how little interested Aristotle is in the central concepts of that enterprise as it is carried on today. Concepts like evidence and justification, the || Humean problem of induction – all this belongs in Aristotle’s terms to the process by which we make

59 Here I dissent from Irwin (1977), who gives a very clear statement of the interpretation of the An. post programme in terms of knowledge and justification which I am opposing. Among other difficulties which Irwin then raises for Aristotle is the need for a ‘pseudo-performance’, viz. νοῦς, to endow the first principles with a non-inferential certainty they cannot get from induction. I submit that these and other difficulties are objections to the interpretation, not to Aristotle’s actual doctrine.
something γνώριμον to us. His treatment of this process in An. post. II.19 and its companion, the first chapter of the Metaphysics, is by our standards perfunctory in the extreme. It is natural, therefore, but mistaken – a mistake encouraged by the translation of ἐπιστήμη as ‘knowledge’ – to try to get less perfunctory answers to our epistemological questions out of the body of the Posterior Analytics. That is bound to give a distorted picture of what Aristotle is doing. Of course, epistemological matters are raised here and there (e.g., in II.12, which deals with problems about syllogising across time). But they are not central. Aristotle’s thought is concentrated on the τέλος, the achieved state of understanding which is the end and completion of the epistemological process.

VI

This conclusion suggests a brief return to Berkeley. Berkeley translated Theaetetus’ first definition of ἐπιστήμη not, as we do, ‘Perception is knowledge’, but ‘Sense is science’.60 Thereby he was enabled to construe the argument in the first part of the dialogue as a vindication rather than the penetrating refutation it actually is of the epistemology on which he premised his instrumentalist account of science. This translation is plainly and importantly wrong. ἐπιστήμη at the start of the Theaetetus must be translated ‘knowledge’. The discussion which ensues, unlike Aristotle’s discussion in the Posterior Analytics, has plenty to do with certainty and justification. But remember what happens at the end of Part II of the dialogue (200e–201c). The discussion at this point is concerned with Theaetetus’ second definition of knowledge, to the effect that knowledge is simply true belief, which Socrates refutes by the example of a jury reaching the right verdict on a matter which only an eyewitness can know. We all readily agree that the jury has true belief but not knowledge, hence that knowledge is not just true belief. So the question becomes, ‘What must be added to true belief to make it knowledge?’ – the familiar question from which every text-book in epistemology begins. But if we expect the familiar type of answer in terms of good reasons, justification, the right to be sure, and the like, we are disappointed. Part III of the dialogue suggests adding to true belief the possession of an account (λόγος), but this account is throughout considered as something which answers the question ‘What is X?’ (203ab, 206e, 208cd). What is not considered, to the bewilderment of some commentators,61 is an account which would answer the

60 Siris §§304–5. 61 E.g., Runciman (1962) 38.
epistemological question ‘Why, on what grounds, do you believe that p?’

The discussion passes over that epistemological concern to a consideration of what it is to master a whole τέχνη or domain of objects, analysed right back to their elements; ἐπιστήμη verges towards understanding as it is related to intelligible systems of elements (206ab, 207c2–3, 207d–208b; cf. Soph. 253ab, Plt. 277e ff., Phlb. 18bd). Some recent commentators have seen Part III of the Theaetetus as broaching issues that were to concern Aristotle in the Posterior Analytics. I would like to suggest that Plato was led in this direction by the thought, roughly, that what you need to add to true belief to yield ἐπιστήμη is something that will secure understanding. He focuses on the ability to give and receive an account (202c), and what that secures is not knowledge alone (in the bare modern philosopher’s sense) but understanding. You have ἐπιστήμη or γνώσει of a thing if and only if you know what it is in the sense of having a λόγος which analyses it right back to its elements (201c–203b, 207ab, and compare the phrase μέχρι τῶν στοιχείων in Aristotle’s definition of γιγνώσκειν in Ph. i.1). Alternatively, you know a thing if and only if you have systematic and scientific understanding of it in terms of its first principles—lacking Aristotle’s clear formulation of the distinction between γνώριμα τῇ φύσει and γνώριμα ἡμῖν (cf. 206ab), Plato tends, characteristically, to assimilate knowledge to understanding; one might describe him as, in effect, explaining γιγνώσκειν in terms of ἐπιστάσθαι.

This makes intelligible the claim at 207e–208a, otherwise as outrageous as Aristotle’s claim at An. post. 1.2, 71b19–20 (above, p. 135), that a man who spells ‘Theaetetus’ correctly,

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62 For a detailed discussion of the Jury passage and the transition to Part III, see ch. 5, above. In an interesting and suggestive paper, Moravcsik (1979) argues that already in the Republic and elsewhere Platonic ἐπιστήμη is understanding, as contrasted with knowledge. He shows that this hypothesis alleviates a number of the traditional interpretative problems. But I do not think it can be the whole story as far as Plato is concerned. I am arguing precisely that the Theaetetus shows it is not, and I would urge the same from the Socratic roots of Platonic ἐπιστήμη. Nevertheless, I welcome the discovery (made after the first draft of this paper was completed) that someone else has independently been thinking along similar lines.

63 Esp. Morrow (1970b); cf. Barnes (1979) 106. Morrow goes wrong, however, when he imports his insight into the translation of 201d–202c, supposing that ‘Elements (στοιχεία) can only be named (ὑπομαθείαι)’ (201e) can mean ‘Basic premises an only be asserted, not demonstrated’ (p. 326). στοιχείον here is that which has no λόγος, where λόγος means ‘definitional account’, not ‘proposition’ (see 206de and Burnyeat (1970)). We can recognise in the notion of στοιχείον a concern with axiomatisation, but it is worked out in relation to primitive and defined terms, not in relation to axioms and theorems.

64 Hence the phrase τελείος πρὸς ἐπιστήμην ἔχειν (202c); cf. 206b9, 44.

65 Although ἐπιστάσθαι itself occurs only twice (207c, 208a), the associated adjectives ἐπιστήμων, ἄνεπιστήμων, τεχνικός (on which see Lyons (1965) 155–6) are frequent in the relevant sections (202c, 207bd, 208b).
and not by accident,\textsuperscript{66} does not know/understand the first syllable of that name unless he also knows the correct spelling of ‘Theodorus’. One must master the whole system if one is to know any of its parts; the parts must be known as parts of the whole (cf. \textit{Phlb}. 18cd).\textsuperscript{67} In short, knowledge is science.

Now Aristotle, as I have interpreted him, goes a long way towards segregating out and distinguishing the elements of knowledge and of understanding, but he reveals at the end of the work that he sees the task he has completed as one of setting forth what is involved in the claim that all \textit{ἐπιστήμη} is \textit{μετὰ λόγου}, accompanied by an account (\textit{An. post}. ii.19, 100b10; cf. i.6, 74b27–8; \textit{Eth. Nic.} vi.6, 1140b33). In other words, Aristotle himself viewed the \textit{Posterior Analytics} as working out the solution to some of the \textit{ἐπιστημονία} with which the \textit{Theaetetus} ends. If, however, we find it difficult to read Aristotle as contributing to a discussion growing out of \textit{Theaetetus’} first definition, that is doubtless because epistemology for us has come to be dominated by issues of justification, historically linked with the challenge of scepticism. But when Plato and Aristotle say that \textit{ἐπιστήμη} involves \textit{λόγος}, neither of them mean \textit{λόγος} to be an answer to sceptical doubt. Scepticism only came to be the dominant force in epistemology after Aristotle’s death, in Hellenistic controversy. A brief illustration of the difference this made will point up the moral I have wished to draw for the interpretation of the \textit{Posterior Analytics}. ||

Consider the difference between the Aristotelian and the Stoic notions of demonstrative proof (\textit{ἀποδεικτικὸς}). For both schools demonstrative proof is a species of deductively valid argument, differentiated by certain supplementary conditions on top of those required for validity. Most obviously, the argument’s premises must be true, but there is more besides, and it is here that the Aristotelian and the Stoic notions diverge in striking fashion. Aristotle’s further conditions have to do, as we have seen, with explanatoriness and the deductibility of a conclusion from the highest level self-explanatory first principles of a science. In the Stoic scheme (here I follow Sext. Emp. \textit{PH} ii.134–43) the further conditions are strictly epistemological. A demonstrative proof is a valid argument which deduces from premises which are both true and evident a conclusion which in itself is non-evident, where ‘evident’ and ‘non-evident’ are strictly epistemic terms

\textsuperscript{66} 207e8: οὐνεῖται τε δεῖν γράφειν.

\textsuperscript{67} The interpretation sketched here is not meant to apply to 208c ff., which discusses a more everyday, ordinary man’s notion of \textit{λόγος} (cf. 208c77) and returns us to themes of Part ii of the dialogue. By contrast, \textit{λόγος} in the discussion of spelling is explicitly linked (206e6) to the Dream with which Part iii begins.
paradigmatically illustrated by what is evident or non-evident to sense-perception. The non-evident conclusion is then made known to us by the proof, as in the much-cited example ‘If sweat flows through the surface of our bodies, there are insensible pores; sweat does flow through the surface of our bodies; therefore, there are insensible pores.’ This approach makes of demonstration an instrument for the increasing of knowledge, for inferring or justifying explanations, rather than for systematising explanations and understanding knowledge which for the most part has been independently acquired.\(^{68}\) But more than that, the very idea of characterising demonstrative proof in terms of evidence, the whole project of marrying a rigorously developed system of logic (such as the Stoics’ logic was) to an epistemic base in perceptual certainty, shows how decisively philosophical concerns have shifted || in the direction of epistemology as we now know it.

A parallel shift occurs in the notion of what is intrinsically (in itself) convincing (πιστὸν). That appellation is transferred by the Stoics from the first principles of Aristotelian science to the ground-level certainties of perceptual experience. They think that nothing is more evident than the intrinsic evidence of what they call the cataleptic impression.\(^{69}\) And what is intrinsically evident is also, necessarily, convincing in itself (πιθανὸν or πιστὸν).\(^{70}\) But of course at the level of perceptual experience intrinsic convincingness does not help to distinguish the true from the false. The now familiar epistemological predicament is posed, and there is no ignoring it. All through the Hellenistic period, both positive philosophy and the negative attacks of scepticism take their starting-point to be the problem of perceptual certainty. Aristotle does not. But not because he is not acquainted with sceptical arguments for conclusions which would undermine his enterprise, nor because he does not think (some of) them worth extended discussion. He is simply very firm that he is not going to let them structure his inquiries or dictate his choice of starting-points (for some characteristic instances of this firmness, see Top. i.11, 105a3–9; Ph. i.2, 184b25–a20; ii.1, 193a3–9).\(^{71}\)

And this brings me back to my own starting-point. One result of the impact of scepticism was the gradual separation of epistemology from the philosophy of science. Descartes challenged scepticism with a valiant

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\(^{68}\) I have learned much about Stoic δύναταις from Brunschwig (1980) and Barnes (1980a).

\(^{69}\) A striking testimony to this thought (a passage the appreciation of which I owe to Malcolm Schofield) is Cic. Acad. ii.17.

\(^{70}\) Thus on the Stoic division of impressions at Sext. Emp. M vii.242ff. the cataleptic impression is defined as a species of πιθανή impression.

\(^{71}\) Cf. Hamlyn (1976) 172.
attempt to pull them together again, with a philosophy of science based on epistemology, reversing the Aristotelian (Platonic) enterprise of putting philosophy of science at the centre of epistemology. But Descartes failed to carry conviction. Epistemology and philosophy of science became divorced, for better or for worse. It may be counted a permanent victory for scepticism that, by achieving this divorce, it has made Aristotle’s *Posterior Analytics* remarkably hard for us to read.\(^7\)

\(^7\) In preparing the final version of this paper I have been helped by criticisms received at the conference and by the discussion of earlier drafts at Cambridge, Stanford and UCLA. Individuals to whom thanks is due include John Ackrill, Rogers Albritton, Jacques Brunschwig, Theodor Ebert, Jonathan Lear and, especially, Jonathan Barnes and Richard Sorabji. My debt to the writings of Jonathan Barnes is greater than any note of acknowledgement can record.
How are the two halves of the Analytics related to one another? Does the Prior Analytics precede the Posterior Analytics, or vice versa? Is the theory of the syllogism earlier or later than the theory of demonstration? Does formal logic come before or after formal proof?

The scholarly ardour which those questions once kindled

has cooled. It is not that the questions have received universally satisfactory answers; rather, *Entwicklungsgeschichte* has lost its old seductive charm — nowadays, we would rather read our Aristotle than dismember him and chronologise his severed parts. In general, that is all to the good; but in the case of the *Analytics*, genetic studies have been prematurely put to rest. For what is now the orthodox view of Aristotle’s logical development is mistaken; and, more importantly, the genetic questions have a direct connection with two issues of philosophical interpretation.

The first issue concerns the relationship between Aristotle’s theory of demonstration and ancient Greek mathematics. On the one hand, geometry was the only ancient science to approach Aristotle’s demonstrative ideal. It is disputable how far axiomatic geometry had advanced by the time Aristotle came to write the *Analytics*, and it is uncertain to what extent later geometers were influenced by Aristotle; but contemporary mathematical practice was undoubtedly one of the stimuli which provoked Aristotle’s theory of proof; and Aristotle surely imagined that this theory, once developed, would be fruitfully applied to the mathematical sciences.

The second issue of philosophical interpretation concerns the relationship between the *Posterior Analytics* and Aristotle’s major treatises. On the one hand, the theory of demonstration was designed primarily as a method for the presentation and transmission of scientific truths — demonstrations are « didactic arguments »; and many of Aristotle’s treatises attempt to systematise and transmit the truths of science: we might reasonably expect them to be fraught with demonstrative argument.

On the other hand, the logic of the *Analytics*, however admirable its rigour and elegance, is inadequate for the formalisation of even the most elementary geometrical proof: syllogistic is a small and relatively insignificant part of logic; and the mathematician who tries to conduct his arguments within its confines will get nowhere. Later Peripatetics piously pretended that syllogistic could serve the mathematical scientist; but their desperate advocacy can have convinced no practising geometer.

Thus if Aristotle’s theory of demonstration is dependent upon his logic, and if proofs are, in his view, ineluctably syllogistic, then we shall be obliged to conclude that the account of demonstrative science given in the *Posterior Analytics* is inapplicable to the paradigm demonstrative discipline of mathematics; and we shall have to explain how Aristotle could have been blind to the mathematical imbecility of his philosophy of science.

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4. See Barnes, Aristotle’s *Theory*, pp. 78-81, for references, and cf. M. F. BURNET, Aristotle on Understanding Knowledge, in this volume. — SOLMSEN, *Entwicklung*, p. 241, says of Apodeictic that « this professional pedagogic instruction, this exposition of knowledge before a silent audience, which is the polar opposite of Socratic conversation, fits exactly with the character of the treatises »: the theory of the *Posterior Analytics* perhaps fits the character of the treatises — the problem is that it does not seem to fit their contents.
On the other hand, those treatises notoriously contain few syllogisms: assiduous study will discover a few inferences in syllogistic form; and the ancient commentators were given to inventing syllogisms where they could not discover them. But by and large, the logic of the Analytics has had little discernible effect on the structure of Aristotle’s scientific reasoning. Nor, given the narrow range of that logic, is the fact at all to be lamented.

Here too it may seem as though the Analytics is a sterile work: it offers a philosophy of science which its inventor tacitly ignores in his own scientific enquiries; it suggests a mode of presenting scientific knowledge which Aristotle’s own scientific treatises do not adopt. And that calls for some explanation.

Those two issues are of more than passing importance for our understanding of Aristotle’s philosophy. Entwicklungsgeschichte cannot by itself solve the problems; but genetic questions must, I believe, be asked and answered before any solution can be found — that, at least, is the main excuse for this paper.

II

Evidently, the questions I began with need some elucidation; for they present not one but several issues. I shall distinguish four problems of priority: the problems are closely connected one to another; but confusion results if they are not studied separately.5

First, there is what I shall call the question of didactic priority: Does Aristotle require us to con the syllogistic theory of the Prior Analytics before we peruse the demonstrative theory of the Posterior Analytics? does he regard his logic as a necessary propaedeutic to his philosophy of science? Or is demonstration prior in this sense to syllogistic? Or are the two theories didactically independent?

Secondly, there is the question of theoretical priority: Does demonstration essentially depend upon the syllogism? is the theory advanced in the Posterior Analytics a logical parasite on the body of the Prior Analytics? Or again, is the theoretical priority the other way about? Or are the two works theoretically independent?

Thirdly, I shall pose the question of priority in discovery: Did Aristotle first work out the formal syllogistic of the Prior Analytics and then turn his mind to the theory of demonstration? Did the discovery of the syllogism precede in time the discovery of demonstration? Did demonstration come first, and syllogistic second? Or were the theories perhaps excogitated pari passu?

Finally, there is the question of priority in composition: Did Aristotle pen the Prior Analytics before he wrote the Posterior Analytics? was the syllogistic written up before the theory of demonstration was written down? Or again, were the Posterior Analytics λόγῳ μὲν ὑπερα, ἕργῳ δὲ πρῶτερα? Or were the two parts of the Analytics composed at the same time?

III

Those questions refer to the theory of the syllogism and the theory of demonstration; and before tackling them, it will be as well to say a little about those two theories. My remarks will be elementary; but lack of precision on these matters has plagued past discussion of my questions — and in any event elementary truths can stand restatement.

First, let me characterise three distinct logical notions: all are, in a loose sense, varieties of argument; and I give them the names « Inference », « Deduction », and « Sylo-

5. See SOLMSEN, Discovery, p. 414, admitting that Entwicklung is not as clear as it might have been. (But Entwicklung is clearer than its critics: see esp. p. 78.) I do not mean to imply that my four questions exhaust the problem.
of the first figure, amially known as Barbara, has, in its non-modal version, the general form: $\langle(O)AxB, BaC, AaC \rangle$. 6.

The three notions I have just characterised are distinct: it is trivially true that all Syllogisms are Deductions, and that all Deductions are Inferences; but it is not trivially true (and in fact it is false) that all Inference are Deductions; and it is not trivially true (but in fact false) that all Deductions are Syllogisms.

 Aristotle's word for « Deduction » is « συλλογισμός » 7; for « Inference » he will sometimes use « τὸ ἀναγκαῖον » (An. pr. 1 32, 47 a 31-5); he has no word for « Syllogism », but he can express the notion periphrastically.

Of Inference I shall say nothing more, beyond noting that Aristotle explicitly recognises that not all Inferences are Deductions 4. My concern is rather with Deductions and Syllogisms.

Aristotle's classic account of Deduction runs like this: συλλογισμός δὲ εστὶ λόγος ἐν τῷ τεθέντων τινῶν ἐπεξ ὁ τῶν κειμένων ἐξ ἀνάγκης συμβαίνει τῷ ταύτα εἶναι (An. pr. 1 1, 24 b 18-20) 5. That is, I hope, appropriately


7. Why not use « Syllogism » for « συλλογισμός »? Because « Syllogism », in standard logical usage, has (at least roughly) the sense I give it: the orthodox translation of « συλλογισμός » by « syllogism » has obscured the important difference between Deduction and Syllogism, and has led to misunderstandings of Aristotle's logic.

8. An. pr. 1 32, 47 a 33-5: ἐπὶ πλείον δὲ τὸ ἀναγκαῖον ἢ τὸ συλλογισμὸς, ὅ μὲν γὰρ συλλογισμός πᾶς ἀναγκαῖον, τὸ δὲ ἀναγκαῖον οὐ πάντων συλλογισμός.

