

Conviction and Priority in Aristotle's Account of Scientific Understanding

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Aristotle is often portrayed as a certain sort of rational foundationalist, who thinks that all our scientific understanding (*ἐπιστήμη*) is justified on the basis of first principles, and that these first principles are themselves justified by some non-inferential form of rational intuition (*νοῦς*). It's usually admitted that experience and observation play an important role for Aristotle, and are in some way responsible for our coming to develop the rational intuition in question. But on the foundationalist reading, only our rational intuition is *epistemically* relevant—experience and observation might be good ways to bring about the right sort of intuition, but (the story goes) they cannot *justify* our grasp of first principles in and of themselves.¹

Aristotle's remarks about epistemic priority are typically invoked to motivate foundationalist readings of this sort. Aristotle tells us that:²

they [= the premises in our demonstrations; first principles most of all] must be explanations and better known and prior [relative to our demonstrated conclusions]—explanations because we only understand something when we know its explanation, prior since they are explanations, and known beforehand not only in the sense that we comprehend what they mean, but also that we know them to be the case. (*APo* A2 71b29-33)

Foundationalist readers take this passage as evidence that Aristotle considers first principles primitive in two distinct senses: primitive in the natural, metaphysical

¹Irwin (1988: 132–36) provides a characteristic example of this kind of take on Aristotle's epistemology, as well as the most sustained argument in its defense. Among specialists, Allan (1970: 118), Anagnostopoulos (2009: 107), Ferejohn (2009: 66, 75), Frede (1996: 172), Grote (1872: 292–93), Kraut (2006: 89), Le Blond (1939: 127, 136–39), and Ross (1949: 49–50) express similar views. But foundationalist portrayals of Aristotle are also widespread in the modern literature on epistemic foundationalism—see for instance the IEP article on the subject (<http://www.iep.utm.edu/found-ep/>) or Sosa (1997: 282).

²Unless otherwise noted, translations are my own.

order (i.e. *explanatorily* basic), but also primitive in an *epistemic* sense—i.e. such that our knowledge of them serves as a primitive source of *justification*. These two forms of priority, they argue, might come apart: we might be justified in believing some metaphysically prior fact on the basis of some metaphysically posterior one, for instance when we infer an explanation for something we already know.³ But in the case of first principles, they coincide: principles serve both as our ultimate explanations *and*, when intuited, as our ultimate source of justification.

This sort of view is often taken to explain why Aristotle thinks we should be convinced of first principles “better” or more strongly (*πιστεύομεν μᾶλλον*) than we are of their demonstrative consequences (*APo* A2 72a25ff).⁴ If our noetic grasp of first principles serves as a basic source of warrant for our demonstrated conclusions, then whatever justification we have for believing these principles will have to be stronger—or at least as strong—as our justification for believing the claims demonstrated on their basis. So on the foundationalist view we should be most strongly convinced of principles precisely because of their foundational justificatory role.

Foundationalist interpretations of this sort have been criticized before.⁵ But the criticisms have not gone far enough. First, because they tend to neglect more sophisticated formulations of the foundationalist view, which are sensitive to the fact that Aristotle does not generally share the justificatory concerns of modern epistemologists. And second, because they do not offer an adequate reading of Aristotle’s remarks about conviction—either they claim that these remarks are out of line with the rest of *APo*, or that Aristotle has an unusual kind of conviction in mind, or again that an expert’s conviction merely concerns the *role* principles play as principles, rather than the principles themselves. I will argue here that these concessions are unnecessary—Aristotle’s remarks about epistemic priority and conviction do not make him a foundationalist, even on careful formulations of the view.

I’ll begin by offering an account of epistemic priority in Aristotle. I’ll argue on the basis of related passages from *APo* and Aristotle’s lexicon (especially *Met*

³In such cases, we would initially know *p* without knowing anything about what might explain it, and would then infer *q* as an explanation for *p*. The metaphysical and epistemic orders would thus be opposite: *p* would be epistemically prior, but explanatorily posterior, to *q*. This thought is already present in Philoponus’ commentary on this passage.

⁴See for instance Anagnostopoulos (2009: 107), Grote (1872: 292), Irwin (1988: 132), or Salmieri et al. (2013: 5). Sometimes foundationalism is also taken to explain the sense in which our intuition of principles is “truer” and “more exact” than whatever we might understand on its basis, as Aristotle tells us at *APo* B19 100b5ff (cf. also *APo* A27, where exactness and priority are associated with each other).

⁵Most famously in Burnyeat (1981), but see also Bronstein (2016: 128–29) and Goldin (2013) for more recent treatments of the key texts.

Δ11) that Aristotle’s first principles are not *justificatory* primitives—on the view I defend, principles are primitive in a metaphysical explanatory order, and the sort of epistemic priority Aristotle assigns them is strictly meant to reflect this fact. I will then consider the sort of conviction Aristotle assigns to an expert’s grasp of first principles, and argue that (despite appearances) this conviction is not indefeasible, and therefore does not provide a justificatory bedrock for our demonstrative conclusions. If this is right an expert’s grasp of principles *can* be justified—at least on a commonplace way of thinking about justification—and this does not threaten what Aristotle has to say about the role these principles play as epistemic primitives, or as sources of conviction for the conclusions she might demonstrate on their basis.

I will further argue, however, that the notion of *justification* does not adequately capture any of the various forms of priority or conviction Aristotle employs in his writings. Epistemic and metaphysical priority are both better understood as parts of Aristotle’s account of human learning as a process beginning from things better known to us, and progressing to things less well known to us but better known “by nature,” as are his claims about conviction in the context of demonstrative science. We should thus resist not only the foundationalist view, but also the terms in which its proponents defend it.

1 Scientific Understanding and Its Principles

Aristotle’s most extensive treatment of scientific understanding is found in *APo* A2. It begins with the following definition:

[1] We think we understand something *simpliciter*, and not in the sophistical, incidental manner, when we think we know of the explanation (*αἰτία*) why something is the case, that it is its explanation, and also [know] that it’s impossible for it to be otherwise.

Ἐπίστασθαι δὲ οἰόμεθ’ ἕκαστον ἀπλῶς, ἀλλὰ μὴ τὸν σοφιστικὸν τρόπον τὸν κατὰ συμβεβηκός, ὅταν τὴν τ’ αἰτίαν οἰώμεθα γινώσκειν δι’ ἣν τὸ πρᾶγμα ἐστίν, ὅτι ἐκείνου αἰτία ἐστίν, καὶ μὴ ἐνδέχασθαι τοῦτ’ ἄλλως ἔχειν. (71b9-12)

We understand some fact *x* when we know why *x* must be the case, and recognize the explanation why *x* as an *explanation why x*. Scientific understanding is thus a theoretically sophisticated state—to understand some scientific domain we must not only know how to explain the truths pertinent to that domain, but also know what explanatory role our explanations play.

In the rest of A2, Aristotle offers a demonstrative account of this sort of scientific understanding:

[2] We'll say later whether there is another kind of understanding; we do claim here that there is knowing through demonstration.⁶ By “demonstration” I mean a scientific deduction, and by “scientific” [deduction] I mean [the sort of deduction] by possessing which we understand [something]. So if to understand is what we've posited it to be [in 71b9-12], demonstrative understanding must be from [premises] that are true, primitive, and immediate, and better known than, prior to, and explanatory of their conclusion; for it's in this way that the principles will be appropriate to what's being proved. There can be a *deduction* even when these conditions aren't met, but no *demonstration*, for it won't produce understanding.