9. See also Top 1 1, 100 a 25-27; Soph. el. 1, 165 a 1-2; Rhet 1, 2, 1356 b 16-8; and for comments see e.g. A. SEDRU, Sur la définition du syllogisme aristotélique, in Recherches sur l'Organon, ed. A. Joja, Bucharest 1971; M. FREDIE, Stoic vs. Aristotelian Syllogistic, « Archiv für Geschichte der Philosophie », 56, 1974, 1-32, at pp. 15-23. – The phrase « τῷ ταύτα εἶναι », which An. pr. glosses by « διὰ ταύτα », reappears in Rhet (where Kassel rightly excises « διὰ ταύτα ») but not in Top. Instead Top has « διὰ τῶν κειμένων ». Is that difference significant? It is tempting to think that it is: « τῷ ταύτα εἶναι » is precisely the clause which in An. pr. and Rhet distinguishes Deductions from Inferences; « διὰ
captured by the explanation of Deduction given above. Is Aristotle’s account a stipulative definition of a new technical term? or is it offered as a reference to a step in a demonstration, or an analysis of deductive entailment? In my opinion, Aristotle’s account of entailment is a stipulative definition of a new technical term: « συλλογισμός » is not an Aristotelian neologism, and Plato uses it, and the verb « συλλογίζομαι », to mean something like « inference », and « infer ». On the other hand, the ordinary Greek for « infer » seems to have been not « συλλογισμός » but the simple « λογίζομαι ». I imagine that the status of « συλλογισμός », to mean something like « inference », and « infer ». On the other hand, the ordinary Greek for « infer » seems to have been not « συλλογισμός » but the simple « λογίζομαι ». I imagine that the status of « συλλογισμός » in Aristotelian Greek is something like the status of « entail » in modern Anglo-Saxon philosophy; and that Aristotle’s attempt to analyse the συλλογισμός is comparable to modern attempts to analyse entailment. The notion of a συλλογισμός or Deduction is, as it were, semi-technical.

10. (i) From Alexander onward, commentators have stressed Aristotle’s pluralism, « τόν κειμένον τούς » and « τῶν κειμένων », inferring that « τόν κειμένον » will be a συλλογισμός only if « τῶν κειμένων » are two or more propositions. And Aristotle does often say that every συλλογισμός must have (at least) two premises (e.g. An. pr. 1 14; 34 a 7-8; An. post. 1 6, 57 c 29). But for Aristotle, that thesis is, I think, a substantial metatheorem, not a trivial consequence of his definitions. (ii) The important phrase « τῷ ταύτα εἶναι » requires some commentary. I have said a little about it in Proof Destroyed, in Doubt and Dogmatism, ed. M. Schofield, M. F. Burnyeat, J. Barnes, Oxford 1980; and it would take me too far afield to discuss it here.

— an idealisation of our ordinary, pre-theoretical, concept of inference.

However that may be, the notion of a Syllogism is wholly technical; and the characteristic vocabulary of moods and figures, middle terms and extremes, majors and minors, is an Aristotelian innovation. I have already remarked that the notion of a Deduction is quite distinct from the notion of a Syllogism; and that in fact not all Deductions are Syllogisms. In the Prior Analytics, however, Aristotle argues that « διὰ τῶν προεξήκοντων σχεμάτων οἱ συλλογισμοί πάντες » (1 28, 44 b 7-8; cf. 23, 41 b 1-3); i.e. that all Deductions are Syllogisms. It is of the first importance to understand the status of that false view.

Aristotle does not think that the word « συλλογισμός » means « Syllogism », or « Deduction in one of the Syllogistic figures »; nor does he think that it is a trivial consequence of his definitions that all Deductions are Syllogisms. On the contrary, the thesis that all Deductions are Syllogisms is presented as a powerful and unevident metatheorem, established by a long metalogical argument. Thus although Aristotle mistakenly believes that every Deduction is a Syllogism, his belief is not a mere confusion; for his argument in favour of it proves him well aware that the notion of a Deduction is quite distinct from the notion of a Syllogism.

So much for the theory of the Syllogism. I turn now to the theory of demonstration. The notion of demonstration or proof — ἀπόδειξις — is worked out in the first six Chapters of the Posterior Analytics. A demonstration is a sort of Deduction, συλλογισμός τις (e.g. An. pr. 1 4, 25 b 30). In particular, it is a συλλογισμός ἐπιστημονικός, that is to say, a Deduction « in virtue of which, by possessing it, we have knowledge » (An. post. 1 2, 71 b 18). We
might say: \( \{ a_1, a_2, \ldots, a_n \}, \sigma \) is a demonstration if and only if (1) it is a Deduction and (2) anyone who possesses it thereby knows its conclusion.

Aristotle suggests that a Deduction will meet the epistemic requirement, (2), if its premisses satisfy certain conditions: according to the Posterior Analytics, in a demonstration each \( a_i \) must be true and universal and necessary and primitive and immediate, and also appropriate to and prior to and more familiar than and explanatory of \( \sigma \) (see An. post. 1 2 and 1 4). Following Aristotle, let us call a proposition which satisfies all those nine conditions a principle (\( \alpha \chi \pi \alpha \) \( \chi \pi \) \( \alpha \) \( \tau \)) for \( \sigma \); then \( \{ a_1, a_2, \ldots, a_n \}, \sigma \) will be a demonstration (of \( \sigma \)) if and only if it is a Deduction and each \( a_i \) is a principle for \( \sigma \).

In point of fact, that definition is more restrictive than Aristotle intends: he will allow that a Deduction is a demonstration even in cases in which its premisses are not, or not all, principles. The point is made most clearly in the Topics: « There is demonstration when the Deduction depends on what is true and primitive, or on things such that one gets the beginning (\( \alpha \chi \pi \alpha \) \( \chi \pi \) \( \alpha \) \( \tau \)) of one's knowledge about them from certain primitive and true things » (Top. 1 1, 100 a 27-9; cf. An. post. 1 10, 76 b 10; Rhet. 1 2, 1357 a 7). Thus the premisses of a demonstration must be either principles or else propositions demonstrated from principles. Starting from a set of principles, we might first demonstrate a group of propositions, and then use those demonstrated theorems as premisses for further demonstrations.

That final point in effect introduces the notion of a demonstrative science; for, crudely speaking, such a science is no more than a coherent sequence of propositions, beginning with a set of \( \alpha \chi \pi \alpha \) or axioms, and proceeding thence from theorem to theorem. A little more precisely, a demonstrative science is a set of materially homogeneous propositions, \( \Sigma \), such that (i) if \( \alpha_i \) is in \( \Sigma \), then either \( \alpha_i \) is an \( \alpha \chi \pi \alpha \) \( \chi \pi \) \( \alpha \) \( \tau \) for some \( \alpha_i \) in \( \Sigma \) or there is a subset \( \pi \) of \( \Sigma \) such that \( \{ \pi, \alpha_i \} \) is a demonstration of \( \alpha_i \); and (ii) if \( \pi \) is a subset of \( \Sigma \) and \( \{ \pi, \alpha_i \} \) is a demonstration of \( \alpha_i \) then \( \alpha_i \) is in \( \Sigma \).

That must suffice as a brief account of the theory of demonstration, or Apodeictic. My questions concern the relationship between Apodeictic and Syllogistic, between demonstration and the Syllogism. Note that the second term in the relation is neither Inference nor Deduction: it is Syllogism, in the technical sense of that term.

IV

The first of my four questions of priority is now readily answered: the Prior Analytics is didactically prior to the Posterior Analytics; Aristotle regards Syllogistic as a propaedeutic to Apodeictic, and he supposes that we shall have read the Prior Analytics before we embark on the Posterior.

12. Hence we require a recursive definition of demonstration for example:

1. \( \{ a_1, a_2, \ldots, a_n \}, \sigma \) is a demonstration of \( \sigma \) if
   (i) \( \{ a_1, a_2, \ldots, a_n \}, \sigma \) is a Deduction; and
   (ii) each \( a_i \) is a proof-premiss for \( \sigma \)
2. \( \alpha \) is a proof-premiss for \( \sigma \) if
   (i) \( \alpha \) is a principle for \( \sigma \), or
   (ii) there is a Deduction \( \{ \beta_1, \beta_2, \ldots, \beta_n \}, \alpha \) such that each \( \beta_i \) is a proof-premiss for \( \alpha \).

Evidently, that uses concepts which were not available to Aristotle; but it expresses precisely his notion of an \( \alpha \chi \pi \alpha \) \( \chi \pi \) \( \alpha \) \( \tau \). On this point, and on the definition of demonstrative science, I have been greatly helped by the comments of Steve Williams and Christopher Kirwan.

13. I doubt if that has ever been denied. Solmsen, the most strenuous advocate of an early Apodeictic, insists that « Aristotle's Apodeictic theory, in the form in which we have it (An. post. 1), is tied, both internally and externally, in the closest possible way to the general logical theory of the Prior Analytics » (Entwicklung, p. 38; cf. pp. 37, 112, n. 1; Discovery, p. 414).
The *Prior Analytics* begins by announcing that its subject is «demonstration and demonstrative knowledge» (ι 1, 24 a 10; cf. ι 4, 25 b 26-31); and the last chapter of the *Posterior Analytics* records that «as for Deduction and demonstration, it is evident both what each is and how it comes about» (ι 19, 99 b 15): both the programme for the *Analytics* and its conclusion treat the work as a unitary whole. Cross-references within the *Analytics* confirm the fact 14; and elsewhere Aristotle is happy to use one title, «τὰ Ἀναλυτικά», to refer to either half of the treatise 15.

Those formal indications are corroborated by a mass of internal evidence: in terminology and content, the *Posterior Analytics* time and again presupposes a knowledge of the *Prior Analytics*. Sometimes there are references to particular theses of the Syllogistic: *An. post.* ι 14, for example, assumes an understanding of the three Syllogistic figures; and ι 3 explicitly refers to a technical result which is proved in *An. pr.* ιι 5-7. More often, there is a general presupposition of Syllogistic competence – an assumption that the audience or the reader can follow Syllogistic reasoning, comprehends the technical terms of Syllogistic, and will pick up casual allusions to Syllogistic metatheorems. It would be tedious to document that familiar fact at length: for examples, see the chapters on ignorance at ι 16-17, or on infinite strings of predication at ι 19-22 16.

It is not just that the *Posterior Analytics* is decked out with Syllogisms: Syllogistic is the official logic for demonstrative Deduction. In *An. pr.* ι 23 Aristotle argues that «every demonstration and every Deduction necessarily comes about through the three aforesaid figures» (41 b 1-3); and that is his way of saying that every demonstration and every Deduction is a Syllogism. Of course, that every demonstration is a Syllogism is a trivial consequence of the metalogical thesis that every Deduction is a Syllogism.

In the *Posterior Analytics*, to be sure, Aristotle does not explicitly state that ἀποδείξεις are Syllogisms. Nor are his remarks on the logic of demonstration as decisive as we might desire. (For example, it is not entirely clear whether or not all three of Aristotle's Syllogistic figures are demonstratively permissible.) But however that may be, the *Analytics* as a whole leaves us in no doubt that Syllogistic is above all the logic of science.

14. See Ross, *Discovery*, pp. 254-8; Bonitz, *Index Aristotelicus*, 98 a 2-15. The most significant references are at *An. pr.* ι 1, 24 b 12 and 13, 32 b 23, which refer to *An. post.* as τὰ Ἐπομενα. But none of the several references in *An. post.* to *An. pr.* clearly implies that *An. pr.* is an earlier part of the same *pragmautēs*. Indeed at *An. post.* ιι 12, 96 a 1, τὰ πρώτα probably refers to *An. post.* ι 3 – and that might be taken to indicate that *An. pr.* is not the «first part» of *An. post.*

15. See Bonitz, *Index* 102 a 30-40 (e.g. de Int. 10, 19 b 31, uses «τὰ Ἀναλυτικά» to name *An. pr.*; *Metaph.* ι 12, 1037 b 8, uses it to name *An. post.*; *An. Post.* uses «τὰ περὶ συλλογισμοὺς» at ι 3, 73 a 14, and ι 11, 77 a 34, to refer to *An. pr.;* but that does not imply that *An. pr.* was conceived of as an independent *pragmautēs*. – The titles «Ἀναλυτικά πρώτα» and «Ἀναλυτικά οἷτε» are post-Aristotelian (they are first found in Diogenes' catalogue of Aristotle's works; see P. Moraux, *Les listes anciennes des ouvrages d'Aristote*, Louvain 1931, pp. 87-9, for discussion; and cf. e.g. Ammonius, in *An. pr.* 5.5-7.25).

It is not Aristotle's view of the nature of demonstration, but rather his theory of Deduction, and in particular his metalogical thesis that every Deduction is a Syllogism, which makes Syllogistic the logic of proof. We cannot understand the *Posterior Analytics* unless we have a grasp of Syllogistic; but, from a theoretical point of view, the doctrine expounded in the *Posterior Analytics* is entirely— or almost entirely— independent of the Syllogism.

Now it is not a trivial truth that Syllogistic can be so readily separated from Apodeictic; for the type of Deduction permissible within a theory will, to some extent at least, determine the forms its constituent propositions may assume. (For example, if a theory adopts the standard sentential calculus as the basis of its logic, it must express its propositions in the vocabulary of that calculus, so that it must use 'material implication' rather than any other type of conditional connective.) Thus we might antecedently expect that Syllogistic would set certain formal constraints on the propositions of a demonstrative science. To a limited extent that expectation may be satisfied: hence my earlier qualification—Apodeictic is 'almost entirely' independent of Syllogistic. Consider first the condition that a principle be immediate or \( \text{διμεσός} \) (An. post. 1 2, 71 b 21). Etymologically, a proposition is \( \text{διμεσός} \) if it lacks a middle term; and since only propositions in Syllogistic form can have middle terms, only Syllogistic propositions can sensibly be called \( \text{διμεσός} \). Thus the requirement that \( \text{διμεσός} \) be immediate implies that they be in Syllogistic form.

At An. post. 1 2, 72 a 8, Aristotle explains that a proposition « is immediate if there is no other proposition prior to it ». Why not say, more simply, that \( \text{AxB} \) is immediate if there are no propositions \( \text{AyC}, \text{CzB} \), and thus no term 'between' \( A \) and \( B \)? — But then no propositions will be immediate, and there will be no \( \text{διμεσός} \). — Then let \( \text{AxB} \) be immediate if there are no true propositions \( \text{AyC}, \text{CzB} \) from which \( \text{AxB} \) is Syllogistically derivable. — But the argument of An. post. 1 13 forbids that suggestion. — Thus Aristotle can only say that \( \text{AxB} \) is immediate if there are no prior propositions from which it is Syllogistically derivable, i.e. if it is Syllogistically primitive.

In sum, the immediacy condition is merely a specification of the primitiveness condition: if we revoke the immediacy condition, we break the dependency of Apodeictic on Syllogistic, and we leave Apodeictic virtually unimpaired.

Consider, secondly, the condition that an \( \text{διμεσός} \) be universal. Syllogistic, to be sure, has no proprietary claim on universality; for Syllogistic may have particular premises. And it is Aristotle's epistemology, not his logic, which demands universality — for « knowledge comes by becoming familiar with the universal » (An. post. 1 31, 87 b 38).

17. As I wrongly imply in Aristotle's *Theory*, p. 65; consequently, I supposed there (p. 68) that « \( \text{άπαθεν} \) » usually has a non-technical sense in Aristotle. K. J. J. Hintikka, *On the Ingredients of an Aristotelian Science*, "Nous", 6, 1972, pp. 55-69, rightly rebukes me for that supposition, and asserts that « whatever the use of the term \( \text{άπαθεν} \) may be on the different occasions in Aristotle, it always seems to have in his logical works a rather close connexion with formal demonstration » (p. 57). I now agree that « \( \text{άπαθεν} \) » usually means « demonstration », in the sense defined in An. post. But that, I fear, is not what Hintikka means (if I understand his English aright): he thinks that by « \( \text{άπαθεν} \) » Aristotle usually means « Syllogistic proof » — and that is quite out of the question.


19. Or is that pedantic? It is easy enough to give a non-Syllogistic sense to « \( \text{μέσον} \) » and « \( \text{διμεσός} \) »; and it may be that the logical terminology of 'middles' (which presumably derives from *Philebus* 17A) was not, at first, tied to the Syllogism.


That constraint on the principles, to which I shall return, is unduly restrictive from a modern point of view (it rules out, for example, the first axiom of Dedekind-Peano arithmetic: 1 is a number); but the fetters were not fashioned by Syllogistic.

Yet there is more to Apodeictic universality than the proscription of singular (or of particular) propositions. Take the first two of Euclid's 'common notions' or axioms:

(1) Things equal to the same thing are equal to one another as well
(2) If equals are added to equals, the wholes are equal

Both those axioms are universal in a perfectly ordinary sense: they refer to any equal items; if they were expressed in the language of predicate logic, they would be prefixed by a universal quantifier. But neither proposition is universal in the sense required by the Posterior Analytics; for a demonstrative proposition affirms or denies « one thing of one thing » (1 2, 72 a 9); and a universal proposition affirms or denies one thing of all of another 22. In the context, that can only mean that a demonstrative proposition is of the form $AaB$ or $AeB$: if epistemology demands that demonstrative propositions be universal, it is apparently Syllogistic which insists on their being « one thing of one thing » and thus in Syllogistic form 23.

The universality condition, like the immediacy condition, is determined by Syllogistic; and that fact is, historically speaking, of the first importance. But from a systematic or theoretical point of view it is less significant; for Syllogistic universality is merely a specification of universality, and if we revoke the specification and insist on universality, we leave Apodeictic virtually intact.

Then is Syllogistic theoretically prior to Apodeictic? Strictly speaking, it is; for the logic of demonstration is Syllogistic; and the requirements of the Syllogism have constrained Aristotle's treatment of the $apxal$ in at least two respects. But from a more general point of view, we can sensibly say that Apodeictic does not depend essentially on the theory of the Syllogism: none of the central conditions on principlehood is Syllogistic; and only superficial changes are needed in order to adapt the Apodeictic to a richer system of formal logic.

VI

Although the Analytics presents Syllogistic and Apodeictic as a single system, the former a necessary propaedeutic to the latter, the Syllogism is in fact an incidental adjunct to the theory of demonstration: the theory can be formulated analogously named « Aristotle's Fall » by P. T. Geach, History of the Corruptions of Logic, in his Logic Matters, Oxford 1972).

24. No doubt a man of perverse ingenuity will be able to provide complex terms, $A$ and $B$, such that $AaB$ is a formalisation of (1); but I doubt if that would really satisfy Aristotle's requirements that the principles say « one thing of one thing »; and in any case, if (1) is formalised by $AaB$, it loses its logical potency – for its multiply quantificational structure is thereby suppressed.
without reference, explicit or implicit, to Syllogistic, and it could have been discovered by someone who knew nothing whatever about the Syllogism. I turn now to my third question: Was Apodeictic in fact discovered by someone who knew nothing whatever about the Syllogism? did Aristotle work out his Apodeictic before he hit upon the theory of the Syllogism?

Three lines of argument suggest that Apodeictic was conceived before Syllogistic: the first two begin from our Posterior Analytics; the third starts from the Topics.

(A) The First Argument: The Posterior Analytics shows that Aristotle's Apodeictic was shot through with the spirit of Plato; Platonism is a sure sign of an early date; so we may infer that Aristotle first developed his Apodeictic at an early, pre-Syllogistic, stage in his philosophical career.