Εἰ μὲν οὖν καὶ ἕτερος ἔστι τοῦ ἐπίστασθαι τρόπος, ὕστερον ἐροῦμεν, φημὲν δὲ καὶ δι' ἀποδείξεως εἰδέναι. ἀπόδειξιν δὲ λέγω συλλογισμόν ἐπιστημονικόν ἐπιστημονικὸν δὲ λέγω καθ' ὃν τῷ ἔχειν αὐτὸν ἐπιστάμεθα. εἰ τοίνυν ἔστι τὸ ἐπίστασθαι οἷον ἔθεμεν, ἀνάγκη καὶ τὴν ἀποδεικτικὴν ἐπιστήμην ἐξ ἀληθῶν τ' εἶναι καὶ πρώτων καὶ ἀμέσων καὶ γνωριμωτέρων καὶ προτέρων καὶ αἰτίων τοῦ συμπεράσματος οὕτω γὰρ ἔσσονται καὶ αἱ ἀρχαὶ οἰκείαι τοῦ δεικνυμένου. συλλογισμὸς μὲν γὰρ ἔσται καὶ ἄνευ τούτων, ἀπόδειξις δ' οὐκ ἔσται οὐ γὰρ ποιήσει ἐπιστήμην. (71b16-25)

On Aristotle's view, then, a demonstration is a deduction that provides the person who grasps it with an *understanding* of its conclusion: we understand the things we can demonstrate. To count as a demonstration, a deduction must begin from premises which are true, primitive, and immediate. It's clear enough why Aristotle would want these initial premises to be true. To require that they also be *immediate*, or *unmiddled things* (ἄμεσα) is to require that they not have an explanatory “middle term,” that is, given some premise AaC , that there be no term B such that AaB and BaC where B explains why AaC .⁷ Finally, to require that these premises be *primitives* (πρώτα) is to require that our understanding of these premises not depend, in some way, on our understanding of further prior premises. My aim in what follows will be to spell out the exact sense of priority and dependence at play. On foundationalist readings the sort of priority Aristotle has in mind is (or includes) *justificatory* priority: our understanding of demonstrated conclusions is *justified* by our grasp of the premises from which our demonstrations begin.

In addition to these three requirements, Aristotle tells us that demonstrative premises must be better known than, prior to, and explanatory of their conclu-

⁶The nondemonstrative understanding alluded to here is presumably our understanding of the indemonstrable principles from which our demonstrations begin—i.e. *νοῦς*. For *νοῦς* as a species of understanding, see for instance *APo* A3 72b18-21.

⁷For instance, “planets are non-twinkling” is not an *immediate* premise, as Aristotle makes plain in *APo* A13. For *nearness to the earth* explains why planets don't twinkle—in this case the relevant syllogism (reconstructed slightly) goes “All planets are near the earth (AaB), all things near the earth are non-twinkling (BaC), so all planets are non-twinkling (AaC).”

sions. Though he doesn't make the point clearly here, Aristotle conceives of demonstrations as chains of explanatory syllogisms, and strictly speaking these last three requirements should be read as requirements on each of the *syllogisms* that appear in the context of a demonstration, rather than requirements on the demonstration as a whole. Read this way, his claim is that the premise pairs in each of the syllogisms appearing in a demonstration will have to *explain* that syllogism's conclusion—so that the middle term *B* in the premise pair *AaB*, *BaC* will have to explain why *AaC*, the middle term *C* in the premise pair *AaC*, *CaD* will have to explain why *AaD*, and so on for all syllogisms in a deduction beginning from an initial premise *AaB* and ending with some demonstrated conclusion *AaX* (for some term *X*). The premises in each of these premise pairs will moreover have to be *better known than* (*γνωριμώτερα*) and *prior to* (*πρότερα*) their corresponding conclusions—and our demonstrations will thus begin with the premises that are *most prior* (i.e. primitive) and *best known*.⁸

These explanatorily basic, primitive, and best known premises are the *first principles* (*ἀρχαὶ*) proper to some scientific domain, and the principles relevant to the passages I will be discussing are *definitions*.⁹ Definitions state the essence of the natural kinds studied by some science—so for instance “triangles are three-sided rectilinear figures” might be a geometrical principle, if indeed this is what triangles are essentially, and something no further geometrical fact could explain. Since first principles cannot be explained and demonstrations explain their conclusions, first principles cannot be demonstrated. We therefore understand principles in a nondemonstrative way—in Aristotle's terminology we “intuit” or have *νοῦς* of principles.¹⁰

⁸All these relations are asymmetric and transitive—*AaB* is prior to *AaD* if it's prior to *AaC*, and primitive if there is no *AaX* prior to it. I'll be discussing the “better known” relation in more detail below; for now it's enough to note that, as it's being used here, the “better known” relation tracks explanatory priority.

⁹At 72a15ff Aristotle tells us that first principles also include *axioms* (*ἀξιιώματα*) and *suppositions* (*ὑποθέσεις*). Axioms are (roughly) basic logical laws anyone must assume in their deductions. Aristotle's discussion of suppositions is hard to follow—he seems to think of suppositions as existential statements corresponding to some definition (e.g. the statement *that* triangles are three-sided rectilinear figures, where this is contrasted with a definition expressing what it is to be a triangle), but it's clear from elsewhere that definitions have existential import (*APo* B7 92b17-19) and are expressed in subject-predicate form (*APo* B3 90b3-4). We can ignore this difficulty here, however: Aristotle's claims about the priority and explanatory role played by principles are most easily read as claims that concern definitions only—and Aristotle often speaks as though all first principles are definitions (cf. Barnes (1993: 107)).

¹⁰Aristotle identifies *νοῦς* as a kind of nondemonstrative understanding at *APo* A3 72b18-21. Saying that *νοῦς* grasps principles doesn't in itself tell us anything about the role *νοῦς* plays in our *learning* these principles: it only tells us that once we know them in the right way we have *νοῦς* (cf. Barnes (1993: 267–70) and Leshner (1973: 63–65)). The claim that we grasp first principles

This demonstrative treatment of scientific understanding gives us a clear picture of what it takes to understand the propositions that make up some scientific domain: begin with the truths in this domain that can't be explained, and demonstrate those that can through a series explanatory syllogisms meeting the conditions outlined above. Demonstrations will make manifest the explanations for our demonstrated truths as explanatory *middle terms*. They will also make manifest the *necessity* of our conclusions: demonstrated propositions will involve some reference to the *essence* of their subject, and thereby reveal the attributes the subject *must* have if it really is to be the kind of subject it is.¹¹ So someone who knows how to demonstrate something knows that it must be the case, and knows its explanation in its explanatory role—the two conditions on understanding set out in [1]. Scientific understanding of some domain can therefore be conceived as a form of demonstrative expertise, or a “disposition to demonstrate (ἐξίς ἀποδεικτική)” the truths pertinent to that domain, as Aristotle puts it elsewhere (*EN* Z3 1139b31-32).

Nothing so far indicates any explicit concern on Aristotle's part with justification: we can see how demonstrations might yield understanding without considering what *justifies* this understanding or the principles from which our demonstrations begin. There are, moreover, some preliminary reasons to doubt that Aristotle intended his notion of priority to pick out any form of justificatory priority—I will briefly raise them here before examining in more detail the texts foundationalists invoke as evidence for their views.

The first reason stems from Aristotle's usage, on which “primitive,” “immediate,” and “indemonstrable” are almost always interchangeable.¹² At a minimum this suggests that the priority first principles have over demonstrated conclusions tracks their explanatory priority. But one might also think that there is a stronger conceptual connection between these notions—that prior premises don't just

noetically is therefore compatible with the claim that we learn these principles by induction (*APo* B19 100b4). Translating *νοῦς* as “intuition” can obscure this fact, since *intuiting* something is typically a way to *learn* it—but I will use this translation for lack of a better alternative, and also because it's the sort of translation foundationalists typically favor. (Foundationalists need not consider *νοῦς* a way to learn principles to state their view—*νοῦς* can serve as a justificatory bedrock for our understanding even if it is not conceived as a capacity that *affords* us a special grasp of definitional principles.)

¹¹So for instance if we were to *demonstrate* that triangles have angles equal to two right angles, one of our basic principles would be the definition of triangles as three-sided rectilinear figures. Thus if a figure *really is* a triangle, then it must (by definition) be rectilinear and three-sided, and so must (by demonstration) have angles equal to two right angles—in Aristotle's terminology, it will have been shown that the angular sum of triangles belongs to them *per se* (καθ' αὐτό). See Angioni (2014) for a more detailed account of the sort of necessity involved, and its connection with the role principles play as explanations.

¹²This is true throughout *APo*, but for some clear examples see 71b27, 72a7, 72b20, or 75b39.

happen to be explanatorily prior, but that their priority, as Aristotle understands it, is *entailed* by their explanatory role (I'll be arguing this below).

The second, broader reason for doubt stems from the familiar observation that Aristotle does not share the concerns of modern epistemologists.¹³ This is clear already from Aristotle's definition in [1], which presupposes a kind of knowledge different from scientific understanding: to understand *x* scientifically (*ἐπίστασθαι x*) is to *know* (*γιννώσκειν* or *γνωρίζειν*) the explanation why *x*, and know it as such.¹⁴ This other kind of knowledge is knowledge in a prosaic sense—Aristotle is invoking an ordinary cognitive state to define an extraordinary form of theoretical expertise.¹⁵ But he invokes this ordinary knowledge without feeling any need to explain what makes it count as *knowledge*, or what relation it might bear to states like belief or opinion. His primary aim here is to define one particular (and quite unusual) kind of knowledge—not to define knowledge in general, or fend off potential challenges to its possibility.

This emphasis in Aristotle's account is well attested, and one might think that it rules out foundationalist readings from the start: if we can *know* things without understanding them demonstratively, then presumably we can be *justified* in holding certain beliefs without having any sort of demonstration for what we believe—including beliefs in the very propositions that serve as definitions, and of which we might also come to have *νοῦς*.¹⁶ Besides, Aristotle's account of the

¹³See for instance the introduction to Barnes (1993), Burnyeat (1981: 136–39), Kahn (1981: 386–87), Kosman (1973: 380–89), or Taylor (1990: 116–17) for different expressions of this point. Of course, some contemporary epistemologists *do* focus on understanding and seek to distinguish the state from common conceptions of knowledge—see for instance Grimm (2012) or Zagzebski (2001). But these epistemologists typically do not share the concerns that motivate proponents of (contemporary) theories of epistemic foundationalism, and indeed often portray themselves as returning to a form of epistemology found in the writings of Plato and Aristotle.

¹⁴For formulations of the definition with *γνωρίζειν*, see the parallel passages at *Phys* A1 184a12 or *Met* A3 983a26 (sometimes Aristotle also uses *εἰδέναι*). For a more detailed defense of this translation of knowledge terms, see Burnyeat (1981, 2011) or Barnes (1993: 89–93). It's worth noting that a number of foundationalists translate *ἐπιστήμη* “knowledge,” which makes more plausible the thought that justification only really occurs in the context of a demonstrative science (if we only get *ἐπιστήμη* by demonstration and *ἐπιστήμη* is knowledge, it's plausible to think that we only get justification by demonstration). But such a translation obfuscates the distinctions Aristotle draws between various forms of knowledge throughout *APo*. I take the arguments to this effect formulated by Barnes, Burnyeat, and Kosman to be decisive.

¹⁵Aristotle even thinks that we can understand *that* something is the case without understanding *why* it must be the case, and indeed that this sort of understanding *precedes* our understanding why it must be the case (cf. *APo* A13, and B2). So the sort of expertise he treats demonstratively is quite extraordinary: one could rightly be said to have *understanding* “that” (*ἐπιστήμη ὅτι*) without yet having the complete sort of scientific understanding he describes in *APo* A2 (understanding *why*; *ἐπιστήμη τὸ διότι*). On this point see also Kosman (1973: 283–84).

¹⁶Arguably there is some evidence for this in Aristotle's discussion of opinion and understanding

cognitive development that leads to our intuition of principles, as he presents it in *APo* B19 and *Met* A1, clearly assigns observation and practical forms of knowledge a prominent role: *perception* is picked out as a starting-point for our development, and a practical form of *experience* (*ἐμπειρία*) is identified as a key prerequisite to any theoretical understanding of scientific first principles.¹⁷ It's natural to think that these prenoetic states would provide some sort of *support* for our intuition of first principles—and this makes it hard to see how our intuition of these principles could serve as an exclusive, unjustifiable source of justification.

But objections of this sort don't rule out more careful formulations of the foundationalist view. Foundationalists can coherently allow that *ἐπιστήμη* is not just *knowledge* in any humdrum sense, and indeed that Aristotle's concern in *APo* is not justification or knowledge in general. Their claim is only that scientific understanding admits of a special *kind* of justification, and that *this* justification issues from our rational intuition of demonstrative principles (and nothing else). So while we might, in some ordinary sense, justifiably believe that planets don't twinkle before being able to demonstrate it—because we've observed that this is the case, say—we will not thereby possess the sort of justification had by an expert who *understands*, on the basis of a demonstration, that planets don't twinkle.¹⁸

If this is right, foundationalism can be formulated in (at least) two ways. The claim is either that justification *properly understood* only occurs in the context of a demonstrative science, or that there is a *species* of justification (or a specific *degree* of justification) that only occurs in the context of a demonstrative science.¹⁹ On this view any non-expert might have reasons to believe that planets don't twinkle, but this belief is only *justified* (or only justified *in the scientific sense*, or

in *APo* A33—despite appearances to the contrary at 88b30. On this point see Fine (2010: 330) and Morison (forthcoming).

¹⁷I won't be discussing the many interpretive difficulties surrounding this account here—see my (redacted) for an attempt to address some of the main ones. What I say about Aristotle's account in this paper should not be controversial. On the importance of perception in this account, see Bronstein (2012), Modrak (1987: 157–77), or Moss (2012: 153–54).

¹⁸Anyway this is something foundationalists *should* allow. It's not clear to me they all do. Irwin, for instance, tells us that “in claiming that the principles are known through themselves, Aristotle cannot simply mean that nothing else is needed to justify them within the demonstrative system; he must also mean that nothing else is needed to justify them at all” (1988: 132). But it seems absurd to suppose that we could not justify the *belief* that some definition is true (that humans are rational animals, say, or triangles three-sided rectilinear figures) except through some non-inferential form of rational intuition. The more charitable way to take Irwin's claim here is that we can justify our beliefs in these principles, but cannot justify them *scientifically*, in the way a demonstration justifies its conclusion—since these are indemonstrable definitions, our intuition of them must serve as our source of scientific justification. Irwin does also say something along these lines (1988: 124).

¹⁹To my mind the second formulation sounds more plausible, but foundationalists often rely on the first (I give some examples in the main text).

to the *degree* appropriate for scientific understanding) for an expert astronomer who knows how to demonstrate it. And the sort of justification such an expert possesses must ultimately derive from her intuition of certain basic principles.

Foundationalism is therefore compatible with Aristotle's account of the cognitive development leading from perception to *νοῦς*. Foundationalists think an expert's intuition of principles is not *justified* by anything but itself; but this is not to say that this intuition comes out of nowhere, or that its causal genealogy is irrelevant. The thought is only that there is a distinctive form of epistemic support the prenoetic stages of our cognitive development will not provide. Here is how two prominent foundationalists put the point:

Experience and familiarity with appearances are useful to us as a way of approaching first principles; they may be psychologically indispensable as ways to form the right intuitions. But they form no part of the justification of first principles. When we come to have the right intuition we are aware of the principle as self-evident, with no external justification. That is its real nature, and that is what we grasp after we have used ordinary methods of inquiry. The acquisition of *nous* is not meant to be magical, entirely independent of inquiry. Nor, however, is it simply a summary of the inquiry, or a conclusion that depends on the inquiry for its warrant. (Irwin (1988: 136))

[T]o the extent that [Aristotle's account of our cognitive development] is a natural process based on perception, the relation between our perceptions and our knowledge of first principles, or whatever knowledge we have by reason, is a natural, a causal, rather than an epistemic relation. Our knowledge of first principles is not epistemically, but only causally, based on perception. And this is how Aristotle can be an extreme rationalist and still constantly insist on the fundamental importance of perception for knowledge. (Frede (1996: 172))

Thus on this sort of view perception and experience, necessary though they may be to *bring about* our cognitive development, are not states that provide the sort of justification or epistemic support first principles require. It's only when we intuit these principles that they provide the proper sort of epistemic basis for our demonstrative conclusions.