That argument is difficult to evaluate because its first premise is vague: what precisely does the alleged Platonism of Aristotle's Apodeictic amount to?

First, we might suppose that we are to find, hidden in the text of the Posterior Analytics, certain Academic doctrines that were rejected by the adult Aristotle. Now a few obiter dicta in the Posterior Analytics are perhaps amenable to such a Platonic interpretation; but the essential features of Apodeictic are wholly unPlatonic. It has, to be sure, been suggested that Aristotle's notion of ὁ χαὶθ ὁ στόχ (An.

post. i 4) is a kinsman of Plato's ᾑοτόκ ὁ στόχ ῥμάτικος, and hence of the Theory of Forms. But the relationship is purely verbal: for Aristotle, to say that A belongs to B ὁ στόχ ῥμάτικος, in the apodeictically relevant sense, is to say that A is in the λόγος of B, or vice versa (1 4, 73 a 34 - b 24). That is a logical, not an ontological, notion; and it is not remotely connected to Platonic Forms.

Secondly, then, we might construe the alleged Platonism of the Apodeictic more liberally, and take its proponents merely to mean that the theory of demonstration manifests Platonic influence. And we may well agree that, say, Aristotle's ruminations on ὄποιατιές in An. post. i 10 develop a line of thought which began in the sixth Book of Plato's Republic; that Aristotle's concern over the dangers of an infinite regress of knowledge (1 3) was first caused by discussions in the Academy; that Aristotle's reflections on the relationship between 'division' and demonstration in 11 5 and 11 13 are intelligible only against their familiar Platonic background.

That there was Platonic inspiration behind various aspects of the Apodeictic is neither disputable nor amazing. But it hardly suggests an early origin for Apodeictic: the Academy inspired Aristotle throughout his career, as it has since inspired countless other philosophers; and there is no reason at all to think that Academic influence betokens a pre-Syllogistic stage of Aristotle's thought — after all, the theory of the Syllogism has itself plausibly been assigned a Platonic godfather.
But there is a middle ground between the dubious postulation of Platonic doctrine in the *Posterior Analytics* and the vacuous affirmation of Platonic influence upon it. A proponent of the First Argument might put his case thus: «The Prior Analytics is self-contained, linear in development, purely Aristotelian in style. Contrast the *Posterior Analytics*: its atmosphere and ambience are Academic; its problems continually put us in mind of Plato and his circle, and its polemics are directed against positions they adopted; for the most part, its procedure is aporetic, its reasonings dialectical, its structure a patchwork — and all that stinks of the Academy. Any sensitive reader will feel the shadow of Plato over the *Posterior Analytics*, not as a remote inspiration, but as a present and powerful influence». For my part, I find such words persuasive; but the feelings they evince are impressionistic, and it would be foolish to place much evidential weight upon them.

(B) The Second Argument: The apparatus of Syllogistic is often applied to good effect in the *Posterior Analytics*: it gives a formal rigour to many of Aristotle's complex arguments; and it provides a clear structure for several of his major discussions. But that is not always so: Aristotle's illustrations sometimes look uncomfortable in the Syllogistic clothing he tailors for them; when the Syllogism is introduced into an argument it occasionally has the aspect of an afterthought, an addition not fully integrated with its context; and Syllogistic seems flatly at odds with some of the requirements of Apodeictic*. Such inconcinnities in one of Aristotle's works, and the fact forms no sound reason for dating this work specially early» (Ross, *Aristotle's Analytics*, p. 22). — On the connexion between Syllogistic and the *Phaedo* see the classic paper by P. SHOREY, *Origin of the Syllogism*, «Classical Philology», 19, 1924, pp. 1-19.

30. Again, there are passages in *An. post.* which do not employ the techniques of the Syllogism and which would surely have done so had those techniques been available to their author: see Solmsen, *Discovery*, pp. 414-5, on *An. post.* 1.1.

the text of our *Posterior Analytics* suggest that at some point the theory of the Syllogism was grafted on to a preëxistent Apodeictic; and that in turn would indicate that the Apodeictic itself was worked out in a pre-Syllogistic epoch of Aristotle's thought.

I shall give one example of each of the three types of inconcinnity I have mentioned: such examples could be multiplied, and taken *en masse* they would provide the second argument for the priority of Apodeictic over Syllogistic.

(i) In *An. post.* 11 Aristotle sets himself to show that all the four causes «are proved through the middle term» (94 a 23); that is to say, he is expressly attempting to apply the Syllogism to scientific explanation. The fourth 'cause' is the final cause: «e.g. why does he walk about — In order to be healthy. . . . That for the sake of which is being healthy. . . . Walk after dinner, C; the food's not remaining on the surface, B; being healthy, A. Let making the food not remain on the surface of the stomach belong to walking after dinner, and let that be healthy. For B, the food's not remaining on the surface of the stomach belong to walking after dinner, and let that be healthy. For B, the food's not remaining on the surface, seems to belong to C, walking; and A, healthy, belongs to this» (94 b 8-18).

There are several minor infelicities in all that; and there are two major faults. First, the argument is designed to explain why 'he walks'; but no standard Aristotelian Syllogism could possibly do that, since singular propositions do not appear in the Syllogistic. Secondly, the argument is supposed to prove the final cause «through the middle term»; but health, the final cause of his walking, figures not as the middle term, B, but as the major term, A.

Plainly, the argument at the back of Aristotle's mind is a 'practical syllogism': «He wants to be healthy; taking a constitutional produces health; so he walks». For there «he walks» is indeed the conclusion; and the notion of health gives the explanation — the final cause — of his walking. Now the 'practical syllogism' can be presented as a Deduc-
tion; and it is a plausible illustration of how the ‘final cause’ may mediate in an explanatory argument. But it cannot be dressed up in Syllogistic garb.

What is the moral? Perhaps an earlier version of the Apodeictic employed the ‘practical syllogism’ in its normal form, to show how final causes could appear in explanatory proofs. Later, when the advent of Syllogistic occasioned a remoulding of the Apodeictic, the illustration was brutally (and fruitlessly) mauled.

(ii) An. post. 13 discusses the twin dangers of infinite regress and circular argument. Most of the chapter is concerned to show that circular argument can prove nothing; we cannot first prove \( \sigma \) from a set of premisses \( \{ \alpha_1, \alpha_2, \ldots, \alpha_n \} \), and then prove one of the \( \alpha_i \) from a set of premisses that includes \( \sigma \). In the simplest case, (72 b 37), there is only one \( \alpha_i \): then it is circular — and improper — to offer as a proof of \( \sigma \) the argument \( \{ \alpha_i, \sigma \} \), and as a proof of \( \alpha_i \) the argument \( \{ \sigma, \alpha_i \} \).

Aristotle offers three arguments against circular proof. The third (73 a 6-20) relies on certain results obtained in the Prior Analytics to which it explicitly refers (73 a 14). An. pr. n 5-7 syllogizes circularity. Circular argument there involves precisely three interrelated inferences — a circle in Barbara, for example, consists of the following three Syllogisms:

1. \( \{ \text{AaB, BaC}, \text{AaC} \} \)
2. \( \{ \text{AaC, BaA}, \text{BaC} \} \)
3. \( \{ \text{CaB, AaC}, \text{AaB} \} \)

There, in (1), you infer that \( \text{AaC} \) on the basis of \( \text{AaB} \) and \( \text{BaC} \); and \( \text{AaB} \) and \( \text{BaC} \) are each inferred, in (2) and (3),


32. For other illustrative examples ill-suited to Syllogistic see: 11, 71 a 19-21; 13, 78 b 4-11; 24, 85 b 305; n 12, 95 a 15-21; b 31-7; 96 a 2-7.

33. According to Ross, if this section is removed from 13, then « Aristotle’s disproof of the possibility of circular demonstration becomes a very broken-backed affair » (Ross, *Discovery*, p. 257); but see Solmsen, *Discovery*, pp. 417-8.

from premisses which include \( \text{AaC} \). In An. post. 13, Aristotle observes, truly, that such circles occur only if the premisses of the original inference convert (73 a 6; cf. An. pr. n 5, 58 a 13), i.e. only if \( \text{BaA} \) holds as well as \( \text{AaB} \) and \( \text{CaB} \) as well as \( \text{BaC} \); he remarks that such conversion is relatively rare in demonstrations (73 a 17); and he concludes that « it is both empty and impossible to say that demonstration is reciprocal » (73 a 18-9).

That argument fits Aristotle’s purposes well enough; but it is the third of three arguments and it can be removed from 13 without any serious loss. Moreover, two small details make it look like a later addition to the chapter.

First, it employs the letters ‘\( A \)’, ‘\( B \)’, ‘\( C \)’, to represent terms, following the normal practice of the Prior Analytics. But in the immediately preceding part of the argument those letters were used to represent prepositions (72 b 38 - 73 a 5). The change in status is not explained: would Aristotle have allowed it had he written 13 consecutively? Secondly, the paragraph at 72 b 32 - 73 a 6 ends by claiming that circular arguments show only that « if \( A \) is the case, \( A \) is the case»; and the Syllogistic paragraph begins by asserting that « even that is impossible — except in the case of things that follow one another, such as properties ». Thus Aristotle’s words imply that he is about to show that « If \( A \), then \( A \) » can only be proved if \( A \) converts; but in fact he makes no attempt to do so.

It is a plausible conjecture that the Syllogistic section is a late addition to 13, and that the Apodeictic originally discussed circularity before the Syllogism was dreamed up. That conclusion gets some support from a difficult passage in n 12, where Aristotle considers periodical natural events: although his discussion presupposes Syllogistic, the examples he cites cannot easily be put into Syllogistic form, and
probably predate the Syllogism (95 b 38 - 96 a 7).  

(iii) Aristotle more than once offers classifications of the varieties of demonstrative principles. One class of principle consists of \( \delta \xi \omicron \omega \mu \alpha \tau \alpha \) (\( 2, 72 \ a 16; 7, 75 \ a 42 \)), examples of which include the Law of Excluded Middle (\( 11, 77 \ a 30 \)), and the mathematical principle that « if equals are taken from equals, the remainders are equal » (\( 10, 76 \ a 41 \)), which is Euclid's third 'common notion'. The latter principle is identical in form to Euclid's second 'common notion', which, as I have already observed, resists Syllogistic formulation. It is no less clear that the Law of Excluded Middle cannot be expressed as a Syllogistic proposition.

To be sure, Aristotle holds that the axioms will not be used in their full generality, but only in the specific form appropriate to the science in question (\( 10, 76 \ a 37-40 \)); thus in an arithmetical context, the Euclidian axiom will be advanced in the form: « If equal numbers are subtracted from equal numbers, the remaining numbers are equal ». But specification of that sort does not change the logical form of the axiom, or make it any more amenable to Syllogistic treatment.

A second class of principles consists of existential propositions: « Now both what the primitives are and what the things dependent on them signify is assumed; but that they are must be assumed for the principles and proved for the rest — e.g. we must assume what a unit or what straight and triangle signify, and that the unit and magnitude are; but we must prove that the others are » (\( 10, 76 \ a 32-6; 11, 71 \ a 11-17 \)). In geometry, then, one of the principles will be: « There are magnitudes »; one of the theorems: « There are triangles ».

But existential propositions of that sort have no place in Syllogistic; for they are not in Syllogistic form: « There are X’s » is not of the form \( AXB \).

Aristotle's account of the nature and variety of scientific \( \delta \omicron \chi \eta \alpha \) is fundamental to his analysis of Apodeictic; and it is patently incompatible with the claim that Syllogistic is the only logic for science. The account of the \( \delta \omicron \chi \eta \alpha \) cannot, then, have been developed at a time when Syllogistic already held sway over the theory of demonstration: a pre-Syllogistic Apodeictic is once again revealed.

There are objections to that easy conclusion. First, \( \delta \xi \omicron \omega \mu \alpha \tau \alpha \) and existential propositions may be resistant to Syllogistic formulation; but must they have seemed so to Aristotle? may he not have blithely assumed that they were Syllogistic? (After all, in the face of all the evidence, he asserts that « the mathematical sciences carry out their

the things dependent on them signify is assumed; but that they are must be assumed for the principles and proved for the rest — e.g. we must assume what a unit or what straight and triangle signify, and that the unit and magnitude are; but we must prove that the others are » (\( 10, 76 \ a 32-6; 11, 71 \ a 11-17 \)). In geometry, then, one of the principles will be: « There are magnitudes »; one of the theorems: « There are triangles ».

34. In Entwicklung, p. 145, n. 2, Solmsen seems to imply that An. pr. II 5-7 recalls An. post. I 3 and allows the possibility of circular proof; in Discovery, pp. 417-8, he urges (as I do in the text) that \( 73 \ a 6-20 \) is a later addition to \( 11 \), a correction made in the light of An. pr. — In Aristotle, Menoechmus and Circular Proof, pp. 289-92, I suggest that An. post. I 3 is objecting to a theory advanced in An. pr. II 5-7: I now incline to reject that suggestion; but the relationship between the two passages requires further investigation. — For other possible additions of this sort see e.g. \( 6, 74 \ b 26-39; 11, 77 \ a 12-21; 24, 86 \ a 13-21; 32, 88 \ a 19-30 \).

35. For details see Barnes, Aristotle's Posterior Analytics, pp. 138-9.

36. Hintikka, Ingredients, p. 59, says that the axioms are « suggested » by Syllogistic: I do not see the suggestion; and Hintikka does not explain how the axioms can function as Syllogistic \( \delta \omicron \chi \eta \alpha \).

37. Perhaps identical with the \( \upsilon \omicron \delta \omicron \omicron \omicron \omicron \omicron \omicron \omicron \) of An. post. I 2, 72 a 20;
hypothesis that Syllogistic was at some time superadded to an earlier account of Apodeictic.

So much for the second line of argument. Plainly, it requires more discussion; for its weight depends on the amount of material in the *Posterior Analytics* which does not readily take to Syllogistic. The preceding paragraphs have not stated the second argument: they have merely exhibited a few of its constituent parts.

(C) *The Third Argument:* ‘The *Topics* does not know the theory of the Syllogism; the *Topics* does know Apodeictic: therefore Apodeictic was worked out before the Syllogism was discovered’. I begin by examining the first premise of that simple argument.

Does the *Topics* know about Syllogistic? The words « ἰλλογυζαίμενον» and « αἰσθανόμενον» occur in the work; and *Top* I 1, 100 a 25-6, gives the classic account of ‘the syllogism’ which we find also at *An. pr.* I 1, 24 b 18-20. But those facts, as is clear from section III, tell us nothing whatsoever about Syllogistic: they show that the *Topics* knows about Deduction; but they do not show that the *Topics* knows the Syllogism.

42. From a finite set of *n* axioms, Syllogistic can infer precisely \( \frac{1}{2} (n (n-1)) \) theorems: that fact (which neatly points up the inadequacy of Syllogistic as a logic of science) may not have been known by Aristotle; but he was quite clear that the theorems of a Syllogised science must be finite (cf. *An. post.* I 19-22, 32, 88 b 3-6; *An. pr.* I 25, 42 b 16-26). Once or twice, however, he seems to assert that the theorems of science are infinite (*An. post.* I 12, 78 a 16; 32, 88 b 6, 10: see *Barnes, Aristotle’s Posterior Analytics*, pp. 187-8; Mignucci, *L’argomentazione dimostrativa*, pp. 632-4; W.J. Verdenius, *Notes on Some Passages in Book I*, in this volume – none of whom are convincing). Is that a legacy from a pre-Syllogistic Apodeictic?

43. « ἰλλογυζαίμενον» and « αἰσθανόμενον» are frequent in *Top.* I, v, vii 3-5, viii, and Soph. el.; outside those books the only occurrences are at *v* 2, 130 a 7; *vi* 2, 139 b 30; *ii*, 149 a 37. *Marek*, *Syllogistik*, II 2, pp. 79-82 n, inferred that at least *Top.* I and viii knew ‘the syllogism’, although the central core of *Top* was ‘pre-syllogistic’ (so too, e.g. E. Dir Strycker, *Concepts-étè breaks terminologie dans les livres ii à vish des Topiques*, in Aristotle on
More significant is the fact that the *Topics* refers three or perhaps four times to the *Analytics*. Two of the references are to passages that essentially involve Syllogistic theory (viii 11, 162 a 11 ~ *An. pr.* ii 2-4; viii 13, 162 b 32 ~ *An. pr.* ii 16). But both those references are clearly footnotes: they have no integral connexion to their contexts, and they may easily have been added to a finished *Topics* long after its completion.

The third passage, *Soph. el.* 1, 165 b 9, reminds us that « about demonstrative arguments we have spoken in the *Analytics* ». That reference is fairly well entrenched; but it does not advert directly to Syllogistic, and it could be taken to refer to an early version of the Apodeictic.

A fourth passage must also be mentioned. In vii 3, Aristotle approaches the problem of how to establish a definition. He asserts that « it is for another treatise to state with precision both, what a definition is and how things ought to be defined » (153 a 11-2); then he indicates how « it is possible for there to be a Deduction of a definition and of a thing's essence » (153 a 13-4), he offers such a Deduction, and he concludes in these words: « That it is possible for there to be a Deduction of a definition is evident; but from what elements it should be established has been determined more precisely elsewhere — but for our present purposes the same commonplaces will serve » (153 a 23-6). What is the « other treatise », and where is « elsewhere »? In 3-8 of the *Posterior Analytics* discuss the matter of Deducing definitions at some length and with some precision; and it is natural to suppose that those chapters are the object of both our references.

But that cannot be right. The main burden of *An. post.* 11-3 is precisely that definitions cannot in any straightforward sense be Deduced: and it is incredible that Aristotle should have referred to those chapters for a « more precise » account of such Deductions. Moreover, the specimen Deduction at 153 a 15-22 is anatomised at *An. post.* 11 6, 92 a 6-19, and it is rejected as useless on the grounds that it 'begs the question'. Evidently, *Top* vii 3 does not refer to our *Posterior Analytics*.

Then what is Aristotle referring to? There is no place more appropriate to a discussion of the Deduction of definitions than the *Posterior Analytics*: perhaps Aristotle is indeed referring to the *Analytics* — but to a version of that work earlier than and importantly different from the version we now read? Thus *Top* vii 3 is evidence for, and not against, an early Apodeictic. That, of course, is the merest guess; but whether or not vii 3 points to a pre-Syllogistic

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"Proof and the Syllogism"
Apodeictic, it certainly does not show that the *Topics* is familiar with the Syllogism.

Cross-references in Aristotle's texts rarely tell us much and the references in the *Topics* are of no weight at all. I know of nothing else to support the view that the *Topics* knows Syllogistic.

The evidence on the other side is this. The *Topics* is a treatise on Deduction: according to 1.1, its aim is to « discover a method whereby we shall be able to make Deductions (συναγώγες) from reputable premisses about any problem proposed to us » 47: and the first task is to say « what a Deduction is » (100a 18-21). The last Chapter of *Soph. el.* recalls that programme (« we proposed to discover a Deductive method ... »: 183a 37), and indicates that the *Topics* has attempted to carry it out; and Aristotle ends on a note of triumph: « About Deduction there was absolutely nothing that we could say before we had engaged in laborious research and studied for a long period of time. And if it seems to you on consideration that, given the conditions we started from, the method is in an adequate state compared to the other disciplines which have grown in the course of tradition, then it remains for all of you who have heard me to pardon any omissions in the method and to give me your hearty thanks for my discoveries » (184b 1-8).