Now, there is still some pressure here to provide some evidence that Aristotle entertained a distinction between the "causal" and "epistemic" contributions of various states, and for thinking that our understanding of demonstrated conclusions and their principles might admit of some distinctive form of epistemic support—and indeed I think foundationalist arguments to this effect fall short. But foundationalism cannot be ruled out simply by pointing out that Aristotle's theory of scientific understanding is not meant as a general theory of justification,

guided by the concerns of contemporary epistemologists, as Burnyeat, Kosman and others have long made clear.

So far, then, I've argued that Aristotle saw first principles as explanatorily basic, primitive, and better known than anything demonstrated on their basis, and presented a brief presumptive case against interpreting his notion of priority as a kind of *justificatory* priority. I've also tried to show, however, that such interpretations aren't immediately ruled out by familiar considerations about the scope and ambitions of *APo*: Aristotle might not think of *ἐπιστήμη* as the sole locus of justification, but still consider it a cognitive state that provides us with a distinctive *kind* or *degree* of justification lesser states cannot provide. I'll now examine the texts foundationalists invoke in their defense, and argue that these texts do not in fact support foundationalism—even in its more careful formulations.

2 The Priority of Principles

Aristotle tells us principles are *primitives*; that is, *prior* to whatever we demonstrate on their basis. We know that, at a minimum, principles are *explanatorily* primitives: they explain all the truths belonging to some domain, and are not themselves explained by anything else (this is just what it means for them to be *immediate*, as Aristotle tells us in [2]). But foundationalists think principles are also *justificatory* primitives: our intuition of principles is the source of justification for the conclusions we demonstrate on their basis, and is not itself justified by any further knowledge we might possess—even when this knowledge causes us to form the right intuition.

Foundationalists find evidence for such a view in the following passage:²⁰

[3] they [=the premises in our demonstrations; first principles most of all] must be explanations and better known and prior [relative to our demonstrated conclusions]—explanations because we only understand something when we know its explanation, prior since they are explanations, and known beforehand not only in the sense that we comprehend what they mean, but also that we know them to be the case.

αἰτία τε καὶ γνωριμώτερα δεῖ εἶναι καὶ πρότερα, αἴτια μὲν ὅτι τότε ἐπιστάμεθα ὅταν τὴν αἰτίαν εἰδῶμεν, καὶ πρότερα, ἔπειρ αἴτια, καὶ προγνωσκόμενα οὐ μόνον τὸν ἕτερον τρόπον τῷ ξυνιέναι, ἀλλὰ καὶ τῷ εἰδέναι ὅτι ἔστιν. (*APo* A2 71b29-33)

This passage is meant to explain three of the requirements on demonstrative

²⁰On this passage in particular see Irwin (1977: 211) and Irwin (1988: 124–25).

premises presented in [2].²¹ The first requirement is that these premises serve (via their shared middle term) as *explanations* for the conclusion being demonstrated. This follows straightforwardly from the requirement that demonstrations yield understanding, together with the definition of understanding in [1]. The second requirement is that these premises be *prior to* the conclusion derived on their basis: Aristotle simply states that this must be the case since the premises are explanations (εἴπερ αἴτια). The third requirement is that these premises be *better known than* the conclusion derived on their basis. Aristotle’s elaboration here is hard to follow: in his explanation “known beforehand” (προγνωσκόμενα) has replaced “better known” (γνωριμώτερα), but it’s not immediately clear why these two would relations would correspond, or why we would have to know the premises of our demonstrations before learning their conclusions.

Before addressing this difficulty, it’ll be important to consider the next few lines, where Aristotle elaborates on these last two relations:

[4] Things are prior and better known in two ways; for it isn’t the same to be prior by nature and prior in relation to us, nor to be better known and better known to us. I call prior and better known in relation to us items which are nearer to perception, prior and better known *simpliciter* items which are further away. What is most universal is furthest away, and the particulars are nearest—these are opposite to each other.

πρότερα δ’ ἐστὶ καὶ γνωριμώτερα διχῶς οὐ γὰρ ταῦτὸν πρότερον τῇ φύσει καὶ πρὸς ἡμᾶς πρότερον, οὐδὲ γνωριμώτερον καὶ ἡμῖν γνωριμώτερον. λέγω δὲ πρὸς ἡμᾶς μὲν πρότερα καὶ γνωριμώτερα τὰ ἐγγύτερον τῆς αἰσθήσεως, ἀπλῶς δὲ πρότερα καὶ γνωριμώτερα τὰ πορρώτερον. ἔστι δὲ πορρωτάτω μὲν τὰ καθόλου μάλιστα, ἐγγυτάτω δὲ τὰ καθ’ ἕκαστα καὶ ἀντίκειται ταῦτ’ ἀλλήλοις. (APo A2 71b33-72a5)

Things can thus be prior and better known in two ways: according to an objective, metaphysical (or “natural”) order of explanation, on the one hand, and according to the order in which *we*, as non-experts, might go about learning

²¹In splitting up the passage this way I resist the change in punctuation suggested by Barnes, who removes the comma after the third αἴτια and reads the προγνωσκόμενα clause as a further defense of the priority requirement (1993: 96). Barnes’ worry here is that saying that something is “better known” is quite different from saying that it’s “known beforehand,” since Aristotle makes it clear that the temporal order of our learning need not correspond to the “natural” order tracked by the “better known” relation. But this solution is grammatically awkward: the αἰτία τε καὶ γνωριμώτερα ... καὶ πρότερα construction has three parts, to which the αἴτια μὲν ... καὶ πρότερα ... καὶ προγνωσκόμενα clauses are naturally taken to correspond. In any case I will argue below that we can make sense of the thought that the premises of our demonstrations will have to be “known beforehand” in a way that does not conflict with Aristotle’s remarks about the order in which we learn things.

things—i.e. typically starting from what we perceive.²² In passage [3], Aristotle clearly means to tell us that principles are prior and better known *by nature*: he often emphasizes that scientific principles are the things farthest from perception and most universal.²³ And this natural order is precisely the order explanatory demonstrations are meant to preserve. So the kind of priority proper to first principles must track explanatory priority—things are prior and better known by nature when they’re closer to the fundamental explanatory grounds for some scientific domain.

Now, Aristotle *also* tells us, in [3], that principles will have to be known before their conclusions—that we will have to comprehend what they mean but also know that what they express is *true* (εἰδέναι ὅτι ἔστιν). This is a puzzling claim for him to make. For Aristotle’s demonstrative theory is not meant to describe how we first *learn* things—we might come to *appreciate* facts differently once we can demonstrate them, and thereby come to *understand* things we already knew in an ordinary way, but demonstration is not a way to discover facts of which we were ignorant in our pre-demonstrative state.²⁴ So it’s not clear why we would have to know principles *before* learning their demonstrative consequences. Indeed Aristotle often tells us the opposite—he tells us that principles are the *last* thing we would discover (most notably in his account of our cognitive development in *APo* B19 and *Met* A1), and that their discovery requires our already having gathered the facts pertinent to the scientific domain in question.²⁵ For instance, it might be definitional that planets are heavenly bodies near the earth. But it’s plausible that we’d learn this *after* observing that planets don’t twinkle, and indeed *infer* it from our observations—even though the planets’ proximity to the earth explains what we observe.²⁶

Foundationalist interpreters take this as evidence that Aristotle is telling us two distinct things in passages [3] and [4]. First, that an expert’s principles

²²Unlike what’s better known “by nature,” what’s better known “to us” depends on the subject—as Aristotle makes clear at *Top* Z4 141b36ff and in passage [9], below. As I understand the claim here, perceptual knowledge is the knowledge that is (typically) better known to us *early on*, before we have made any progress in our inquiry. Different things can become better known to us as our inquiry progresses. We count as experts (i.e. have understanding) when what’s better known to us just is what’s better known by nature. But since Aristotle is *contrasting* what’s better known to “us” and better known by nature, he presumably does not take “us” to be experts in this passage.

²³See for instance *Top* Z4 141b36ff, *Met* A9 992b24ff, or *Met* Z3 1029b3ff.

²⁴Arguably coming to understand what we already know counts as a form of learning for Aristotle—see Bronstein (2016: 31–42). My point here is only that we do not go from ignorance to knowledge by demonstration.

²⁵See for instance *APr* A30 46a17-27, *APo* B1 89b29-31, *HA* A6 491a7-14, or *PA* B1 646a8-12.

²⁶Philoponus raises a similar case in his commentary on this passage: we might infer the shape of the moon from observing its phases, even though its shape causes it to have the phases we observe it to have.

serve as *explanatory* primitives, and second, that they serve as *epistemic* primitives (i.e. as basic sources of justification). The second point does not necessarily follow from the first: in cases where we infer an explanation for something we already know, our knowledge of the explanandum is *explanatorily* posterior but (on the foundationalist view) *epistemically* prior to our knowledge of the explanans—epistemically prior because our knowledge of the explanans depends for its justification on our prior knowledge of the explanandum.²⁷ But Aristotle’s claim here is that *for an expert* the justificatory and explanatory orders coincide. Since the priority at play in [3] is priority “by nature,” this means that an expert’s intuition of first principles is *objectively* the right basis for justifying demonstrated claims, in addition to being (objectively) the right basis for explaining them.²⁸ Principles must therefore be “known before” their conclusions to guarantee that an expert’s scientific understanding be *justified* in the right sort of way, and their characterization as epistemic primitives is an expression of this justificatory precedence.

But what Aristotle actually says about epistemic priority (or “priority in knowledge”) tells against interpretations of this sort. Here is the relevant passage in Aristotle’s lexicon:

[5] Things are called prior in another sense, on which what’s prior in knowledge is [treated] as if it were also prior *simpliciter*. Of these the things prior in formula are different from those prior in perception, for in formula universals are prior, and in perception particulars.

ἄλλον δὲ τρόπον τὸ τῇ γνώσει πρότερον ὡς καὶ ἀπλῶς πρότερον. τούτων δὲ ἄλλως τὰ κατὰ τὸν λόγον καὶ τὰ κατὰ τὴν αἴσθησιν. κατὰ μὲν γὰρ τὸν λόγον τὰ καθόλου πρότερα κατὰ δὲ τὴν αἴσθησιν τὰ καθ’ ἕκαστα (*Met* Δ11 1018b30-34)

Aristotle distinguishes two senses of epistemic priority here: epistemic priority “in formula” and epistemic priority “in perception.” This distinction is plainly meant to mirror the distinction (in [4]) between things prior by nature and things prior to us: in both cases, universals are prior in one sense (in formula, by nature), and particulars in another (in perception, to us).

Both forms of priority fall under a general definition: to say that *p* is epistemically prior to *q* is to say that our knowledge of *p* doesn’t depend on our

²⁷Of course there’s a difficulty in stating things this way since (as I argued above) foundationalists sometimes speak as though there is no justification at all outside the context of demonstrative science. Probably the right thing to say here is that we can justifiably infer an explanation, but the resulting justification isn’t the kind of justification that befits scientific understanding—for *that* kind of justification follows the order of explanation.

²⁸See Irwin (1988: 124–25, 134–36) for a more elaborate defense of these points.

knowledge of q .²⁹ In this definition “knowledge” is invoked in a *generic* sense, and the two species of epistemic priority in [5] correspond to the species of knowledge involved.³⁰ If the knowledge in question is *understanding*, then epistemic priority tracks explanatory priority: p can’t be prior to q if q is part of the *explanation* why p , for then our understanding p would depend on our understanding q . This species of epistemic priority (epistemic priority “in formula”) is just a correlate of priority “by nature.” However if the knowledge in question is knowledge of a different sort, then epistemic priority need not track explanatory priority: our knowing p might depend on our perceiving q , even if it turns out that p explains q .³¹ This species of epistemic priority (epistemic priority “in perception”) is a correlate of priority “to us,” or at least, priority to us as we typically stand at the beginning of our inquiry.

Only the former sense of epistemic priority applies to first principles. This leaves it open that principles are *not* epistemic primitives in the latter sense (i.e. “to us,” where “we” are not yet experts). Indeed, we should expect them not to be. For on Aristotle’s definition, as reconstructed above, the knowledge primitive to us is a form of knowledge that does not depend for its existence on prior knowledge of *any sort*—and Aristotle explicitly tells us this form of knowledge is provided by perception (*APo* B19 99b32-35). Hence if we wish to think of epistemic priority *to us* as providing a certain form of justification, we *can, contra* foundationalists, “justify” our principles: we can invoke knowledge of an ordinary sort—including, ultimately, *perceptual* knowledge—as grounds for our noetic grasp of principles.

I’ll argue below that this is probably an infelicitous way to put things. What’s

²⁹It’s a bit later, at *Met* Δ11 1019a1ff, that Aristotle indicates that all senses of priority are cases in which certain things can be without others, but not vice versa; so that, in the epistemic case presented here, it would be possible for some knowledge to exist in a subject without some other knowledge existing in that subject, but not vice versa. So “depends” in this formulation is shorthand for “depends for its existence.”

³⁰I thus agree, on the surface, with Barnes’ analysis: “there is an obvious analysis of ‘ P is primitive,’ viz. ‘there is no Q prior to P ,’ i.e. ‘there is no Q from which knowledge of P must be derived’” (1993: 94). However Barnes seems to take the “knowledge” in his formulation to be *ordinary* knowledge. I think this is a mistake: “knowledge” is used in a generic sense, and only one species of priority involves ordinary knowledge. Of course in saying this I assume that *γνώσις/γνωρίζειν* can be used in a generic sense that encompasses both ordinary knowledge (*γνώσις* in its prosaic sense) and more advanced states like *ἐπιστήμη*. Though I agree with Burnyeat (2011) that Aristotle often uses *γνωρίζειν* and its cognates to *contrast* ordinary forms of knowledge and scientific understanding, there is good reason to take its occurrence in [5] in the generic sense—a sense also found (for *γνωρίζειν*) at *APo* B19 99b18, and in the opening sentence of the *Physics*. The reason is simply that the two types of epistemic priority are meant to match the two ways of being “better known,” and being better known by nature is a relation that matches the structure of scientific *understanding*, rather than ordinary knowledge.

³¹On perception as a *γνώσις*, see for instance Burnyeat (1981: 114).

important for now is that Aristotle’s remarks on epistemic priority seem to rule out the view that first principles are epistemic primitives in a sense that would not merely reflect their status as explanatory primitives. To say that principles are epistemically primitive “in formula” is just to say that our understanding of these principles does not depend on our understanding of anything else. But this simply follows from the fact that our principles are explanatory primitives: our understanding of them could not depend on any further piece of understanding, for *that* understanding would then serve as (part of) an explanation for principles that are, by definition, unexplainable.

So it’s no surprise that Aristotle, in [3], tersely invokes our principles’ explanatory role to support the claim that these principles must be prior to demonstrated conclusions (*πρότερα, ἔπερ αἴτια*, 71b31). Nor is it surprising that Aristotle uses “immediate” (i.e. unexplainable) and “primitive” interchangeably, as I mentioned above (p.6). This is not just a loose manner of putting things: the fact that our principles are explanatory primitives *entails* their status as epistemic primitives—i.e. epistemic primitives *in formula*. If this is right what Aristotle says about priority gives us little reason to impose on his epistemology the concern with justificatory relations stressed by foundationalist interpreters.

In particular, we need not do so to make sense of the requirement (voiced in [3]) that principles be “known before” demonstrated conclusions. As I understand it, that requirement is meant to reflect the cognitive order that would belong to an expert in some domain. The claim is not that such an expert must have *discovered* principles before their consequences, or that she will invoke principles as an ultimate source of *justification* for her demonstrated conclusions. Rather, the claim is that the sort of explanatorily-sensitive knowledge that constitutes an *understanding* of some demonstrated conclusion (as Aristotle describes it in [1]) requires an explanatorily-sensitive understanding of the *premises* from which that conclusion is derived: to recognize the explanations for certain conclusions *as explanations* will require recognizing certain premises *as explanatory primitives*.³² Thus the sense in which an expert must know principles before knowing her conclusions is, specifically, that she must *understand* her principles before *understanding* her conclusions—and this is just to say (on my reading of [5]) that principles are better known by nature and epistemically prior in formula, in the sense at play in [4].³³ It’s consistent with this view that our *ordinary knowledge* of demonstrative conclusions precede our understanding of demonstrative principles.