In that treatise on Deduction, which seemed so original and so impressive to its author, there is no whiff of the Syllogism. The characteristic terminology of Syllogistic, which pervades the *Analytics*, is entirely absent from the *Topics*: here there are no moods and figures, no middle terms and extremes, no majors and minors, no conversions, no expositions, no reductions. The *Topics* never uses a Syllogism; it never hints at Syllogistic technique.

Had Aristotle already discovered the Syllogism when he wrote the *Topics*, could he have suppressed all mention of it — and then boasted of his contribution to the theory of Deduction? Surely not: once the *Analytics* was written, the *Topics* can no longer have been paraded as the last word in Deductive theory 49. Could Aristotle have discovered Syllogism and then puffed the *Topics*? could Verdi have written *Otello* and then extolled *Il Trovatore* as the last word in operatic technique? 50


48. The « method », I take it, is going to tell us how to argue — indeed it is going to be, in part at least, a textbook on logic. WEIL, *The Place of Logic*, pp. 93-4, argues that the « method » is rather a set of recipes for choosing premisses: in his view, Top does not tell us how to argue, but how to collect material from which to argue; and thus Top presupposes a theory of Deduction, i.e. it presupposes the Syllogistic of *An. pr.* I doubt if the Greek at 180a 18-21 and 184b 1-8 will bear Weil’s interpretation; and the middle books of Top are, in any case, packed with advice on how to argue — indeed τέχνες are, roughly speaking, argument-schemata (cf. BUSCHWIG, *Topiques*, pp. xxx-xxxii). — One might wonder if Top really does treat of Deduction, on the grounds that it speaks explicitly of συναγωγής. HEIDENHAIN does that perhaps imply the existence of a different and complementary treatise on Deduction, dealing with συναγωγής in πρώτον? Solmsen thought so; at least he argued that there were two theories of Deduction, one dialectical and the other Apodeictic, before *An. pr.* unified Aristotle’s logic (see Entwicklungen, e.g. p. 78 — where Solmsen says that the early theories are about methodology rather than logic). But what can that other theory be? (An. post. is not a treatise on Deduction) and why does *Soph. el.* 34 not even mention it? In fact, Top has two main subjects, which Aristotle does not take sufficient pains to distinguish: (a) a description of dialectical procedures, and (b) a theory of Deduction. At viii 1, 155b 7-10, Aristotle makes it clear that the theory of Deduction is useful for the ‘philosopher’, i.e. for the demonstrative scientist, as well as for the dialectician.

49. When the Syllogism was discovered, did the *Topics* lose its importance? did it acquire a new function? or did it continue to enjoy the same status and to perform the same function? Those are difficult questions, which I cannot answer here (see, e.g., SOLMSSEN, *Entwicklung*, pp. 58-72; WEIL, *The Place of Logic*, for contrasting views); but I should perhaps observe that it is no part of my thesis that the Syllogistic replaced the logic of the *Topics*.

50. See esp. SOLMSSEN, *Entwicklung*, pp. 40-1; and cf. Dialectic wit-
That, to be sure, is an argument _ex silentio_. But the silence of the _Topics_ speaks trumpet-tongued — at any rate, it speaks persuasively enough to convince me that the _Topics_, as we read it now, was put into its final form before ever the Syllogism was dreamed of.

So much for the first premiss of the third argument. Now for the second: does the _Topics_ know anything about Apodeictic? A number of texts suggest that it does.

First, in his introductory account of the different varieties of Deduction, Aristotle explains that « there is demonstration when the Deduction depends on what is true and primitive or on things such that one gets the beginning of one’s knowledge about them from certain primitive and true things » (I 1, 100 a 27-9); and he adds that « things are true and primitive if they hold their conviction not through others but through themselves (for in scientific principles one must not seek the reason why, but each principle must itself be convincing in itself) » (100 b 18-21).

Of that account of demonstrative Deduction two things can be said: first, that it betrays some prior thought, and secondly, that it points to almost the same Apodeictic that we find in the _Posterior Analytics_ — indeed, in section III I adduced the passage in order to characterise Aristotle’s theory of demonstration.

The _Analytics_ sets nine conditions on the premisses of a demonstration. Two of them, truth and primitiveness, are explicit at 100 a 27-9; and the analysis of primitiveness at 100 b 18-21 implies three more — explanatoriness, familiarity, and priority. A sixth condition, appropriateness, is said in the _Analytics_ to follow from explanatoriness (An. post. I 2, 71 b 23); and in any case the _Topics_ expressly mentions it a few lines further on (I 1, 101 a 6, a 14). Various hints and aside from later chapters of the _Topics_ add further evidence. Thus in I 2 Aristotle notes that the _ἀγαθός_ of any science must be primitive and appropriate (101 a 37-9). In VI 4 he argues that a definition must be composed of elements that are prior to and more familiar than the _definiendum_; « for we get knowledge not from any source but from what is prior and more familiar — as we do in demonstrations » (141 a 26-30). In VIII 1, he refers to « scientific Deductions », which are evidently the same thing as demonstrations, and observes that their premisses must be « as familiar as possible », in addition to being true (155 b 11-16).

The intimations of VIII 1 are taken up, again briefly, in VIII 3. There Aristotle remarks that « it is impossible to demonstrate anything if you do not begin from appropriate principles, and argue without a break (συνεργοῦστα) to the last elements » (158 a 56-7); and he comments that « other things are proved through these [sc. the principles] but these cannot be proved through anything else, but it is necessary to come to know each of them by a definition » (158 b 2-4). The final clause brings to mind the importance of definitions in the _Posterior Analytics_ 51. A further casual reference in VIII 11 confirms the familiarity of that Book with the Apodeictic (162 a 12-5).

From the _Sophistici Elenchi_ I have already cited the reference to demonstrative arguments at 1, 165 a 9. In chapter 9 Aristotle discusses a method of classifying refutations which presupposes some account of the sciences; and his argument is carried out against a background familiar to us from the _Analytics_ — different sciences have different _ἀγαθός_ on which their constituent demonstrations depend (170 a 21-34). A later passage refers to « the primitives

out the Forms, p. 65: « It is an irony of intellectual history that in the work at whose conclusion he claims credit for having created the _methodos_ of the syllogism _ex nihilo_, the essence of the syllogism was still hidden from him. »

51. In An. post and elsewhere definitions are _ἀγαθός_ (see Barnes, Aristotle’s _Posterior Analytics_, p. 109); but _Top_ VIII 3 does not say quite that here, definition is a way of attaining _ἀγαθός_; from which it does not follow that the _ἀγαθός_ attained are themselves definitions. See also H. Scholz, _The Ancient Axiomatic Theory_, in _Articles on Aristotle_, pp. 55-6.
and appropriate principles» of a science (11, 172 a 19) 52.

Thus the Topics is familiar with Apodeictic theory; and it knows of at least six of the nine conditions which the Posterior Analytics requires ἄξια to satisfy. The three conditions not mentioned in the Topics are immediacy, necessity, and universality. The absence of immediacy is unsurprising, since it is intimately linked with Syllogistic; but it is remarkable that neither necessity nor universality is mentioned. Perhaps that omission is accidental: after all, it is no part of the programme of the Topics to give us a comprehensive account of Apodeictic. But it is a possibility worth contemplating that the omission has a more substantial explanation: perhaps the Apodeictic theory known to the Topics did not require necessity or universality of its principles? 53

There may indeed be traces of such an Apodeictic surviving in our Analytics. First, Aristotle is sometimes prepared to countenance demonstrations whose constituent propositions hold only 'for the most part', ὡς ἔστι τὸ πολὺ (130; II 12). What holds for the most part does not, in Aristotle's view, hold of necessity (e.g. An. pr. 1 13, 32 b 16); so that here we are faced with non-necessary theorems, which require non-necessary ἄξια (cf. An. post. II 12, 96 a 11-19) 54.

Secondly, I have already noted that the ἄξια include existential propositions, and that they cannot readily be fitted into a Syllogistic theory of proof. But existential ἄξια are actually more troublesome than that; for they are not universal propositions. Principles such as « Units exist » are, or ought to be, a considerable embarrassment to the Posterior Analytics: they are at odds both with the Syllogism and with the requirement of universality; and if their presence testifies to a pre-Syllogistic Apodeictic, it testifies equally to an Apodeictic which did not impose the stultifying condition of universality.

It might be suggested that existential propositions are universal in a loose sense, in that they do not refer to any particular individuals; and that the ἔτοιμον requirement was originally designed to exclude singular propositions, and was later strengthened to exclude particular propositions as well. But the early Apodeictic seems to have admitted singular propositions too. At all events, we have already hit upon a singular proposition among the examples of II 11 (« he walks »); and that same chapter implies that we can in principle prove the singular proposition that the Persians fought the Athenians (94 a 36). Again, at 1 31, 88 a 1-5, Aristotle implies that, in explaining the phenomenon of lunar eclipses, we may expect to prove the singular proposition that the moon is eclipsed now.

Thus there is some evidence to suggest the existence of an early Apodeictic theory within which the axioms of Euclid – or even of Dedekind – might have been accommodated. But I do not want that issue to obscure or cast doubt upon the main conclusion of the Third Argument, which is this: since the Topics knows Apodeictic and does not know Syllogistic, Apodeictic was developed before Syllogistic was discovered 55.

52. The main references to Apodeictic come in Top 1, vii and Soph. el.; and many scholars believe that those books are later than the central core of the Topics (see esp. MANGE, Syllogistik II, pp. 78-82 n (see above n. 43); BRUNSCHWIG, Topiques, pp. LXXII-LXXXIII). Perhaps Aristotle worked out his Apodeictic after he had assembled the materials of Top i-vii but before the Topics as a whole was conceived? Perhaps Apodeictic succeeds Deduction but precedes Syllogistic? But subtle hypotheses of that sort are more than our scanty evidence will support.

53. It is worth noting that in the formal account of ἐπαθέσεως at An. post. 1 2, 71 b 19-25, neither necessity nor universality is mentioned.

54. See further M. MIGNUCI, ὡς ἔστι τὸ πολὺ et nécessaire dans la conception aristotélicienne de la science, in this volume; J. BARXEO, Sheep have four legs, in the Proceedings of the World Congress on Aristotle, held at Thessalonike in August 1978.

55. In Dialectic without the Forms SOLMSSEN advises us not to neglect the Rhetoric in this context (p. 52, n. 4); and his own argument in Entwicklung did indeed begin from a detailed analysis of Rhet. 1 1 (pp. 13-38). The analysis allegedly uncovered two strata
The Apodeictic theory which the *Posterior Analytics* presents is married to Syllogistic; but there is reason to believe that, before the wedding, Apodeictic lived a virginal life, untouched by the Syllogism. Perhaps, too, we can discern two phases of that prenuptial state, in the earlier of which demonstrations were not required to exhibit universality and necessity. Of course, it is plausible to suppose that Apodeictic underwent various changes as it grew up under Aristotle's tutelage; but the fine history of that putative development is beyond our capacity to discover.

**vii**

My final question concerns priority in composition: was the *Prior Analytics* written before or after the *Posterior*? If we hang on to the answer to the first question, and insist that the *Analytics* is a unitary work, we may be inclined to regard the fourth question as ill-formed. Philosophy books are not written like nineteenth century novels, episode by episode; they are not composed by a sort of intellectual knitting, line by consecutive line. Rather, we might imagine that the two halves of the *Analytics* were written at exactly the same time, or over a single period of time.

Moreover, we may well be sceptical of the fourth question on other, more specifically Aristotelian, grounds. For scholars seem to accept the theory that the *Analytics*, like Aristotle's other treatises, is a *pragmata* made up of several *logoi* – of lectures designed to be read aloud to an audience and then discussed. Like any lecture course, then, the *Analytics* will have been used and reused; and with each employment they will doubtless have received modifications, excisions, embellishments. The *Analytics* was not composed in a year or two as a textbook: it grew, organically, over a long period, as a set of lectures. Thus to ask whether the *Prior* was written before or after the *Posterior Analytics* is simple-minded – it presupposes a mode of composition.

57. Ross, *Discovery*, p. 257, holds that some of the cross-references in the *Analytics* indicate that the *Prior* was written before the *Posterior*; he cites An. *post.* 13, 73 a 8 and 11 (but see above n. 33); 16, 80 a 6; 25, 86 b 10; and An. *pr.* 1, 4, 25 b 26 (but see Solmsen, *Discovery*, p. 418).

58. There is a clear account of this commonplace view in R.A. Gauthier, *L'Ethique à Nicomaque*, vol. 1, Louvain 1970, pp. 63-70; the *locus classicus* is W.W. Jaeger, *Studien zur Entstehungsgeschichte der Metaphysik des Aristoteles*, Berlin 1912, pp. 131-48. It is not always remembered that, as well as maintaining that «the treatises are not works of literature» (p. 133), Jaeger equally held that they are not lecture notes; and he emphasised that «no impromptu talk was given, but γράμματα were read out» (p. 139). His only reference for this practice is to Plato, *Parmenides*, 127 C; his only Aristotelian reference is to Soph. *el.* 34, 184 a 9-b 8 (quoted above, p. 47), which says nothing about the recitation of γράμματα.

59. For suggestions about later additions to An. *post.* see above, n. 34; Solmsen, *Entwicklung*, pp. 93 n. 6, 112 n. 3; *Discovery*, pp. 418-9.
entirely alien to the circumstances in which Aristotle produced his philosophical oeuvre.

That account of the nature of Aristotle’s treatises is in part illgrounded and even absurd. There is no evidence that the treatises were composed of ἄξονα of the sort which Plato’s Zeno read aloud; the supposition that the Analytics was recited in instalments is ridiculous; and the theory that the treatises grew over lengthy periods of time is a speculative hypothesis, supported by no direct evidence. But that is by the way: the general point, that the Analytics was not written after the manner of Bleak House orchester Towers, is hardly in doubt.

All that, however, loses significance in the light of the answer to my third question. For if Aristotle had worked out an Apodeictic before he invented the Syllogism, it is surely reasonable to suppose that it was written down before the Prior Analytics. That work will have been an early version of our Posterior Analytics, and it will not have been conceived as one half of a single Analytics. Rather, we must suppose that the early text on Apodeictic was later joined to a tract on the Syllogism, and that the eventual issue of their union was our Analytics.

We cannot hope to ascertain how much of the present Posterior Analytics goes back to that earlier text60; superficially, at least, the earlier work was very different from its Syllologised successor. But I guess that the fundamental part of the Posterior Analytics, the part which expounds the theory of demonstration, was written in something like its finished form before the Syllogistic was thought out; and in any event, we may say that the period within which the Posterior Analytics was written began earlier than the period of the Syllogistic texts, so that in a clear sense the Posterior Analytics is chronologically earlier than the Prior.

60. Solmsen, Entwicklungen, p. 140 n. 2, has a tentative list of early bits of An. post.: it is strenuously criticised by Ross, Discovery, pp. 298-60; and my own list (for what that is worth) differs markedly from Solmsen’s.

So much for the relative dates of the Analytics. I shall now exceed my brief and ask whether we can fix on any absolute dating. Scholars usually place both Analytics in Aristotle’s middle period, in the 340’s61, but their arguments are often frail, and the issue merits a fresh consideration. The starting point of the inquiry must be the Topics. There are familiar and widely accepted arguments to show that the Topics is a relatively early work62; it is reasonable to suppose that Aristotle worked at it during his years in the Academy; but since he himself tells us that it was a long time in the making (Soph. el. 34, 184 b 2), we cannot place it very early. I imagine that a terminus ante quem of about 350 would meet with general approval.

If that is right, then we may infer that the original Posterior Analytics was composed before 350, and that the Syllogism was discovered after 35063. As far as I know, there is nothing within the Posterior Analytics to suggest

61. F. Nuyens, L’Évolution de la Psychologie d’Aristote, Louvain 1948, pp. 111-15, dates both Analytics to 347-38: his only decent argument is based on An. pr. ii 24, 68 b 41-69 a 11, which I discuss in the text; for the Analytics, which contains almost no psychological material, is ill-suited to his methodology. Ross, Aristotle’s Analytics, pp. 22-3, thinks of 350-44 for both Analytics: since the Analytics is later than the Topics, which was a long time in the writing, it cannot be much earlier than 347; since the Analytics makes few references to Aristotle’s other works, it cannot be a late production. GAUTHIER, L’Éthique à Nicomache, p. 34, asserts without argument that the Analytics are certainly to be dated to 348-4; there is a heterodox view in I. DÜRING, Aristotles, Heidelberg 1966, p. 54, who thinks that the Organon was completed by 355; but he offers no argument.

62. See Solmsen, Entwicklungen, pp. 191-4; P. M. Huby, The Date of Aristotle’s Topics and its Treatment of the Theory of Ideas, « Classical Quarterly », 12, 1962, pp. 72-80; BRUNSCHWIG, Topiques, pp. lxxl-XlV; and the references in Index III, s. v. Topics (b), to Aristotle on Dialectic. For a contrary opinion see WEST, The Place of Logic, pp. 111-2.

63. Those figures will be confirmed if Rhet too is after the original Apodeictic but before the Syllogistic (see above, n. 55); for Rhet is largely datable to the 350’s (see Solmsen, Entwicklungen, pp. 213-29; DÜRING, Aristoteles, p. 119).
any more precise dating; and I conclude, vaguely enough, that the Apodeictic was worked out in the mid-350's.

For the Prior Analytics we may seem better placed. At II 24, 68 b 41-69 a 11, Aristotle produces an illustrative 'paradigm' which purports to show that it is bad for the Athenians to make war on Thebes; and the premiss of the 'paradigm' is supported by reference to a disadvantageous attack by the Thebans on Phocis. The Theban attack is often, and plausibly, referred to the Third Sacred War, and Aristotle's comment on the failure of the attack yields a terminus post quem of 346. But even if that gives us a date for II 24, it hardly dates the Prior Analytics as a whole.

The conclusion of the paradigm demands more attention. Athens and Thebes were old enemies, and they were on bad terms in the mid fourth century. But the battle of Chaeronea in 338 seems to have marked a turning point in their relations: after 338 war between Athens and Thebes would no longer have been discussed as a matter of course. Thus after 338 Aristotle's 'paradigm' would have been maladroit; and that may give us a terminus ante quem for An. pr. II 24, and hence for the discovery of the Syllogism 64.

I know of no other chronological intimations in the text of the Prior Analytics; and the argument from II 24 is hardly probative: the illustration may have been made up in the 340's, but only adapted to a Syllogistic form at a later date; Aristotle may not have thought that the illustration was particularly maladroit in the 330's – or he may not have cared whether it was or not. And there is a reason of a more general sort which tempts me to disregard the history of Athens and Thebes. For it is a remarkable fact that the other Aristotelian treatises pay little or no attention to the Analytics, and that their discussions are almost wholly unaffected and unmoved by the astounding discovery of the Syllogism; indeed, were the Analytics lost, we should have little reason to associate Aristotle's name with Syllogistic 65. Clearly, the later the Syllogism was discovered, the easier it is to understand that fact. Anyone who is not impressed by the argument from II 24 may well be inclined to put the Prior Analytics in the 320's 66.

However that may be, it is, I hope, plain that Apodeictic dates from the 350's and that Syllogistic dates, from the earliest, from the 340's.

In the polished Analytics Apodeictic and Syllogistic form an integrated whole. But theoretically speaking, most of Aristotle's Apodeictic can be prised away from the formal theory of the Syllogism; and historically speaking, there is good reason to believe that Aristotle worked out much of his Apodeictic, and wrote it down, before he had conceived of Syllogistic. If that sketch of Aristotle's development is correct, then it has consequences for the two problems I adverted to in section I of this paper.

64. For advice on the historical matter of these two paragraphs I am greatly indebted to Simon Hornblower and George Cawkwell.