So these passages don’t provide any positive evidence for foundationalism—

³²For a more detailed argument that this is Aristotle’s view, see (redacted).

³³Here I am in agreement with Bronstein’s reading of the “better known” relation (2016: 128). As will be clear in what follows, however, I disagree with his assimilation of *conviction* with this “better known” relation.

indeed as I read them they provide some evidence against it. Foundationalist interpretations rely on a notion of epistemic priority as a form of *justificatory* precedence which need not always coincide with the sort of explanatory priority that plays a central role in Aristotle's demonstrative theory, but happens to do so in the context of a demonstrative science. The thought is that first principles are not just *explanatory* primitives, but *justificatory* primitives, too, and that they must be grounded in a form of rational intuition since they don't admit of demonstrative justification.

I've argued above that we should resist the very first move: there's no evidence that Aristotle thought of first principles as epistemic primitives in a sense that isn't entailed by their being indemonstrable *explanatory* primitives. Aristotle employs two senses of epistemic priority, one applicable to scientific understanding, and one applicable to different sorts of ordinary knowledge. On the former sense first principles are epistemic primitives, on the latter they are not (on the latter, the knowledge we get from *perception* is primitive). We can explain Aristotle's remarks in [3] and [4] without considering how our understanding might be justified, by simply focusing the dependence relations between various species of knowledge: principles must be understood before we can understand demonstrative conclusions because our understanding of these conclusions requires an appreciation of their explanatory role, and this can only be done once we appreciate the role principles play as explanatory primitives. How we might justify our belief in principles and demonstrative conclusions is a different question entirely.

3 Principles and Expert Conviction

Even once we set aside his discussion of priority, however, Aristotle may seem to exhibit foundationalist tendencies in his description of the relative *strength* of an expert's conviction in her principles and demonstrated conclusions. Here is the key passage:

[6] For something always holds better of that because of which it holds, for instance, that because of which we love is better loved. So since we know and are convinced of [some conclusion] because of the primitives, we know and are better convinced of these [primitives], because it's because of them that we know and are convinced of posterior things. [...] Anyone who's going to have understanding through demonstration must not only know the principles better and be better convinced of them than what's demonstrated—there must also be nothing more convincing or better known for him among the opposites of the principles (from which there will be a deduction of the contrary mistake), since anyone who understands [some conclusion] *simpliciter* cannot be convinced [otherwise].

αἰεὶ γὰρ δι' ὃ ὑπάρχει ἕκαστον, ἐκείνῳ μᾶλλον ὑπάρχει, οἷον δι' ὃ φιλοῦμεν, ἐκεῖνο φίλον μᾶλλον. ὥστ' εἴπερ ἴσμεν διὰ τὰ πρῶτα καὶ πιστεύομεν, κακείνα ἴσμεν τε καὶ πιστεύομεν μᾶλλον, ὅτι δι' ἐκείνα καὶ τὰ ὕστερα. [...] τὸν δὲ μέλλοντα ἔξευ τὴν ἐπιστήμην τὴν δι' ἀποδείξεως οὐ μόνον δεῖ τὰς ἀρχὰς μᾶλλον γνωρίζειν καὶ μᾶλλον αὐταῖς πιστεύειν ἢ τῷ δεικνυμένῳ, ἀλλὰ μηδ' ἄλλο αὐτῷ πιστότερον εἶναι μηδὲ γνωριμώτερον τῶν ἀντικειμένων ταῖς ἀρχαῖς ἐξ ὧν ἔσται συλλογισμὸς ὁ τῆς ἐναντίας ἀπάτης, εἴπερ δεῖ τὸν ἐπιστάμενον ἀπλῶς ἀμετάπειστον εἶναι. (APo A2 72a29-b4)

Thus first principles should not only be explanatory primitives, and grasped by an expert as such, but they should also be the things an expert is most *certain* about—to the point where nothing could convince her of their falsity. The level of conviction an expert displays towards various propositions will moreover correspond to their demonstrative priority: her conviction will be strongest in the case of first principles, and less and less strong as we move down the explanatory tree formed by their demonstrative consequences.³⁴ Aristotle makes a similar point in the *Topics*, where he describes principles as “true and primitive,” and “convincing because of themselves rather than something else” (τὰ μὴ δι' ἐτέρων ἀλλὰ δι' αὐτῶν ἔχοντα τὴν πίστιν 100b18-19).

The sort of “conviction” or “trustworthiness” (πίστις) at play here is not something that merely *describes* the confidence someone might display towards principles and their consequences.³⁵ When Aristotle says that an expert is best convinced of principles and ἀμετάπειστος, it's natural to think of him as endorsing a general norm according to which we *should* be more confident about our demonstrative principles than we are about their consequences. Foundationalists may seem to have a plausible explanation for this norm: we should trust our demonstrative principles more than their consequences because our intuition of these principles *justifies* what we derive on their basis. On this sort of view the justificatory role of our intuition of principles *explains* their trustworthiness and the relative trustworthiness of our demonstrated conclusions.³⁶ And the fact that

³⁴Aristotle doesn't explicitly extend his remarks to *all* demonstrative conclusions, but clearly the thought on which his remarks are based would apply generally: since *all* demonstrated conclusions hold because of their premises, we will always have to be “better convinced” of these prior premises, even when they're not the primitive first principles of which we are *best* convinced.

³⁵Aristotle uses πίστις to refer both to a cognitive state (a conviction, or a strongly held belief), and to the factors that contribute or ought to contribute to the development of such a state—so that, for instance, an argument, or a speaker's character might count as types of πίστις (sometimes the argument's *subject matter* is the πίστις; cf. Grimaldi (1957)). For the first sense, see e.g. APo 90b14 and DA 428a20, or, in its more common verbal form (as in [6]) Rhet 1356a6 or Rhet 1366a11. For the second, see e.g. Rhet 1354a15 or Rhet 1355a4-5. As I will be reading Aristotle here, to say that *X* ought to be πιστότερον for us than *Y* (or that we should πιστεύειν *X* more or better than *Y*) is to say that our belief in *X* ought to be held more strongly than our belief in *Y*.

³⁶On some views degrees of justification just *are* degrees of conviction (under certain constraints).

our first principles serve as justificatory primitives explains why an expert would never be convinced of competing alternatives, or seek to ground his conviction about principles in anything else: the expert is ἀμετάπειστος simply because there is no source of warrant more basic than his intuition of principles.

Critics of foundationalism have dealt with this passage in two ways. Some simply argue that the passage is anomalous, and that, given Aristotle's overall emphasis on our grasp of the *explanatory role* of demonstrative premises and conclusions, we should take the conviction at play here to reflect an expert's confidence *that her principles are explanatorily basic*, and *that demonstrations explain their conclusions*. The point of [6] would then be that an expert's confidence that some demonstration explains its conclusion will not exceed her confidence that the principles from which this demonstration begins are explanatory primitives—any doubts about the status of our principles will lead to doubts about the explanations our demonstrations are meant to provide.³⁷ Some, on the other hand, wish to draw a close conceptual connection between the claim that certain things are better known by nature and the claim that we should be “more” or “better” convinced (πιστεύομεν μᾶλλον) of these things. On this reading, to trust principles “more” just is to take them to be more fundamental than their demonstrative consequences, and there is a difference in kind between this form of conviction and that provided outside the context of demonstrative science.³⁸

But neither solution is adequate. The first simply says something Aristotle does not: the claim is that we should trust our *principles* most of all, not that we should trust the *status* of our principles, or that we should trust an expert's recognition of her principles *as principles*. Aristotle is careful when formulating claims about explanatory status in *APo*—witness his definition of understanding in [1] as knowledge “of the explanation why something is the case, that it is its explanation” (71b11-12). Aristotle clearly has a distinction in mind here between knowing an explanation and knowing an explanation *as an explanation*.³⁹ It seems uncharitable to suggest that he is simply being sloppy and assimilating the two when discussing conviction.⁴⁰

If that's right [6] would be an even stronger piece of evidence for foundationalism: it would express the foundationalist view, and not just be explained by it.

³⁷For this reading, see Goldin (2013: 211–13), or Bronstein (2016: 128).

³⁸Burnyeat, for instance, thinks Aristotle has two notions of conviction—one associated with demonstration from principles, and one associated with experience (1981: 128). McKirahan takes the “more” (μᾶλλον) in Aristotle's formulation to mean “more fundamentally,” rather than “stronger,” so that in [6] Aristotle is telling us only that “knowledge of principles is primary, that of conclusions derivative” (1992: 35).

³⁹On this point see also his discussion of explanatory order in *APo* A13.

⁴⁰Bronstein claims that something is more convincing to an expert when it's better known (by nature) and explanatorily more basic, and that we become convinced of principles by appreciating

The second solution doesn't fare much better, though, as will become clear, I am sympathetic to its motivating thought. There is no indication in [6], or in Aristotle's discussion at the beginning of the *Topics*, that the sort of conviction displayed by an expert would be different in kind from the sort of conviction we might display in other contexts, when confronted with arguments or evidence that fall short of demonstration. It's one thing to say that something is more convincing when it's better known and explanatorily more basic. It's another thing to say that this is what it *means* for demonstrative premises to be more convincing than their consequences. On a straightforward reading, to be *more* convinced of something is simply to have a greater *degree* of conviction about it, not to be convinced of it as of something more fundamental, or in a manner only accessible to an expert.⁴¹ To the extent that we can, we should understand Aristotle's remarks in these terms.

The key to doing so is to see that Aristotle's views on conviction are more nuanced than what passage [6] suggests on its own. For one thing, Aristotle doesn't consider principles most trustworthy in all circumstances: perception and experience constitute the "most authoritative" forms of knowledge concerning *particulars* (cf. *Met* A1 981a13ff, 981b11). So the confidence we place in our beliefs about particulars (e.g. "this planet isn't twinkling," "this fire is hot") is presumably something that ought to be based on our observations, rather than anything we might infer from general demonstrative conclusions—a point Aristotle often emphasizes in his description of practical wisdom (see esp. *EN* Z11 1143b11-14).

Moreover, Aristotle quite clearly thinks that principles should be given up when they conflict with such observations:⁴²

[7] [The followers of Empedocles and Democritus], because of their love of these [principles], fall into the attitude of men who undertake the defense of a position in argument. For holding their principles as truth, they submit to everything that follows, as though some principles did not require to be judged from their results, and above all from their end. And that end, which in the case of productive understanding is the product, in the case of our

their explanatory role (2016: 128). This is compatible with thinking that our conviction concerns the principles themselves, even if the *source* of our conviction is their explanatory role. But it leaves unexplained what the conviction itself amounts to, and doesn't tell us *why* an expert would be so convinced—a question to which foundationalists may seem to have a clear reply.

⁴¹A point Goldin is right to stress (2013: 212n28). The straightforward reading of *μᾶλλον* is in line with the language Aristotle uses elsewhere to describe the confidence of non-experts—see for instance *GA* 716a7, *GA* 722a1, or *Rhet* 1356a6.

⁴²The translation here is adapted from Stocks'. Apart from the two passages below, see *DM* 698a11-14, where Aristotle emphasizes that universal explanations must always accommodate (or "fit," *ἐφαρμόττειν*) the particular phenomena they explain, and also *EN* X.8 1179a16-22, where a similar sentiment is voiced concerning our conviction about general ethical claims.

understanding of nature is the phenomena, which are always authoritatively given by perception.

Οἱ δὲ διὰ τὴν τούτων φιλίαν ταῦτὸ ποιεῖν εὐόκασι τοῖς τὰς θέσεις ἐν τοῖς λόγοις διαφυλάττουσιν ἅπαν γὰρ ὑπομένουσι τὸ συμβαῖνον ὡς ἀληθεῖς ἔχοντες ἀρχάς, ὥσπερ οὐκ ἐνίας δέον κρίνειν ἐκ τῶν ἀποβαινόντων, καὶ μάλιστα ἐκ τοῦ τέλους. Τέλος δὲ τῆς μὲν ποιητικῆς ἐπιστήμης τὸ ἔργον, τῆς δὲ φυσικῆς τὸ φαινόμενον ἀεὶ κυρίως κατὰ τὴν αἴσθησιν. (DC 306a11-17)

If there's any general norm at play in this passage, it clearly isn't one that would preclude someone with a grasp of principles from abandoning them in the face of conflicting phenomena. In a similar vein, Aristotle tells us in *GA* that:

[8] This is what seems to hold for the generation of bees, both from argument and from the things that are thought to be their characteristics. These characteristics haven't yet been sufficiently grasped, and if some day they are, we should then be better convinced by perception than arguments, and by arguments only if what they show agrees with the phenomena.

Ἐκ μὲν οὖν τοῦ λόγου τὰ περὶ τὴν γένεσιν τῶν μελιττῶν τοῦτον ἔχει φαίνεται τὸν τρόπον καὶ ἐκ τῶν συμβαίνειν δοκούντων περὶ αὐτάς οὐ μὴν εἴληπται γὰρ τὰ συμβαίνοντα ἱκανῶς, ἀλλ' ἐάν ποτε ληφθῆ τότε τῆ αἰσθήσει μᾶλλον τῶν λόγων πιστευτέον, καὶ τοῖς λόγοις ἐὰν ὁμολογούμενα δεικνύωσι τοῖς φαινομένοις. (GA 760b27-33)

So scientific principles are not premises we should be *absolutely* certain about, or believe whatever their consequences—our real source of confidence seems to be our senses, and scientific arguments only seem to be worth believing to the extent that they appropriately recover and explain our observations. The claim that principles are more convincing than their demonstrative consequences does not rule out our giving them up when these consequences conflict with the phenomena.

What then of Aristotle's claim that an expert is *ἀμετάπειστος*? There's good evidence that this claim is only qualifiedly true. In the *Topics* Aristotle often affirms that someone with understanding cannot be convinced out of her conclusions, but always qualifies the claim by saying that an understander cannot be so convinced *by argument* (ὑπὸ λόγου).⁴³ This is significant because not

⁴³This is true of all but one occurrence of the term, which appears eleven times, and always in connection with the state of understanding (that the *ἐπιστήμων* is *ἀμετάπειστος* seems to be a stock example—see *Top* 130b16, 133b29ff, 134a1ff, 134a35ff, 134b16). Apart from these occurrences, the term only appears three times in the Aristotelian corpus: in passage [6], in the *Metaphysics* (where necessity is said to be *ἀμετάπειστόν τι*, because it's contrary to the movement that follows choice and reasoning (ἐναντίον γὰρ τῆ κατὰ τὴν προαίρεσιν κινήσει καὶ κατὰ τὸν λογισμόν, *Met* Δ5 1015a32-33)), and in the *Magna Moralia* (where it's suggested that an *opinion* might resemble understanding if it's very firmly held and *ἀμετάπειστον*, *MM* 1201b6).

all our *beliefs* are arrived at by argument; in particular, *perceptual* beliefs are not inferred from anything else, and explicitly distinguished by Aristotle from λόγος-involving cognitive states.⁴⁴ So one way to understand passage [6] in light of Aristotle's remarks in [7] and [8] is this: to be convinced of something, in the sense at play in [6], is to be convinced of it by *mere argument*, that is, by an argument that does not rest on new *evidence*. Since perception isn't a mere argument in this sense, an understander can be ἀμετάπειστος and nonetheless abandon his principles in the face of conflicting phenomena.