65. Syllogistic terminology is rare outside the Analytics: the only examples I know at present are Metaph. Z 6, 1031 a 25-6 (καὶ διάφορα); Eth. Nic. vi 9, 1142 b 24 (καὶ μέτοχος δρόμος); vii 12, 1143 b 3 (οὐ τε τιμάω τούτως); De motu 7, 701 a 26 (οὐ τε τιμάω τούτως).

66. Solmsen, Entwicklung, pp. 1446, places An. post. – or rather, « the first kernel of the Apodeictic » – during Aristotle's years in the Academy; and he thinks that An. pr. fits « the picture of the last period of Aristotle's thought ». Bochenski, Ancient Formal Logic, p. 24, dates Syllogistic to the late 330's, and the modal syllogism, together with An. pr. II, to the last years of Aristotle's life. But he puts An. pr. I after the Syllogistic. – Myles Burnyeat, echoing Ross (above, n. 6) suggests that if the Prior Analytics is late we should expect to find in it (and in the revised An. post.) hints of Aristotle's mature philosophical views. I suppose that the Analytics simply has no occasion to give such hints; but the suggestion may well have more force than I incline to grant it, and it requires detailed investigation.
First, we may adopt a more charitable attitude to Aristotle as the founder of demonstrative science: Syllogistic, to be sure, is scientifically fruitless; and the attempt to Syllogise mathematics is merely futile. But if we separate Apodeictic from Syllogistic, we may see how Aristotle can have been influenced by the mathematicians of his day, and how, in turn, his own investigations could have influenced his scientific contemporaries. For the pre-Syllogistic Apodeictic holds fair promise for science. Mathematicians and physicists will not have been disgusted by the Syllogism when they first heard of Aristotle's views on deduction, demonstration, and knowledge; and his Apodeictic, however sketchy and inadequate its first elaboration, must have been regarded as a potent and original contribution to the philosophy of science.

Secondly, we may profitably look again at the relationship between Apodeictic and Aristotle's major treatises. We need no longer hunt for Syllogisms in those works, and be puzzled or dismayed by our failure to find any; for the absence of Syllogistic no longer need indicate absence of Apodeictic intent and Apodeictic technique. For centuries, learned Aristotelians sought and found the influence of the Posterior Analytics on the scientific πράγματα; more recently, impressed by the Syllogistic content of the Posterior Analytics, scholars have tried to divorce that work from the rest of the Aristotelian corpus. If, instead, we liberate Apodeictic from the shackles of Syllogistic, we may again look for the influence of the Analytics on Aristotle's scientific and philosophical practice; and if we take seriously the possibility of an early Apodeictic, unhampered by the bonds of necessity and universality, our search will proceed more easily. I do not pretend to know how much we shall find; but I now think, as I once did not, that the search is worth undertaking 67.

But what, after all, of the Syllogised Analytics? what part can they have played on the Aristotelian stage? Aristotle himself certainly hoped that the Syllogism would add rigour, power and elegance to the old, informal, Apodeictic. But I cannot believe that he ever thought out the implications of his innovation; and I wonder if the application of the Syllogism to Apodeictic was not one of his last philosophical enterprises — an enterprise he did not live to finish, and was never in a position to assess.

The end of it all is a pleasing irony. On any account, the Syllogism was one of Aristotle's greatest achievements: for the first time in history, a formal logic was developed, systematised, and subjected to rigorous metalogical scrutiny. But that great organ proved scientifically sterile; and it was many centuries before the theory of demonstration enjoyed the services of a new formal logic and found it a potent begetter of scientific progeny 68.


68. Richard Sorabji generously read a first draft of this paper, and his many acute observations enabled me to make several improvements; my fellow-Symposiasts at Padua offered a wealth of stimulating criticism and valuable advice: to all, my thanks.

**AITIA IN PLATO AND ARISTOTLE. FROM EVERYDAY LANGUAGE TO TECHNICAL VOCABULARY**

Carlo Natali

1. Aitia in Plato’s dialogues

The word *aitia* together with other etymologically related terms (*aitsion, aitos, aitiasthai* etc.) is frequently used in Plato’s works: a TLG search shows more than two hundred and fifty interesting contexts. At a first glance, we can say that for Plato *aitia* belongs to everyday language and is used as such. This is due to the literary genre of the dialogue: the interlocutors of the various dialogues discuss with each other in the current language of the educated classes of Plato’s time and not in the technical language of philosophical treatises. It is only through philosophical investigation that *aitia* takes on — in some contexts and not always — a technical meaning. The most common uses of the word are not completely set aside; rather, they are occasionally used and their implications are spelled out. Particular dialogues seem to resort to *aitia* in a specific sense, by exploring different aspects of this notion; in conclusion what we get is quite a complex theoretical framework.

1.1. Usages of *aitia* in everyday language

The etymology of *aitia* has been the object of a debate in recent years, but there are no doubts as to the main meaning of the word. The word is only attested in a fairly recent time, its first appearances being in Democritus and Herodotus. Etymological studies maintain that the word *aitia* is used in two principal senses: ‘accusation/charge’ and ‘guilt’ from which others derive, like ‘cause’, ‘reason’ and so on.

1 See Chantraine (1999), p. 41. Salvaneschi (1979), p. 27 ss., proposes ‘distribution’ as the original meaning of *aitia*, from which the two attested meanings would derive. See
1.1.1. Accusation/charge/guilt

Plato’s use reflects this distinction very precisely. We have some dialogues in which the word aitia indicates an ‘accusation’ or a ‘charge’. This usage is not confined to a particular period of Plato’s activity, but is attested throughout the dialogues from the Apology to the Laws. In Ap. 38c 1-3 Socrates warns the Athenians: should they sentence him, they shall bear «the name and the accusation of having killed Socrates».

In this case aitia is constructed with the epexegetical hos, as in Resp. 565b 5-6: «the accusation of plotting against the people» and of being oligarch.

Sometimes however aitia with the meaning of ‘accusation’ is construed with the genitive of specification which spells out the contents of the accusation. In fact, the same concept that in Resp. 566c 2-3 is expressed with hos, a few lines later is indicated with a genitive: ἀνήρ χρήματα ἔχων καὶ μετὰ τῶν χρημάτων αἰτίαν μισοδήμους εἶναι, «a man, endowed with riches, and, together with riches, with the accusation of being an enemy of the people». In the same way Leg. 856e 7, mentions an «accusation of high treason».

Connected with the use of aitia in the sense of ‘accusation’ is the use of aitia in the sense of ‘guilt’ ‘crime’: in the Apology, Socrates claims that the Thirty had ordered him to catch a certain Leon, ὅς πλείστοις ἀναπλήσσῃ αἰτίαν, «in order to involve as many people as possible in their crimes».

On other occasions aitia indicates the ‘blame’, as in Phaed. 90d 5: «may he transfer the blame from himself to the arguments».

With a lighter connotation, the aitia can simply be a ‘name’ or a ‘reputation’, as in the case of the Scitians, as we read in Resp. 435e 4:

also Darbo - Peschanski (2010). I shall not join in the debate here, since this meaning is not preserved in the classical age, with which I am concerned. On the term in Antiphon see Scandellari (1979).
«Thracians and Scythians have the reputation of having an aggressive spirit».

Therefore, when Socrates declares himself aitios of something — as it often happens in the dialogues — the word can be equally translated as ‘guilty’, ‘blameworthy’ or ‘responsible’: «I am blameworthy (or: responsible) for the fact that you have not replied correctly» (Lach. 191c 7).

Blame and responsibility can also be ascribed to non individual beings, such as old age: the elderly tò γηρας ὕμνοισιν ὃσων κακὸν σφίσιν αἴτιον, «sing the litany of how many harms old age is guilty to them». On the opposite side, the word anaitios means ‘not responsible, not blameworthy’. In the famous scene of the choice of the lives in the tenth book of the Republic, the herald, who invites the souls to choose a demon, concludes his address by saying that: «the responsibility is of the one who makes the choice; the god is not responsible» Resp. 617e 4-5.

1.1.2. Responsibility

The notion of responsibility, nevertheless, naturally is wider than the so to speak legal use of the notions of accusation or guilt (I say ‘so to speak legal’, because somebody can be accused or be guilty of something outside trials). One can also be the cause or can also be responsible of goods. We read quite often, in particular in the Symposium, that «the god is the cause of their goods» (194e 7).

We also read that Gorgias is aitios of Thessaly’s cultural development, having brought it about (Meno 70b 3). In this case the genitive indicates belonging.

At the same time, the causal function can be ascribed also to mental processes such as pleasure and reasoning. In this case the idea is preserved...
that the particular individual is responsible for what he does, but it is specified that his acting is caused by something which is or happens in him. In the *Philebus*, intellect and pleasure are said to be not good, but the cause of human good: «each of us will ascribe the responsibility of such a life the one to intellect, the other to pleasure» (22d 2-4)\(^{12}\), and in the *Timaeus* sight is said to be the cause of many benefits: ὅμισυ δὴ κατὰ τὸν ἔμον λόγον αἴτια τῆς μεγίστης ὀφελίας γέγονεν ἡμῖν, «according to me, sight is for us the cause (or: source) of the greatest advantage» (47a 2). In this sense any kind of psychological process can cause or be responsible of movements and states of affairs: pleasure, fear (*Prot*. 352d 8-9, *Leg*. 863b 2), the ‘dizziness’ (*pathos*) given by the sight of becoming (*Crat*. 411c 2), the incapability of knowing oneself (*Phaedr*. 229e 5), the ‘folly’ of the philosopher (*Phaedr*. 249d 8), some knowledge or its absence (*Lys*. 209b 8), gratitude (*Gorg*. 520e 7). Also the typical features of the philosopher can be responsible of great goods and great harms for the philosopher himself. It depends on the city he is living in (*Resp*. 495a 6; 489d 9-11). In the same sense strong nature will be held responsible of great goods or great harms, whereas a weak one will only be capable of mediocre actions (*Resp*. 491d 10-e 5). Someone’s *techne*, considered as a subjective capacity can be a productive cause too, since it *demiourgei*, ‘produces’, a *pragma*, ‘artefact’ (*Pol*. 281d 11-e 10)\(^{13}\). In the *Laws* some psychological states are regarded as causes and responsibles of wrong actions: self-love (731e 4), fear and weakness of the soul (790e 5), greed (831c 4, d 2), anger, ignorance (863b 2, d 2-4, 886b 7), lack of self-control (886a 9) and, in general, the weakness of human nature (875a 2). Again, in the *Laws* Plato adds that the fate and character of every human being are caused by the particular choices of the individual: τῆς δὲ γενέσεως τοῦ ποιοῦ τινὸς ἄφηκε ταῖς βουλήσεσιν ἐκάστου ἡμῶν τὰς αἴτιας «he [God] left the causes of the fact that each of us becomes a certain kind of person to the acts of will of each of us» (904b 8-c 2). This passage could be regarded as the point prompting Aristotle’s broad discussion of the same problem in *EN* III 7.

In the *Timaeus*, and in many other dialogues, the same vocabulary is used with reference to the divinity: God’s thought and reasoning (33a 6),

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\(^{12}\) Αἰτιόμεθ᾽ ἐν ἐκάτερος ὁ μὲν τὸν νοῦν αἴτιον, ὁ δὲ ἡδονὴν ἐίναι.

\(^{13}\) The word *sunaietion* — ‘collaborator’, ‘concause’ — appears here, but it is referred to the arts which produce tools; in the *Timaeus*, as we shall see, the word finds a more relevant use.
his plans (44c 7), his productive technē are to be considered causes. We should keep in mind that in these descriptions — in particular in the last one — God is presented in a very anthropomorphic way. God gives life to the universe when he affects it (Pol. 207a 3).

On the other hand, Plato is not inclined to ascribe causality/responsibility to inanimate entities. They appear as causes only when Plato reports the doctrines of the physicists and of the philosophers of nature which he rejects. This is the case in the well-known passage of the Phaedo concerning Socrates’ so-called intellectual autobiography, where Anaxagoras is credited of admitting causality of inanimate entities (95e-99a)\textsuperscript{14}. In the Cratylus this view is ascribed to Heraclitus’ pupils (401d 6), and in the Sophist the similar position of the Sophists and of some Atomists is mentioned (265c 7). Contrasting all these views Plato defends the idea that the cosmos is the product of divine intelligence (Phaed. 99c 2-3, Pol. 270e 3). But in the Timaeus, as is well known, Plato develops an alternative view and admits two kinds of causes, tò mèn ânagkâion, tò dè ðeâiôn (Tim. 68e 4); part of this doctrine is the ascription of a causal function to the spontaneous motions of matter. It is, to be sure, a secondary and limited type of causality, but Timaeus makes a big innovation in Plato’s theory nonetheless\textsuperscript{15}.

1.1.3. Explanation

However, in a high number of passages Plato seems to ascribe the causal function and the qualification of aitia to states of affairs, events and complex situations. In this case Plato’s use of the terminology of aitia is rather metaphorical.

The examples are countless. The aitia of a moral judgement can be the conviction (nenomìsthìai) that it is contemptible for the beloved to give in immediately to his lover’s lust (Symp. 184a 5); at the same time, the aitia of the philosophical nature of Eros is the fact that he is the son of Poros and Penia (204b 5). The aitia of the fact that Lysias’ parents do

\textsuperscript{14} Curiously enough though Plato admits a cause of a physical nature in the Phaedo, a few lines out of and in the Tartarus because it does not have a stable grounding (112b 1); on this point cf. Fine (1987), p. 91. I do not think that in this case we can talk of material cause in the Aristotelian sense.

\textsuperscript{15} There remains a doubt as to how this can fit together with the tenet in Leg. 869a-b, according to which every movement derives from a psuchê.
not let him play the lyre is that he is not good at it (Lys. 209b 8). The aitia of the fact that who provides counselling on the administration of house holding is paid is that this sort of favour immediately produces gratitude in those who receive it (Gorg. 520e 7). The aition of the fact that the Greeks do not remember their past is that cosmic catastrophes periodically sweep away their culture (Tim. 22c 1-23b 3). The aition of the fact that it is necessary to issue universal laws is that it is not possible to provide specific norms for each individual and each particular situation (Pol. 294d 1). The aitia of a conceptual difficulty (aporia) is a controversy (amphisbêtēsis, Phil. 15a 7-c 2). One passage from the Statesman is particularly interesting: in this passage is provided an explanation (to aition) to a bunch of old tales. According to one of these tales, once upon a time the stars used to raise where they now set and vice versa:

«Stranger: All these things derive from the same pathos, and apart from them other countless and even more marvellous things… but as for the pathos which is the aitia of these things, no one has talked about it and we must now say something» (Pol. 269b 5-c 1)16.

In this case what accounts for the change is a pathos. This word can be translated either as ‘event’ (Fowler, Zadro) or as ‘state of affairs’ (Rowe), but it indicates that the universe periodically inverts the sense of its rotation. A pathos can be hardly regarded as a productive agent, and in all these cases the idea of cause/responsibility is employed, as it were, metaphorically. The translation ‘explanation’ or ‘reason’ for aitia in these passages would not be very amiss, if we took into account that in these cases we have to do with the description of a complex situation in which a plurality of causal factors interplay with each other17.

In this context an aitia can also be a certain end. For instance, God provided us with sight so that, by observing the circular motions of the sky, we can calm the disturbances in our soul (Tim. 47b 2-c 4). Nevertheless, in Plato final causality is hardly ever found in isolation: usually

16 ΞΕ. Ταῦτα τοῖνοι ἔστι μὲν σύμπαντα ἐκ ταῦτῳ πάθους, καὶ πρὸς τούτοις ἐτερα μωρία καὶ τούτων ἐπὶ θαυμαστότερα,… ὁ δ’ ἐστὶν πάσι τούτοις αἴτιον τὸ πάθος οὐδὲς εἰρήκεν, νῦν δὲ δὴ λεκτέων.

17 Such situation is reminiscent of the one described by Mackie (1980), without the emerging of a principal causal factor.
it appears in the form of the goal of a productive agent which is aware of her actions (cf. 33a 6).

As is well known, for both Plato and Aristotle the capacity to point at the aitia of something and, therefore, to provide an explanation for something, is what distinguishes technê from empeiria. For only he who has technê or epistêmê knows the nature of the object of its enquiry and its cause: ἔχει λόγον ... ὥστε τὴν αἴτιαν ἐκάστου ... ἔχειν εἴπεῖν (Gorg. 465a 3-5, cf. 501a 2-6).

Furthermore, only technê and epistêmê are characterised by logismos aitias, ‘causal reasoning’. In its connection with science, the relation between a cause and its effect grows stronger and acquires a character of necessity (Meno 98a 3; Soph. 253c 3). In the Lysis and in the Timaeus Plato comes to establish a sort of principle of causality similar to that of the Stoics (fr. 55 L&S = SVF I 89), according to which:

1) there is no effect without a cause;
2) there is no cause without effect18.

This principle will be questioned by Aristotle, who thinks that a cause can be in potency without its effect (Metaph. 1014a 21-4).

1.2. Plato’s accounts of aitia

Plato develops two kinds of enquiry on the notion of aitia. On the one hand he tries to account for it by reducing it to an allegedly simpler and more intuitive notion, i.e. the notion of ‘producer’. On the other hand he aims at picking out those beings which are the most important aitiai, which must be held responsible for the very fact that the world is well organised. These two accounts are of a different nature, the first one concerning the nature of the relation of causality, the second one concerning some of the beings which stand to each other in this relation. These two enquiries should not be confused, as it sometimes happens.

18 Αἴτια γὰρ ἀπολογμένης ἀδύνατον που ἢν ἄτ’ ἐκεῖνο εἶναι (Lys. 221c 3); πάν δὲ αὖ τὸ γιγνόμενον ἕπ’ αἴτιου τινὸς ἕξιν ἀνάγκης γίγνεσθαι παντὶ γὰρ ἀδύνατον χωρὶς αἴτιου γένεσιν σχεῖν (Tim. 26a 4-5). Τὸ γὰρ κινησόμενον ἄνευ τοῦ κινήσουν-τος ἢ τὸ κινήσου ἄνευ τοῦ κινησμένου χαλεπόν, μᾶλλον δὲ ἀδύνατον, εἶναι· (Tim. 57e 3-5). According to Sedley (1998), p. 121, we should add that every genuine cause must be formally the same as its effect.
We are now particularly interested in the first. There are passages where Plato claims that, in general, *hê aitia* or *to aition* should be connected with the idea of production, referring to what Aristotle would call the efficient cause.

1) In the *Sophist* Plato says that *technê* is *aitia*, i.e. cause or responsible, of the generation of things which did not exist before. Because of that, *technê* is called ‘productive’:

«We called ‘productive’ … any capacity which becomes the cause of the coming to be of what was not before and then comes to be» (*Soph.* 265b 8-10).

Clearly this does not entail that every *aitia* is a productive capacity, but, rather, that every productive capacity is an *aitia*. We could therefore understand that the semantic range of *aitia* is wider than the one of *poiêtikê dunamis*. But there are other texts to consider.

2) In the *Hippias maior* — whose authenticity is actually disputed — the beautiful (*to kalon*) is defined as the useful, and the useful is defined as what produces (*to poioun*) the good; but Plato adds that «what produces is nothing but the cause (*to aition*)»; therefore, he concludes, (ara) the beautiful turns out to be the cause of the good:

«Socr.: It appears that the beautiful is the useful… But the useful is what produces the good. — Hp.: Certainly. — Socr.: And what produces is

On the other hand, the *aitia* is also identified with what is expressed through some particles. First of all, the cause is indicated by the expression *di'ho*, ‘that by means of which’; this reflects the use of the Greek language, in which *dia* with the accusative is the commonest way to indicate the cause (*Crat.* 413a 3-4; cf. *Pol.* 274b 3; cf. Luraghi 1989). In a more specific sense, the cause is connected with the expression *hypo* + genitive, ‘that by which’ or ‘that from which’, which indicates the agent and the origin (*Symp.* 184a 5; *Hipp. Ma.* 297a 5, b 1). Furthermore Plato resorts to the causal dative (*Hipp. Ma.* 287c 2,5,8; *Euthiphr.* 6d 11) in the case of inanimate beings. Unlike philosophical schools of the imperial age, in which the common use will be to distinguish the different species of cause through the different particles, Plato does not attach any significant difference to *dia* + accusative and to *hypo* + genitive: it is always a matter of responsibility and of influence of a productive agent.
nothing but the cause; isn’t it? — Hp.: It is as you say. — Socr.: Therefore the beautiful is cause of the good» (Hipp. Ma. 296d 3-297a 1)²¹.

Here ‘cause’ and ‘producer’ are identified.

3) The Philebus is even more relevant, since in this dialogue Aitia is assumed as the fourth highest genus of being. In this case there are no doubts that by aitia Plato means the efficient cause: once he has established the three genera of the limit, the unlimited and the mixture, Plato adds a genus which is responsible for the generation of entities to which the other three genera apply. We are told that:

a) all that comes to be, comes to be διά τινα αἴτιαν, «in virtue of a certain cause», so to speak (26e 3);

b) the essence of the cause consists in producing, so that ‘cause’ and ‘producer’ are synonymous:

«Socr.: So the nature of what produces does not differ at all from the cause, if not for the name, and we can correctly say that the producer and the cause are just one thing? — Prot.: That is correct» (Phil. 27e 6-8)²².

This passage establishes that two things, cause and producer, differ only by name, but in fact they are one single reality (hen). In this important passage Plato resorts indifferently to the feminine substantive aitia and to the substantivated neuter adjective to aition to indicate the cause²³.

The function of the cause is that of demiourgein, i.e. being the maker (27b 1). In fact the demiourgein and the cause are identified with each other: «What is the maker of all these things, the cause, we call that the ²¹ SW. τὸ χρῆσμον ἡμῖν, ὡς ἐοικεν, ἔστι τὸ καλὸν…. Ἄλλα μὴν τὸ γε ὦφελίμων τὸ ποιοῦν ἄγαθον ἕστιν. - ΠΙ. Ἐστι γὰρ. - ΣΩ. Τὸ ποιοῦν δὲ γ’ ἕστιν ὦκ ἄλλο τι ἢ τὸ αίτιον; ἢ γάρ; - ΠΙ. Ὡτές. - ΣΩ. Τοῦ ἄγαθοῦ ἢρα αἴτιον ἕστιν τὸ καλὸν. Ἀτ 297α 7 Socrates repeats that it has been established that the cause is that which produces; the form in which this is expressed, though, is weaker: τὸ αἴτιον ποιοῦν.

²² ΣΩ. Ὅδικον ἢ τοῦ ποιοῦντος φύσις οὐδὲν πλὴν ὄνοματι τῆς αἴτιας διαφέρει, τὸ δὲ ποιοῦν καὶ τὸ αἴτιον ὄρθος ἢν εἴπῃ λεγόμενον ἐγὼ: - ΠΡΩ. Ὄρθος.

²³ Frede (1987), p. 129, hypotizes that in the Phaedo there is a difference between the use of τὸ αἴτιον, which would indicate an agent in the world, and the use of ἡ αἴτια, which would indicate a proposition pointing to the cause of something. This proposal has been disputed by many scholars; among them Ledbetter (1999) and Wolfsdorf (2005). The latter correctly claims that Plato uses the two words without «any significant semantic distinction» (p. 342).
fourth genus» (Phil. 27b 1-2). Plato is talking about the highest and most general *eidê* into which the whole being is divided; therefore the *eidos* of the *aitia* is its Form and realizes fully the essence of being-a-cause in the most complete and perfect way. Hence, for Plato a cause is a producer. The Demiourge of the *Timaeus*, be he one or many, is an individual which falls under this highest genus.

1.3. The causality of the Idea

Given this overall picture and the two main uses of *aitia*, one might ask whether in Plato the causality of Ideas falls within the range of production or within the range of explanation. The issue has been long debated, starting from a seminal paper by Vlastos (1969). Many English-speaking scholars have endorsed the thesis that the causality of the Idea consists in an ‘explanation’, which only allows to classify a determinate physical being under a determinate class or category. This is called a ‘logical and metaphysical’ kind of causality. Forms as explanations make us to understand the material beings which resemble, even if imperfectly, them. Forms have ‘no causal efficacy’ (as says Vlastos, p. 92). Other scholars, including many Italians, contrast this view. Over the last years, they have remarked that Plato, when speaking about Ideas, uses a language implying the notions of production and generation. Hence, they maintain that Plato’s Ideas somehow transfer their defining features to empirical beings by exerting a sort of ‘efficient’ causality on them.

This interpretation seems to be more adequate to make sense of the point Plato is maintaining in the *Phaedo* passage; a point somehow overlooked by some interpreters. Here Socrates is not presenting his own theory of causality, but is trying to reach a conclusion which is fully

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24 Tò ðè ðή πάντα ταύτα δημιουργοῦν λέγομεν τέταρτον, τήν aítían.
25 Also Stob. I 137,13 (= Aët. I 11, 2) says that for Plato the main meaning of ‘cause’ is to be a producer, (*κυριότατον δ’ ἡγεῖται τὸ ὑφ’ οὗ’ τούτο δ’ ἤν τὸ ποιοῦν*); there is no need to see in this passage a modernising Hellenistic interpretation as Mansfeld (2011), p. 389, thinks. Aëtius’ interpretation is warranted enough by the above referred passages.
26 Hankinson’s (1998), p. 87, attempt of denying the importance of these passages misfires. In my opinion here we do have Plato’s definition of *aitia*.
expressed only at 105e 6: «the soul is immortal» (ἀθάνατον ... ψυχή). Now, in my opinion the demonstration is more convincing if we read it in the sense that the soul infuses life to the body, and it not so much convincing if we want to read in it the idea that the notion of soul logically implies the notion of life28. Even Vlastos hesitates at this point and admits that, in this case, the implication between Forms «is tied firmly to the causal structure of the world» (1969, p. 105).29

In the Republic the Idea of the Good is said to be deliverer of truth and of thought (κυρία ἀλήθειαν καὶ νοῦν παρασχομένη, 517c 2-3). In the Phaedo, as we saw, the action of the Idea on the sensible thing is described as a kind of production, poiein, as it happens in the Hippias Maior (100d 5 = 296c 2-3, e 8, 297a 5-8 etc.). According those interpreters, by poiein Plato means the capacity of Ideas of transferring some properties and qualities to the being that participates in them, causing the presence of some determinate features in it.

The wording of Plato’s text has obviously not escaped Vlastos, who has nevertheless observed — in an apparently convincing way — that the ‘making’ here referred to by Plato must be intended in a metaphorical sense, as when one asks «What makes that chalkmark square?», where the question does not allude to who has produced it, but rather asks «Why do we classify it as a square?» (p. 90-1). This solution is plausible since in Greek poieô has also the meaning of ‘consider, reckon’ (cf. LSJ s.v.). The problem is rather this: could Plato have considered the Idea as aitia only in the sense that they allow to classify a being in a certain class or category?

In the uses that we have seen so far, the passages supporting the interpretation of aitia as ‘explanation’ all refer to a complex situation, to a state of affairs in which a plurality of factors determines a certain result: Eros is a philosopher because he is the son of Poros and Penia; the Athenians forget their past because cosmic catastrophes periodically destroy their civilization; laws must be written because it is not possible to provide precise norms for the behaviour of each particular individual, and so on. In Plato’s dialogues we never find a passage where aitia indicates

28 As Shorey does (1924), p. 7-8.
29 Dixsaut (1991), p. 397, observes that in this passage the soul is not said to be an Idea, but is indirectly immortal. This means that the individual soul participates in the Idea of the soul and provides life to the body in virtue of this participation; cf. Hankinson (1998), p. 101, which provides further bibliographical indications.
the «account of an essence» (Vlastos 1969, p. 91) and performs the logico-metaphysical function of allowing the classification of an empirical individual within a certain set. This is for sure a function that Aristotle’s formal causes have, but, as far as we have seen, it does not belong to Plato’s aitia.

Where does this idea come from then? The idea of the aitia as formal cause is certainly present in Aristotle, but can we ascribe it to Plato? For sure, as everybody knows, in Metaph. A 6 Aristotle ascribes to Plato the discovery of the formal cause, even if in a confused way (amudròs, 988a 23); but later, in A 9, Aristotle seems to say that Plato in the Phaedo ascribes to Ideas an efficient function (991a 1-5; cf. Z 8, 1033b 26-8)30. And Aristotle’s testimony can be biased. The move which has brought Vlastos and other interpreters to introduce this idea into Plato’s philosophy is the assumption that Aristotle’s distinction of the four causes directly reflects the use of common language of the IV century b.C., which Aristotle would have just registered. Therefore, according to this assumption, Plato’s theory of the causes must be read through Aristotle’s conceptual framework. (Vlastos 1969 speaks of Aristotle’s «sensitivity to the values of the words he used», p. 78)31. If really in the language of the educated upper classes of the IV century B.C. aitia could be used to indicate the formal cause, then this usage could have been reflected in Socrates’ speech here. But is this what actually happens? And is it correct to say that Aristotle’s distinction of the four causes does nothing more than reflecting the linguistic use of his time? I do not think it does, and I doubt that it can be used to understand Plato (cf. Natali 1997). In a moment we will see why.

2. Aitia in Aristotle

With Aristotle we step into a different literary genre. His writings are pragmaiteiai, i.e. treatises meant to be read in his school and therefore written in a technical language and with different concerns from Plato’s dialogues.

In Aristotle’s authentic treatises the number of the occurrences of the word *aitia* is very high (almost one thousand) and it is not possible to deal with all of them here. Perhaps we shall do this in the future. So we have to rely on lexica, *in primis* on Bonitz’ *Index*, and on Aristotle’s explicit statements — since Aristotle distinguishes the meanings of the word *aitia* in many passages. The results of the present enquiry are therefore to be regarded as provisional.

According to Bonitz, Aristotle uses *aitia* in the sense of principle of reality and of knowledge as well as in *sensu iudiciali*, i.e. with the meaning of ‘accusation’ — e.g. *aítia μοιχείας* «accusation of adultery» (*Pol. 1306b 19-20) — or with the meaning of ‘name’, ‘reputation’ — e.g. Hermotimus of Clazomenae *aítian ἔξει*, «has the reputation» of being the first to assume the Nous as the principle of the cosmos (*Metaph. 984b 19-20*). The legislator can be said to be *aítioς*, ‘responsible’ of the loss of strength of the city during peace time, because he has failed to educate the citizens to the practice of *scholē* (*Pol. 1334a 9*). Nonetheless this usage seems to be very rare.

2.1. *The origin of the distinction of the different species of aitiai in Aristotle*

When Aristotle lists the meanings of *aitia*, he omits those which are connected with the group accusation-guilt-reputation. This appears to be a sufficient reason for doubting of Vlastos’ claim that Aristotle would refer to the current linguistic uses of his time. Where does his distinction come from then?

We can reasonably suppose the existence of a debate on the causes, *aitiai*, in the old Academy, in connection with the debate on the existence and causal function of Ideas, and with the interpretative problems raising from the *Phaedo*. The *Phaedo* appears to be at the centre of the Academic debate: both Xenocrates and Aristotle (*Metaph. 991a 19-22*) refer to it.

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32 Cf. also 1306a 34; perhaps 1303b 22, *περὶ ἐρωτικῆς ἀτίαν* can signify «with reference to the accusation of violence».

33 The expression *aitéon λέγεται* (194b 24 = 1013a 24) should be intended as a distinction of the meanings of the word *aitéon* and not just as a mere list of kinds of cause; cf. Alex. Aphr., *in Metaph.* 248, 10; Bonitz (1849), p. 218; Ross (1924), p. 291.
Aristotle tells us that (1) Speusippus denied the existence of Ideas «because of the difficulties that he sees as deriving from the admission of their existence» (διὰ τὸ τὰς ἐνούσιας δυσχερείας δρῶν περὶ τὰς ἰδέας), that (2) he did not link numbers and Ideas and that (3) therefore, he was forced to deny that the mathematical number is a cause of things: «it does not appear to be a cause» (οὔτε φαίνεται ὃν αἴτιος). Here it is implied that Ideas, if existing, would have a causal impact, and because of that, numbers not connected to Ideas cannot be causal agents.

On the contrary, according to Proclus’ report, Xenocrates, wishing to be faithful to Plato, assumed a special form of causality for Ideas and defined it as: «paradigmatic cause of natural things which subsist eternally». In this way Xenocrates meant to explain and unfold the nature of the unqualified causality attributed to Ideas in Phaed. 100b. The issue of the existence of Ideas and of their causality seems to develop along two main lines: the causal function of Ideas is either admitted (Xenocrates) or denied (Speusippus and Aristotle). When admitted, a new kind of causality is introduced. This brief mention could suffice to suggest that, when Aristotle distinguishes the senses of the word aitia, he does not refer to the common use of such term, but to the Academic debates on Ideas and different kinds of causes. In this debate the distinction of the kinds of causality was finally resorted to as a conceptual tool to make sense of the problem. The introduction of this distinction was supported by the fact that in his dialogues Plato had more than once distinguished different kinds of cause: in the Phaedo, with respect to Ideas, he speaks of a species of cause (τῆς αἰτίας τὸ εἶδος 100b 3-4) about which he wishes to talk. In the Timaeus he distinguishes explicitly two genera of cause (ἅμφοτερα τῶν αἰτιῶν γένη, 46e 3; δύ’ αἰτίας εἶδη διο-
rίζεσθαι 68e 6): the causes of the intelligent and divine nature (τῆς ἐξιφρονος φύσεως, 46d 8; τὸ δὲ θεῖον, 68e 7) and those which act in virtue of necessity and chance (ἐτερὰ δὲ κατὰ ἀνάγκης κινούντων ... τὸ τυχὸν ἄτακτον ἐκάστοτε ἐξεργάζονται, 46e 1-2 e 5-6; τὸ μὲν ἀναγκαῖον, 68e 6). It seems to me that in Timaeus’ language aitia always indicates a productive cause, even if with different features38; but Plato’s wording might have provided a hint to the following discussions in the Academy and opened the way to admitting much more different kinds of cause.

If this is true, then we can explain a fact which has puzzled many commentators39, i.e. the fact that Aristotle, when introducing the distinction of the four kinds of aitia, does not provide any justification for it: for the public of his pupils must have been acquainted with the philosophical debate in the Academy.

2.2. The distinction of the four causes in Aristotle

The main passages in which the doctrine of the four causes is presented are four: Phys. II 3-7; Metaph. Δ 2; Metaph. Α 3-10; APo. Π 11. To these Metaph. Δ 1, Ι 1 and Λ 4-5 should be added. Of the first four, curiously enough Metaph. Δ 2 is identical to Phys. Π 3, which it repeats literally with some cuts. As a matter of fact, the first lines (194b 16-23), in which Aristotle identifies aitia and dia ti, are missing in the Metaphysics and present only in the Physics:

«Since this enquiry aims at knowledge, and we believe that we do not know any thing before we grasp the why of each of them, which corresponds to grasping the primary cause, it is clear that we have to do this also with respect to coming-to-be and passing-away and to every physical change, so that, knowing their principles, we can try to lead back to them each of the enquired things» (Phys. 194b 17-23)40.

38 The two causes can cooperate and produce an effect precisely because there is no ontological gap between the two of them; cf. Taylor (1928), p. 291-300; Easterling (1967); Natali (1997); Casertano (2003), p. 42-55.
40 Ἐπεὶ γὰρ τοῦ εἰδέναι χάριν ἡ πραγματεία, εἰδέναι δὲ ό οὗ πρότερον οἴομεθα ἐκαστὸν πρὶν ἄν λάβοιμεν τὸ δίὰ τί περὶ ἐκαστὸν (τοῦτο δ’ ἐστι τὸ λαβεῖν τὴν πρῶτην αἰτίαν), ἀπὸ τὸ πέραν τοῦ ποιητέων καὶ περὶ γενέσεως καὶ φθορᾶς καὶ τάσης τῆς φυσικῆς μεταβολῆς, ὅπως εἰδότες αὐτῶν τὰς ἀρχὰς ἀνάγειν εἰς αὐτὰς πειρώμεθα τῶν ζητουμένων ἐκαστὸν. ‘Primary cause’ indicates the cause which
In addition, the final lines (195b 21-30) are missing too. In these lines Aristotle says (1) that one should always enquire into the causes which are the first in the causal chain, and (2) that generic causes should be investigated for phenomena which are regarded as generic, individual causes for individual beings, actual causes for beings which are in actuality and potential causes for beings which are in potency. Finally Aristotle concludes: «Be it enough for this distinction of ours on how many the causes are and how they are causes» (Phys. 195b 28-30)\(^{41}\).

The passage in \textit{Metaph.} \(\Delta \ 2\) seems to be copied from the passage from the \textit{Physics} for many reasons. First of all, the version of the \textit{Metaphysics} is shortened, and it is more likely that Aristotle, or some editor, transcribed a passage from one work to another cutting some parts than adding some new ideas. Secondly, in his \textit{Commentary} on the \textit{Metaphysics Asclepius}, commenting on the first line of \(\Delta \ 2\) (1013a 24), writes:

«The following words have been transferred here from the \textit{Physics}: for [the editors] said that some parts had gone lost and, not being able to imitate them, they adapted here a passage taken from his writings» (d305, 19-22)\(^{42}\).

Ross observes that the displacement of the passage from the \textit{Physics} into the \textit{Metaphysics} could have been operated by Aristotle himself\(^{43}\).

Finally, in \textit{Metaphysics}, book A, introducing the four causes, Aristotle says: «These causes have been adequately considered by us in the \textit{Physics}» (983a 34-b 1)\(^{44}\).

Therefore the \textit{Physics} is the original place of the passage. Here Aristotle does not use the terms \textit{apodeixai} or \textit{deixai}, ‘demonstrate’ or ‘prove’, but the weaker word \textit{theôrein}. Accordingly it seems that Aristotle did not feel the need to demonstrate that these four causes are causes.

\(^{41}\) Όσα μὲν οὖν τὰ αἴτια καὶ δὲν τρόπον αἴτια, ἐστὶν ἡμῖν διωρισμένα ἰκανός.

\(^{42}\) Τὰ ρήτα ταῦτα μετενήκεται ἐνταῦθα ἐκ τῆς Φυσικῆς ἀκροάσεως ἡλεγον γάρ ὅτι τινὰ παραπώλωντο, καὶ μὴ δυνηθέντες μιμήσασθαι ἐκ τῶν αὐτῶν ἐφήμ-μοσαν.

\(^{43}\) Ross (1924), I p. 292; Bonitz (1849), p. 221-2, maintains that the insertion must be due to the editors because the passage 1013a 17 ss., in which all causes are principles (we shall discuss this point below), would make the very presence of Ch. 2 pointless.

\(^{44}\) Τεθεώρηται μὲν οὖν ἰκανός περὶ αὐτῶν ἡμῖν ἐν τοῖς Περὶ φύσεως.
Instead Aristotle feels the need to demonstrate that the causes are not more than these four. In the *Physics* he devotes three chapters (II 4-6) to prove that *tuchê* and *automaton* should not be regarded as causes strictly speaking, and in *Met.* A his explicit aim is to confirm that there are no other causes, because no other philosopher has ever found any other (983b 5-6; 993a 11-13). Therefore the causes are not more than four.

The idea that the causes have been progressively discovered is at odds with the idea that the four causes are already given in the common use of the word *aitia* in the Greek language: if common language were the source of the distinction of the four causes, they would be immediately given since the very beginning, even if murkily (*EE* 1216b 32-5).

What does it mean then when Aristotle claims (*Phys.* II 3, 194b 17-23) that grasping the reason why corresponds to grasping the cause? In *Phys.* II 7 he also repeats the same idea:

«It is clear that there are some causes and that they are in the same number that we said, for we have established that the ‘why’ includes the same number of things» (*Phys.* 198a 14-7)*45.

The reference is to chapter II 3 quoted above. In the main version of the list of the causes (i.e. that of *Phys.* II 3 = *Metaph.* Δ 2), this is presented as a distinction of functions which are indicated through the use of different particles:

«In one sense, cause is said to be *that out of which* something derives, this being *immanent*, for instance the bronze of the statue and the silver of the cup and their genera; in another sense the form and the model, namely the definition of the *essence* and its genera — for instance *<the cause>* of the octave *<is>* the rapport ½ and number in general — and the parts of the definition; furthermore *that from which*, derives the first *principle* of movement and rest — for instance, who deliberates is a cause, and the father of the son and, in general, who produces is the cause of what is produced and who changes of what changes; furthermore as the end, namely *that for the sake of which* — for instance health is *<the cause>* of walking. Why does he take a walk? — we ask. In order to be healthy. And by saying this we believe that we have provided the cause» (*Phys.* 194b 23-35)*46.

*45 Ὑπάρχουσιν δὲ ἄττια, καὶ ὅτι τοσάποτα τὸν ἀριθμὸν δῶς φαμέν, δηλοῦν τοσάποτα γὰρ τὸν ἀριθμὸν τὸ διὰ τί περιείλθεν.

*46 Ἐνα μὲν οὖν τρόπον ἀττίον λέγεται τὸ ἔστιν ὃ ἐν πρώτῳ γίνεται τι ἐνυπάρχοντος, οἷον ὁ χάλκος τοῦ ἀνθρώπου καὶ ὁ ἄργυρος τῆς φιάλης καὶ τὰ τοῦτον γένει ὀλλον δὲ τὸ εἶδος καὶ τὸ παράδειγμα, τούτο δέ ἐστιν ὁ λόγος ὁ οὗ τί ἢν εἰναι καὶ τὰ τοῦτον γένη (οἷον τοῦ διὰ πασῶν τὰ δύο πρὸς ἑν, καὶ ὁλος ὁ ἄριθμος) καὶ τὰ μέρη τὰ ἑν.
The first thing to be noticed is that in this text different particles are used to indicate different kinds of cause, as it will become usual in the philosophy of the imperial age and in contrast to Plato. Only the formal cause is not indicated by a special particle, but with the well-known expression τò τί ἦν εἶναι.

In addition, it is important to understand well Aristotle’s move. Aristotle operates a ‘deconstruction’ (as Derrida would say) of the Platonic cause, by separating the efficient and productive function from the function of paradeigma and from the material function. We shall go back to this.

Platonic Ideas, at least according to our interpretation, have the capacity of generating an effect, of transferring determinate features and qualities to the participated being. Aristotle criticizes the Ideas in the first place because, being separate, they cannot be able to perform the function that Plato ascribes them. Furthermore Aristotle introduces the form in the matter and separates the efficient function from the formal function, ascribing a different kind of causality to each of them. The same happens with respect to the Presocratic concept of matter. Aristotle separates the function of the substratum from that of the efficient cause, which were merged together in the views of Presocratic philosophers. In fact, in Metaph. A 3 Aristotle tells us that some Presocratics — the pluralists — used to ascribe to matter a sort of efficient function:

«they resort to fire as if it had an efficient nature, and of water, of earth and of similar things in the contrary way» (984b 6-8) 47.

For this reason Plato had set a polemical debate with them, as we have seen. Aristotle accuses the Presocratics of having conflated the material cause with the efficient cause, and supports the idea of a material cause deprived of efficient functions (cf. Phys. II 1, 193a 9-28). This is why in Aristotle there is no conflict between matter and form as causes as it happens in Plato, since they have no efficient function. We could say that Aristotle has deconstructed a complex concept dividing in two what both Plato and some Presocratics regarded as unified notions.

τὸ λόγῳ. Ἐπι οὖν ἡ ἀρχὴ τῆς μεταβολῆς ἢ πράτη ἢ τῆς ἡρεμίσεως, οἷον ὁ βουλεύσας αἴτιος, καὶ ὁ πατήρ τοῦ τέκνου, καὶ ὁ λόγος τὸ ποιοῦν τοῦ ποιούμενον καὶ τὸ μεταβάλλον τοῦ μεταβαλλόμενου. Ἐπὶ ὡς τὸ τέλος· τούτο δ’ ἐστὶν τὸ οὐ ἑνὲκα, οἷον τὸ περιπατεῖν ἢ ψύει: διὰ τί γὰρ περιπατεῖ; φαμέν ἵνα ψύειν. Καὶ εἰπόντες οὕτως οἰόμεθα ἀποδεδοκέναι τὸ αἴτιον.

47 Χρονίται γὰρ ὡς κινητικὴν ἔχοντι τῷ πυρὶ τήν φύσιν, ὃδε δὲ καὶ γῆ καὶ τοῖς τοιούτοις τοῦ πυρὸς.
Separating the efficient cause from the form, Aristotle is also able to distinguish the final cause more precisely. For we have seen that in Plato the end sometimes enters the explanation of an event, but usually this happens in the sense of the intentionality of a subject that acts consciously. In Aristotle, on the other hand, finality is a reality existing in nature and consisting in an ordered series of steps leading to a result:

«If the efficient cause is something else, all that comes to be between it and the end, as health <is the end> of slimming down or of the purge or of the drugs or of the surgical instruments, for all this is for the sake of an end; they differ from each other because some are instruments, some are actions» (1013a 35-b 3, cfr. Phys. 199b 7-9)\(^{48}\).

With such changes Aristotle can provide some sort of conciliation between Presocratic and Platonic conceptions of causality. He deprives both matter and form of the role of moving principle, and, conceived in this way, matter and form do not conflict any more. Instead, they need to stay together in the individual thing (the sunolon), since the form of natural entities requires a particular matter to exist.

2.3. Cause or explanation?

In the Posterior Analytics we find the identification of aitia and meson.

«When we know the fact that, or the whether it is... again we look for the reason why or the what it is, and then we look for the middle term... for the cause is the middle term and is what is looked for on every occasion» (APo. 89b 38-90a 7)\(^{49}\).

This has induced some scholars to think that Aristotle’s aitia is in the first place an explanation.

I cannot agree. First, it should be noticed that the expression to aition to meson cannot be taken as meaning, without qualification, that every syllogistic meson is an aition. For according to Aristotle there are middle

\(^{48}\) Καὶ δεὶ δὴ κινήσαντος ἄλλου μεταξὺ γίγνεται τοῦ τέλους, ὅτι τῆς ὑγείας ἢ ἰσχυσίας ἢ καθαρείας ἢ τὰ φάρμακα ἢ τὰ δράγανα πάντα γὰρ ταῦτα τοῦ τέλους ἐνεκα ἐστί, διαφέρει δὲ ἄλληλον ὡς ἄντα τὰ μὲν δράγανα τὰ δ’ ἔργα. Οἱ καὶ ἄντι τῆς μεταφρασμένης ἣν εἴπον τὰ πάντα τοῦ τέλους ἐνεκα ἐστί, ἃς ἄλληλον ἄλλοις, ὡς ἄντα τὰ μὲν δράγανα τὰ δ’ ἔργα. Οἱ καὶ ἄντι τῆς μεταφρασμένης ἢν εἴπον τὰ πάντα τοῦ τέλους ἐνεκα ἐστί, διαφέρει δὲ ἄλληλον ὡς ἄντα τὰ μὲν δράγανα τὰ δ’ ἔργα.

\(^{49}\) Ὅταν δὲ γνώντες ἢ τὸ ὅτι ἢ ἐπὶ ἥσσον... πάλιν τῷ διὰ τῇ ζητοῦμεν ἢ τῷ τί ἔστι, τότε ζητοῦμεν τί τὸ μέσον... τὸ μὲν γὰρ ἄιτιον τὸ μέσον, ἐν ἀπαι δὲ τοῦτο ζητεῖται.
terms of a syllogism which do not have any causal function, while others do\textsuperscript{50}. The expression should rather be read in the sense that, if we have \textit{epistêmê} of a certain kind of being, and we seek the \textit{dioti}, then the cause functions as the middle term of the corresponding syllogism. Therefore being \textit{aition} cannot depend from their being \textit{meson}; rather, it is their being \textit{meson} in a scientific demonstration that depends on their being \textit{aition}. Given that a principle is that «from which being, coming-to-be ad knowledge are» and the cause is a principle, certainly the cause is that from which knowledge is given, but it is not \textit{just} this: it is also that from which being and coming-to-be are. For this reason, translating Aristotle’s \textit{aitia} as ‘explanation’ could be misleading. In addition, translating \textit{aitia} with ‘explanation’ can also be problematic in another way. According to the Oxford concise dictionary (s.v.) ‘explanation’ means «a statement or account that makes something clear», i.e. a sentence, a linguistic item. But, even if indicating an \textit{aitia} amounts to providing an explanation, the \textit{aitia} in itself is not an explanation, but a being in the world\textsuperscript{51}.

For these reasons I think that it is preferable to keep the usual translation, ‘cause’ and explain to the reader that the sense in which the expression at stake is used by Aristotle is different from what we might expect\textsuperscript{52}. For, as noted by Sedley, translating with ‘explanation’ implies admitting that the \textit{aitiai} have «a primarily epistemological function», which, as we have seen, is not true. For instance, if we say: ‘Why did the table burn?’ ‘Because it was made of wood’, the answer ‘Because it was made of wood’ certainly picks out an explanation, but the explanation is such because the table is a determinate form (which in the case of

\textsuperscript{50} In syllogism (A) «Celestial bodies which do not shine are close / the planets do not shine / the planets are close» non-shining is not the cause of being close; in syllogism (B), instead, «Celestial bodies which do not shine are close / the planets are close / the planets do not shine» being close is the cause of non-shining (78a 30-b 4).


\textsuperscript{52} The same opinion is shared by French translators (Carteron, Couloubaritsis, Pellegrin) as well as Spanish (Calvo, Boeri), Italian (Russo, Ruggiu, Franco Repellini) and Portuguese ones (Angioni); German translators oscillate between \textit{Grund} and \textit{Grundursache} (cf. Schwegler, Wagner); Frede, even if he indicates the particular sense of the term, translates \textit{aitia} with ‘cause’. An exception is Mignucci (2007), p. 151, who proposes the translation ‘ragione’.
the table amounts to a function, i.e. sustaining objects), entered on a certain matter, a *logos enulios*. As we know, not any matter is adequate to being matter of a table, and form determines some limitations: there cannot be a table made of water or of tissue paper. Wood is one of the possible matters for the form of the table; apart from the features which make of it the form of a good table (being resistant, being light etc.), it has also some other properties which derive from its being made of wood, i.e. from its being made out of a determinate mixture of the four basic elements according to a determinate proportion; such proportion is the form of ‘being wood’ and determines the possession of some *dunameis*, i.e. some potentialities or passive properties, among which inflammability. The wood has therefore the capacity of reacting in a certain way to an external event, for instance burning when touched by fire (Viano 2006, p. 132-44). This is a «capacity of standing/enduring which in the patient himself consists in a principle of passive movement due to something else or to himself considered as something else» (1046a 11-13)53.

Therefore we do not have to do just with an explicative *meson*, but with a *dunamis* which is genuinely present in matter and which is capable to react, even if not to start a process by itself.

2.4. *Is there a unitary meaning of the term aitia in Aristotle?*

As a consequence of what we have said so far, the following problems arise: (1) if according to Aristotle the word *aitia* in general should not be intended in the sense of *to poioun* — as according to Plato — but *to poioun* is just one of the four kinds of *aitia*, what does *aitia* mean in general? And (2) does it pertain to one single science or to several sciences to investigate all the *aitiai*?

The second problem is approached in *Metaph.* B 2, 996a 18-b 26 and in *Phys.* II 7; it is solved, not without some difficulty, by saying that knowing all four causes pertains to the physicist (*Phys.* 198a 22-3; cf. *De an.* 403a 29-b 9)54.

53 Ἡ μὲν γὰρ τοῦ παθητικῆς ἐστὶ δύναμις, ἢ ἐν αὐτῷ τῷ πάσχοντι ἄρχῃ μεταβολῆς παθητικῆς ὑπ’ ἄλλου ἢ ἤ ἄλλο.

The first problem is more difficult to solve. Aristotle designates the four causes as different *eidê* and *genê* of causality (*Metaph. 994b 28 and 996a 18*). Is there a common genus of the four causes, or is there any other way to unify them, or are they to be interpreted in an analogical sense or are they utterly and irreducibly homonyms? As for the good, Aristotle states explicitly (*Metaph. Α 4-5*) that the four causes are said by analogy:

«With reference to analogy, the elements are three and the causes are four; but they are different in different things and also the first mover is different in different things» (1070b 25-7).

But this only means that the four causes are analogically similar and different in each single being. This does not say anything on the general meaning of the word *aitia*.

A passage from *Metaph. I 1* might give the impression of being helpful, but as a matter of fact it turns out to be disappointing. Here Aristotle, talking about the senses of the one, establishes a principle: for a term *x*, e.g. ‘white’ it is not the same to say (a) which things are said ‘white’ and (b) what is the essence of ‘white’ and its definition. The principle is stated with reference to the ‘one’ and is thence extended to other terms, such as ‘element’ and ‘cause’:

«But we have to keep in mind that it should not be assumed that (a) establishing which things are said ‘one’ and (b) establishing what being one and its definition are, are the same... For ‘being one’ sometimes (b.1) will coincide with some of the aforementioned things, sometimes, (b.2) with a different sense, which is in addition closer to the name itself, while the preceding ones are by *dunamis* (or: closer to the *dunamis*) as it happens in the case of ‘element’ or ‘cause’, if one had to talk distinguishing with reference to what they are applied or giving the definition of the name» (*Metaph. 1052b 1-9 [...] 13-19*).

What holds for *hen* holds for *aition* and *stoicheion* as well. Therefore, either (b.1) one of the four over mentioned *aitiai* must be considered as

55 Στοιχεία μὲν κατ’ ἀναλογίαν τρία, αἴτια δὲ καὶ ἄρχαι τέτταρες· ἄλλο δ’ ἐν ἄλλῳ, καὶ τὸ πρῶτον αἴτιον ὡς κινοῦν ἄλλο ἄλλῳ ἄλλῳ.
56 *Hote* is here used in a non-temporal sense; cf. L.-S. s.v. *hote*, C.
57 Δεῖ δὲ κατανοεῖν ὅτι οὕς ὁσάντως ληπτέοις λέγεσθαι ποιῷ τῇ ἐν λέγεται, καὶ τῇ ἑστὶ τὸ ἐνὶ εἶναι καὶ τῷ αὐτοῦ λόγῳ... Τὸ δὲ ἐνὶ εἶναι ὅτε μὲν τούτων τινι ἔσται, ὅτε δὲ ἄλλῳ δ’ καὶ μᾶλλον ἐγγὺς τῷ ὄνοματι ἑστι, τῇ δυνάμει δ’ ἐκείνα ὅσπερ καὶ περὶ στοιχείου καὶ αἴτιου εἰ δέοι λέγειν ἐπὶ τοῖς πράγμασι διορίζοντα καὶ τοῦ ὄνοματος δρον ἀποδιδόντα.
the definition of being a cause in itself, or (b.2) there is a further meaning of *aitia*, which is ‘closer to the name itself’. In the first case we will have a sort of focal meaning, as for *to on*, namely one of the meaning applied to beings shall work as a core meaning for all other meanings. In the second case, on the other hand, we shall consider a different meaning. But in what sense should this further meaning be ‘different’? On this point the debate is rich: some interpreters consider (b.2) as an opposition between a sense in itself and a sense in potency\(^{58}\), others as the opposition of a nominal definition and a verbal definition\(^{59}\), others as the opposition between a determinate sense and an universal sense\(^{60}\). For ‘cause’ as well, either we must choose one of the four meanings of ‘cause’ as central meaning from which the others derive, or to find a further meaning, closer to the word and applying to every cause.

An example concerning the word *stoicheion* follows. Fire is an element, but it is not the «being an element» (*tò stoicheíwç èínavi, 1052b 12). Aristotle proceeds:

> «the name expresses the idea of this particular property which is ascribed to fire, i.e. that ‘something derives from it as its first component’. The same holds for ‘cause’ and ‘one’ and all similar cases; for this ‘being one’ is ‘being indivisible’ […] but above all it is ‘being primary measure’ in every genus and, in particular, in quantity» (1052b 13-19)\(^{61}\).

In this passage — to our disappointment — Aristotle tells us what is the meaning which is ‘closer to the name’ in the case of the one («primary measure», 1052b 18) and what is such meaning in the case of the element too («first immanent constituent», 1052b 14), but he does not tell us what is the main meaning of *aitia* — which lets us in perplexity. Nonetheless we know that such a meaning exists, because this is explicitly stated at 1052a 15 (quoted above).

\(^{58}\) Ps. Alexander, *in Metaph.* 605, 18; Bonitz (1849), p. 416 (in any case Bonitz thinks that the passage is corrupted); Centrone (2005), p. 24, with some qualification.

\(^{59}\) Ross (1924), II p. 282, who refers to Plato, *Crat.* 393d 3-394c 8.

\(^{60}\) Reale (1968), II p. 475.

\(^{61}\) Τὸ δὲ ὅνομα σημαίνει τὸ τοῦτο συμβεβηκέναι αὐτῷ, ὃτι ἔστι τι ἐκ τοῦτου ὡς πρῶτον ἐνυπάρχοντος. Οὕτω καὶ ἐπὶ αἵτινι καὶ ἕνος καὶ τῶν τοιούτων ἄπαντων, διὸ καὶ τὸ ἐνὶ εἶναι τὸ ἀδιαιρετῶς ἐστὶν εἶναι…. μάλιστα δὲ τὸ μέτρον εἶναι πρῶτῳ ἐκάστου γένους καὶ κυριώτατα τοῦ ποσοῦ.
A more precise indication can perhaps be found elsewhere in the *Metaphysics*. The connection between *aitia* and *hen* can be found in book Gamma as well. Here *aitia* is strictly tied to *archê*:

«Accordingly, if being and one are the same thing and one single nature in the sense that they follow each other, precisely as principle and cause do» (*Metaph* 1003b 22-5).

This only means that everything which is a being is also one and that everything which is principle is also cause, τὸ ἀκολουθεῖν «in virtue of the fact that they follow each other». The link between *aitia* and *archê* is explicitly stated by Aristotle in *Metaph.* Δ 1 as well. Here, after a list of the senses of *archê*, Aristotle adds:

«(1) The causes are said in as many ways: for every cause is a principle. (2) Now, it is common to all kinds of principle that they are the first beings, starting from which are given being, coming to be and knowledge; and some principles are immanent, some are external. (3) For this reason the nature and the element are principles as well as thought and choice and substance and end: (4) for the good and the beautiful are principle of knowledge and of movement for many things» (*Metaph.* 1013a 16-23).

In this passage, (1) confirms what is said at 1033b 22-5: being a principle belongs to every being to which also being a cause belongs. (2) establishes the general meaning of ‘principle’. This must correspond to what was designated as «the meanings closer to the name» in I 1. It is: «being the first starting from which something is given».

In addition internal and external principles are distinguished, which had not been done before. On the basis of this distinction, in (3) the notion of principle is applied to the four causes: matter (nature and element), mover (thought and choice), form (substance) and end. (4) explains how the final cause is also a principle, which might appear strange, given the superficial meaning of the respective words (‘final’ and ‘beginning’):

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62 *Episthêma* 57b 54: ἰδιὰ τὸ δὲν καί τὸ ἐν ταύτω καί μία φύσις τῷ ἀκολουθεῖν ἀλλήλοις ὅσπερ ἀρχὴ καί αἴτιον.

63 *I. skhôs* δὲ καί τὰ αἴτια λέγεται πάντα γὰρ τὰ αἴτια ἀρχαῖ. Ἡσιόδων μὲν οὖν κοινὸν τῶν ἀρχῶν τὸ πρῶτον εἶναι δὲν ἢ ἔσται ἢ γίγνεται ἢ γεγονότειν τούτων δὲ αὐτὸν ἐνυπάρχουσαι εἴσον αὐτὸ δὲ ἔκτος. Διὸ ἢ τε φύσις ἀρχὴ καί τὸ στοιχεῖον καί ἢ διάνοια καί ἢ προαίρεσις καί σύστα καὶ τὸ οὐ ἕνεκα πολλῶν γὰρ καὶ τοῦ γνώναι καί τῆς κινήσεως ἀρχὴ τάγαθον καί τὸ καλὸν.

64 Cf. Bonitz (1849), p. 221.
coming-to-be and knowledge can be brought about starting from the end as well\textsuperscript{65}.

It seems to me that both in the passage from Π and here Aristotle wants to ascribe to every \textit{aitia} the feature of being an \textit{archê}, but he does not want to identify the notion of \textit{aitia} with the notion of \textit{archê}. Therefore \textit{archê} is not the general term which indicates the meaning of \textit{aitia} which is «closer to the name»\textsuperscript{66}. In conclusion we are still unsure what the general meaning of ‘cause’ would be.

The problem of the general meaning of \textit{aitia} has been tackled by the commentators. Alexander of Aphrodisias, in the commentary on 1003b 22-5 (quoted above), says:

«He says that being with respect to the one is in the same sense in which principle and cause are the same. For these both follow each other and are predicated of the same object (for what is principle is cause and what is cause is principle) and nonetheless their definition and the concept that we form in our mind are different, depending on whether we say ‘principle’ or ‘cause’ (for [a] it is a principle as long as it is first with respect to the things whose principle it is and as long as the things whose principle it is depend on it, [b] it is a cause as long as the things whose cause it is are in virtue of it; one thing is ‘that from which’ something depends and one thing is ‘that in virtue of which’.) (\textit{in Metaph.}, 247, 8-15)\textsuperscript{67}.

Therefore every being which is a principle is also a cause and vice versa, but the notion of principle and the notion of cause are different\textsuperscript{68}. Alexander repeats Aristotle’s definition of ‘principle’ at 1013a 18 (see below) while for the definition of ‘cause’ he resorts to \textit{APo.} 85b 38-90a 7 or to \textit{Phys.} II 3, 194b 19-20, namely to the idea (expressed in both texts) that knowing the \textit{dia ti} is the same as knowing the \textit{aitia}. ‘Cause’ is defined


\textsuperscript{66} In this sense I modify what I said in Natali (1997a). See also the discussion in Crubel-lier (2000), p. 159.

\textsuperscript{67} \textit{Λέγει δὲ τὸ ἐν τῷ ὁντὶ οὕτω ταῦταν ἐίναι ὡς ἐστὶ ταῦτα ἀρχὴ τε καὶ αἴτιον. Ὁς γὰρ ταῦτα ἀμφότερα μὲν ἀκολουθεῖ τε ἄλληλοις καὶ κατὰ τοῦ αὐτοῦ κατηγορεῖται (ὅ γὰρ ἀρχὴ, τοῦτο καὶ αἰτίον, καὶ δ ἄτιον, τούτο καὶ ἄρχη), ἄλλος μὲντοι λόγος αὐτοῦ καὶ ἄλλη ἐπιβολὴ τῆς διανοίας καθό ἀρχὴ λέγεται καὶ ἄλλος καθό αἴτιον (ἡ μὲν γὰρ ἀρχὴ καθό πρῶτον ἐστὶ τοῦ οὗ ἐστιν ἀρχὴ, καὶ καθό ἐξ αὐτοῦ τὰ ὑπὸ ἔστιν ἀρχὴ, τὸ δὲ αἴτιον καθό ἐστι δι’ αὐτό τὸ οὗ ἄτιον ἄλλο δὲ τὸ δὲ ἐξ οὗ ἐστὶ καὶ ἄλλο τὸ δι’ ὧν ἔστιν ἀρχή).}

\textsuperscript{68} Cf. Ross (1924), I, p. 257 and 291; Owens (1951), p. 161 n.
as to dia ti. The reason for that it that Alexander did not find any other general definition of aitia in the Metaphysics⁶⁹.

Simplicius touches upon the problem of the general notion of cause in his commentary on the second book of the Physics. In the passage at issue his aim is to modify Aristotle’s scheme of the four causes by adding the instrumental cause and the paradigmatic cause, which are typical of Neo-Platonism. But he deals also with the general notion of cause (316, 22-317, 4). It can be easily seen that we are very far from Aristotle’s doctrine of the causes. Nevertheless Simplicius’ solution is interesting. He says:

«One might argue that these are the kinds of cause, and neither more nor fewer than these, starting from a division, and saying by way of introduction that those things are causes (1) in virtue of which a being is what it is, and comes to be what it comes to be, and (2) which we provide when one asks the reason why». (Simpl., in Phys. 316, 29-33)⁷⁰.

Simplicius adds meaning (2) to meaning (1) already in Alexander. In Simplicius too the cause is characterized both as that in virtue of which things are or come to be, and besides as an explanation. In this way Aristotle’s commentators have integrated the lacuna in their master’s writings and have identified the general meaning of aitia with the dia ti or di’ho. This is an answer, but hardly a clear and informative one.

Our enquiry thence comes to an impasse: Aristotle has said that there is an extensional meaning of aitia, i.e. the four causes, and an intensional meaning, i.e. ‘being a cause’, but has not told us — at least not in the writings at our disposal — what the latter is. Nevertheless, perhaps some indication on the features of ‘being a cause’ can be gathered from other passages.

2.5. Features of Aristotle’s notion of cause

Aristotle’s theory of causes has a set of important features, which I shall sum up. As the majority of other notions of causality, Aristotle’s

⁶⁹ A formulation very close to Alexander’s can be found in EE, 1227a 14: τὸ δὴ δ’, preceded by a reference to the Posterior Analytics (1227a 10-11).

⁷⁰ Οὕτω δὲ τοσοῦτοι εἶσιν οἱ τῶν αἰτίων τρόποι καὶ οὕτω πλέον εἴη εἰλαττονες, τὰχα αὖ τις καὶ ἐκ διαφέρεσις συλλογίσατο, τοσοῦτον προειπάν ὅτι αἴτια ἐκεῖνα ἔστι δὴ ὧδ’ ἐστὶ τὸ τὸν οἷὸν ἔστι καὶ γίνεται τὸ γινόμενον, καὶ ἀπερ ἑρωτηθέντες τὸ διὰ τὸ ἀποδίδομεν.
causality indicates (1) a kind of relation. In addition, according to Aristotle this relation is (2) a relation of objective dependence, which is (3) unidirectional, (4) transmissible and (5) necessary.

Let us start with features (4) and (5). According to Aristotle, causality is transmissible, but only within finite causal segments, which start with a first cause and end with an effect: if $a$ is aitia of $b$, $b$ is aitia of $c$, and $c$ is aitia of $d$, then $a$ is aitia of $d$ (cf. Metaph. α 2, 994a 11-16). The first aitia is the aitia of all successive members of the series ($b, c, d$); intermediate members, $b$ and $c$, are aitiasi, but not first aitiasi, of the successive members — $b$ of $c$ and $d$, $c$ of $d$ only. Causality is transitive from $a$ to $c$, but the role of first cause is not transmissible in this sense. In this sense, the chain of causes finds application only within each single species of aitia: a chain of final causes is characterized by two extremes and a series of intermediates which are all final aitiasi. Every chain starts with a first aitia, which has no further aitia of the same kind. Causal transmission is necessary, at least according to some passages from the Metaphysics (E3). On this point the debate is still open (see Sorabji 1980). By way of contrast, for the Stoics the universal chain of causes is necessary but, at first sight, causality is not transmissible: if $a$ is the cause of $b$ and $b$ is the cause of $c$, then $a$ is not the main or principal cause of $c$.

Let us now consider properties (2) and (3). In the Posterior analytics the relation of causality is said to imply the irreversible priority of the cause with respect to the effect:\footnote{In this sense Aristotle’s notion of causality differs from the conceptions of causality based on regularity as well as from counterfactual conceptions, which cannot exclude the dependence of the cause on the effect (Kistler 2002, p. 644-53). It can happen to read that ancient philosophy lacks the notion of ‘effect’; this is not correct: in Metaph. Δ 2, 1014a 10, Aristotle uses a periphrasis: ἐφ’ ὅν αἴτια τὰ αἴτια, which (pace Wieland) indicates exactly the notion of ‘effect’, while in APo. II 16, 98a 36 there appears — always to indicate the effect — the word τὸ αἴτιατον, which will be commonly used, with this meaning, in later philosophy; cf. e.g. Zeno in Stob. I, p. 138, 14 ss. (= SVF I 89). It is interesting to notice that the term τὸ αἴτιατον is not listed in Bonitz’ Index aristotelicus.}

«It is not possible that they are mutually cause of each other, for the cause precedes what it is the cause of, and in the eclipse the cause is the interposition of the earth, while the eclipse is not the cause of the interposition of the earth» (APo. 90b 16-19)\footnote{Μὴ ἐνδέχεται αἴτια εἶναι ἄλληλοιν (τὸ γὰρ αἴτιον πρῶτον οὐ αἴτιον, καὶ τοῦ μὲν ἐκλείπειν αἴτιον τὸ ἐν μέσῳ τὴν γῆν εἶναι, τοῦ δ’ ἐν μέσῳ τὴν γῆν εἶναι οὐκ αἴτιον τὸ ἐκλείπειν), see also Cat. 14b 11-3.}.
The relation of cause and effect is unidirectional (14b 13-22; cf. Hankinson 1998, p. 166-7), therefore the word *aitia* indicates an asymmetrical relation which is not reversible:

\[C \Rightarrow E\]

This relation must be specified on the basis of the four kinds of causality. In other words, the four *eidê* of *aitia* are four kinds of relation of dependence which happen in the world. Accordingly we have a *dependence account* of causality, which nonetheless includes a *productivity account* as a particular case — i.e. as a case which is confined to just one of the four causes: the mover\(^{73}\).

In Aristotle’s philosophy, saying that ‘*a* is *aitia* of *b*’ amounts to saying:
- that there is an asymmetrical relation of dependence between *a* and *b*;
- that this relation is a real one in the world;
- that this relation is transitive: if *a* is *aitia* of *b* and *b* is *aitia* of *c*, then *a* is *aitia* of *c*;
- that this relation can belong to only one of the four kinds described in the *Physics*;
- that the nature of the dependence varies on the basis of the relevant kind of relation;
- that one and the same science can have all four relations as its object.

Saying that *a* is *aitia* of *b* is not saying something completely clear, because we are just saying that *b* depends on *a*, but we have not specified yet the kind of dependence we are talking about. At the same time, saying that *a* is *aitia* of *b* does not amount to saying something utterly murky, because we know that the possible relations are only of four kinds and that we just need to specify our statement with reference to one of them in order to make it clear. In this sense, Aristotle’s notion of *aitia* appears to be close to those contemporary theories which regard the cause as a *cluster concept*, although there are significant differences. For such theories are based on the idea that there is a series of distinct criteria such that none of them, taken in isolation, is necessary, but each of them is sufficient to characterize a being as a cause; such criteria are connected to each other by a series of «family resemblances» (Godfrey-Smith 2009, p. 332; Longworth forthcoming). Aristotle, on the other hand, at 1051b 1-9 assumes a general

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meaning of cause apart from the four particular meanings — which the supporters of the cluster-concept approach do not do. Aristotle’s conception is stronger than the contemporary.

4. Summary and conclusion

The main theses proposed in the present essay are the following:

1) As for Plato:
   – *aitia* is a word of everyday language and is used as such;
   – the word *aitia* indicates an accusation or a guilt;
   – *aitios* can be indifferently translated as ‘guilty’, ‘blameworthy’ or ‘responsible’;
   – the cause or the responsibility can be ascribed to mental functions such as pleasure or reasoning;
   – Plato is not inclined to ascribe causality to inanimate natural beings;
   – in the passages in which Plato explains the meaning of the word, *aitia* is confined to the notion of a maker, *to poioun*;
   – it is possible to use *aitia* in improper and metaphorical ways as well; in this case, this term indicates an ‘explanation’ and is used with reference to states of affairs, events and complex situations.

2) As for Aristotle:
   – we have to do with a different literary genre: Aristotle’s writings are treatises meant to be read in his school and are therefore written in a more technical language;
   – the usages of *aitia* in the sense of accusation or guilt are quite rare;
   – when Aristotle lists the meanings of *aitia*, he completely omits to mention these senses: for he does not refer to the common use of the word, but to the Academic debate of his time;
   – for this reason Aristotle does not provide any justification of his distinction of the four kinds of *aitia*: the Academic debate must have been known to his audience;
   – Aristotle operates a ‘deconstruction’ of the Platonic cause, separating the moving and productive function from the function of *paradeigma* and from the material function; in addition, he conciliates Presocratic and Platonic causality: matter and form can coexists once they are deprived of the efficient function;
– Aristotle distinguishes different causes with different functions; they are conveyed through the use of different particles, as it will become usual in the philosophical debate of the imperial age;

– translating *aitia* with ‘explanation’ can be misleading: this translation implies the ascription to the cause of a mainly epistemological function, which is not correct;

– apart from the four causes, Aristotle distinguishes a principal meaning of *aitia*, which is different from the meaning of each of them, but, in the preserved writings, he does not say what this is; none the less we can infer from other passages what the word *aitia* means for Aristotle.

With respect to the fundamental article by Frede (1987), our thesis differs in various respects. From the historical point of view, it seems to us that: (1) it is true that in Hellenistic philosophy the notion of cause is more limited than Aristotle’s one, and corresponds, more or less, to Aristotle’s efficient cause. But (2) this restriction is probably influenced by the Platonic use. As a matter of fact, Platonism exerts a strong influence on the theory of causes on Hellenistic philosophies and, in particular, on Stoicism (Moreau 1939, p. 160; Solmsen 1963, p. 495; Kraemer 1971, p. 108-131). In this sense Aristotle’s theory of causes, which is a theory of causality as dependence and not as production, seems to be an isolated case in ancient thought. In Plato and in Hellenistic philosophy the notion of cause was identified with the notion of a producer, and Peripatetic approach was not accepted by other schools. In later history of western thought, however, there were many more *dependence accounts* of the notion of causality.

From the theoretical point of view we can set us a question: does Aristotle’s deconstruction provide us with a sense of cause which is still of some interest for today’s debates or is it historically surpassed? As Fine (1987, p. 71) justly points out, how we answer the question depends on how we intend the notion of cause. After the end of XXth century, and in particular over the last decade, the debate on the cause has regained strength. Frede referred to the notion of cause which is typical of common language, as something that, in some senses, ‘produces’ (or ‘brings about’) its effect; in Frede’s account, the only alternative to this conception of cause was the Humean theory of cause as constant connection

reckoned as ‘muddled’. Many other authors have followed him on this point and denied that the Aristotelian use of the term *aitia* can be rendered with ‘cause’; as an alternative translation, they have proposed ‘explanation’ and similar terms (Hocutt 1974, followed by Annas, Barnes, Fine, Hankinson and others). Today this issue appears to us in a different light.

I take it for granted that Aristotle’s notion of cause does not correspond to what we intend *prima facie* by ‘cause’; but neither the conception of cause as regularity of connection between two events under a determinate physical law nor the counterfactual account of cause reflects our intuitions on the common use of that word. According to our interpretation, what Aristotle proposes is a philosophical theory of the cause which does not assume the word *aitia* from common use. He operates a deconstruction and a reconstruction of the semantic field of the concept of *aitia*.

Today the debate on the notion of cause is constantly growing and many different theories compete with each other. I think that Aristotle’s thesis should be assessed on the basis of this debate. On the one hand, some people think that the main opposition at stake is between «(a) dependence accounts of causation and (b) production ones» (Psillos 2009, p. 154). Amongst the theories of causation as dependence we could mention theories based on regularity, probabilistic theories and counterfactual theories, although the latter seem to be characterized by a certain scepticism. Amongst the theories of causation as production, we could mention those based on the notion of intervention and manipulation as well as those which are linked to the notion of *causal powers* and those which start with the notion of causal process as transmission of a *mark* from one being to another.

On the other hand, some other people claim that the main opposition in the debate is that between (c) reductionist accounts of causality and (d) ‘primitivist’ accounts, which assume causality as a not further analysable concept if not in terms which are causal in their turn.

The debate concerns also whether the notion of causation is (e) epistemic and, in some sense, subjective or, rather, (f) physical and objective; whether ‘cause’ must be defined, or can be known only through the ostension of paradigmatic cases, and so on; whether it is transmissible or non-transmissible; whether the causal relation is necessary or not. So, the field of the enquiry into causation today appears wide open and the debate is extremely lively75.

75 A concise overview of the debate on causality is provided by Laudisa (1999) (in Italian); see also Kistler (1999), p. 17-102 and the very useful essays collected in Beebe et al. (2009).
Against this background, the claim that Aristotle’s notion of causation is ineludibly confused requires revision. Aristotle’s theory of the cause is a theory of causality as dependence, which nevertheless is not opposed to the conception of causality as production — as it is the case in the contemporary debate — but assumes the latter as a particular case (a and b). Furthermore, it is a realistic theory, since it admits that causal dependence exists in the world (f, not e). And it is primitivistic, since does not reduce aitia to a some more basic concept (d not c). From the point of view of the transmissibility of causation, this theory seems to assume an intermediate position: on the one hand, it admits transmission, but, on the other hand, it admits it only within limited segments and does not admits infinite chains of causation for a single event. As for necessity, Aristotle’s theory seems to spread the question over the different kinds of dependence and the different objects between which these dependences hold, instead of assuming a univocal solution to the issue. All these features make Aristotle’s notion of causality at least in part comparable with the one or the other contemporary view and not a notion completely foreign to the contemporary debate, as it might have appeared in the second half of the XXth century.

Usually, the history of the notion of cause started from Galileo or even Hume. Frede suggested to bring it back to Stoics. Now, with a richer and more nuanced notion of cause, we can see the interest of older speculations, as Plato’s and Aristotle’s. The historian’s hope is that they can offer some suggestion also to the contemporary debate.

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REFERENCES