If this is right, scientific expertise doesn't require *fanaticism*. To be *best convinced* of principles isn't to believe principles no matter what, but rather to believe that, *holding the phenomena fixed*, one's principles are more secure than their demonstrative consequences or any competing principle or argument that would defeat them—or, as he puts it in [6], that one's principles are most secure “among the opposites of the principles.” New *evidence* (and presumably arguments *based* on new evidence) might force scientific experts to revise their principles. Various forms of rhetorical persuasion will not.⁴⁵

What all this shows is that the requirement that an expert be ἀμετάπειστος can be well understood without thinking of demonstrative principles as a justificatory bedrock. It's reasonable to think that an expert should be more convinced of explanatorily prior premises: these premises explain a broader range of phenomena, and giving them up means abandoning a broader portion of our demonstrative understanding—to borrow a modern phrase, principles are closer to the center of our “web” of scientific understanding. But an expert's conviction in this case doesn't stem from the absolute *justificatory* precedence of her intuition of certain basic principles. For Aristotle is clear these principles can and should be given up when they lead to conclusions that conflict with observed phenomena. Rather, her conviction stems from the explanatory role principles play in the context of a demonstrative science: we are confident about our principles precisely to the extent that they adequately explain the phenomena relevant to some scientific domain. Demonstrated conclusions explain less than principles, and our confidence about them reflects their more modest explanatory role. But neither principles nor their conclusions are more trustworthy than the evidence they are meant to explain.

If this is right, it undercuts a second important source of motivation for foundationalism. We can see why an expert would be unshakably convinced of her principles by considering the role these principles play as a fundamental

⁴⁴As passage [8] already suggests—but see also my (redacted) and Mignucci (1975: 2–3) on Aristotle's prior knowledge requirement and its limits.

⁴⁵This is in line with what Plato says at *Timaeus* 51e, where he contrasts true δόξα (which is something μετὰπειστόν) and understanding (which is something ἀκίνητον πειθοῦ).

explanatory bedrock for the rest of our understanding. And we can do this without thinking that our understanding is *justified* by our intuition of these principles. Indeed, what Aristotle says in [7] and [8] suggests that our confidence in our principles is, if anything, justified by their explanatory power, and that our intuition *would* therefore depend on other forms of knowledge for its warrant—in particular, the knowledge of explananda we typically acquire by perceptual means.

4 Priority and Justification in Aristotle’s Epistemology

I’ve argued so far against a certain sort of foundationalist reading of Aristotle’s epistemology, on which our noetic intuition of first principles justifies our understanding of the conclusions demonstrated on their basis—or at least, affords our beliefs in these conclusions a special sort of *scientific* justification they would not otherwise possess. So far, I’ve left open the possibility that thinking about the justification of these cognitive states might nonetheless be a fruitful way to interpret some of the things Aristotle tells us about them. Indeed I’ve suggested that our intuition of first principles can be *justified* (as the notion is commonly understood) on the basis of other beliefs, and, ultimately, on the basis of beliefs we acquire perceptually. I’ve also suggested that an expert’s conviction about her principles might be *justified* by considering the role these principles play as explanations for some set of observed phenomena.

In fact I think we should be careful when making claims of this sort. The case has already been made (convincingly, to my mind) that it would be misleading to think of *ἐπιστήμη* as *knowledge* in its contemporary sense. It might nonetheless be tempting to invoke the notion of justification, broadly construed, to interpret some of what Aristotle has to say in passages like [6].⁴⁶ I want to add some further reasons here for resisting this temptation.

The main reason for resistance comes from Aristotle’s portrayal of our progress towards understanding as a process by which we make better known to us things that are better known by nature:

[9] For learning proceeds in this way for all, namely, through that which is less known by nature to that which is more known [by nature]: and just as in practical matters our function is to make what’s actually good good for each, [proceeding] from what’s good for each, so too [in theoretical matters our function is] to make things better known by nature better known to ourselves, [proceeding] from what’s better known to ourselves. And the things better known and primitive to some are often better known [by nature] to a very small extent, and bear little or no relation to what is. But one still has to try, starting from things barely known [by nature] but

⁴⁶For a recent example, see Goldin (2013: 207–13).

known to oneself, to come to know things that are actually known, passing (as was said) via the things [we do know].

ἡ γὰρ μάθησις οὕτω γίνεται πᾶσι διὰ τῶν ἡττον γνωρίμων φύσει εἰς τὰ γνώριμα μᾶλλον καὶ τοῦτο ἔργον ἐστίν, ὥσπερ ἐν ταῖς πράξεσι τὸ ποιῆσαι ἐκ τῶν ἐκάστω ἀγαθῶν τὰ ὅλως ἀγαθὰ ἐκάστω ἀγαθὰ, οὕτως ἐκ τῶν αὐτῶ γνωριμωτέρων τὰ τῇ φύσει γνώριμα αὐτῶ γνώριμα. τὰ δ' ἐκάστοις γνώριμα καὶ πρῶτα πολλάκις ἡρέμα ἐστὶ γνώριμα, καὶ μικρὸν ἢ οὐθὲν ἔχει τοῦ ὄντος ἀλλ' ὅμως ἐκ τῶν φαύλως μὲν γνωστῶν αὐτῶ δὲ γνωστῶν τὰ ὅλως γνωστὰ γινῶναι πειρατέον, μεταβαίνοντας, ὥσπερ εἴρηται, διὰ τούτων αὐτῶν. (*Met* Z3 1029b3-12)

Our goal as learners, on this account, is to make what's better known by nature better known to us. Our paths towards this ideal cognitive state might be different: we all begin from whatever knowledge we have at our disposal, and what this knowledge consists in will depend on the things we've experienced, the arguments and teachers to which we've been exposed, and so on.⁴⁷ But once we understand some domain as an expert does, our demonstrative inferences mirror that domain's objective explanatory structure.

To my mind, there's no good way to extract from this portrayal a general account of what we are or aren't justified in believing. The norm Aristotle suggests is one according to which each of us should seek to develop a cognitive order that matches the objective order of explanation: to explain things by invoking what actually explains them. The development of this sort of cognitive order will depend on different forms of knowledge—in particular, as Aristotle tells us in *APo* B19 and *Met* A1, on the knowledge supplied by our capacity to perceive, remember what we perceive, and develop a practical form of experience on this basis.⁴⁸ But to say that we *rely* on such forms of knowledge is not yet to say we rely on them *as sources of justification*. What Aristotle says is simply that some state is, or comes to be, *from* (ἐκ) some other state—or, as in [9], that some better known *concept* comes to be from a *concept* better known to us.⁴⁹

And it's hard to see what this “from” relation would tell us about the *justification* we have for believing what we do. First, because Aristotle never describes it as an *inference* outside the context of demonstrative science: we get a demonstrative

⁴⁷On this point cf. *Top* Z4 141b36ff.

⁴⁸Even where we rely on what our teachers tell us, the thought is presumably that *they* (or their teachers, or their teachers' teachers, ...) must presumably have started from perception.

⁴⁹Aristotle uses the “from” relation where the relata are states throughout *APo* B19. In [2] the relata are certain *propositions* (or *terms* featured within propositions). See also *APo* A4 73a34ff, where Aristotle claims the essence of triangle is *from* line, and the essence of line *from* point. It's worth noting that Plato also tells us all our knowledge comes “from” perception (*Phaedo* 75ab, cf. also *Republic* 523-525), though it's doubtful he would assign our perceptual beliefs any *justificatory* role.

treatment of scientific understanding, but we don't get any general story about the transition between different prescientific belief contents, or any discussion of the warrant such a transition might supply.⁵⁰ Second, because Aristotle's doesn't seem to think our progress towards scientific understanding would secure any special warrant for our prescientific beliefs. This is a point Aristotle makes most clearly in his description of various forms of human knowledge at the beginning of the *Metaphysics*:⁵¹

[10] Knowledge and understanding belong to craft rather than to experience, and we suppose those with craft-knowledge to be wiser than those with mere experience [...] because the former know the explanation, but the latter do not.

ἀλλ' ὅμως τό γε εἰδέναι καὶ τὸ ἐπαίειν τῇ τέχνῃ τῆς ἐμπειρίας ὑπάρχειν οἰόμεθα μᾶλλον, καὶ σοφωτέρους τοὺς τεχνίτας τῶν ἐμπείρων ὑπολαμβάνομεν, ὡς κατὰ τὸ εἰδέναι μᾶλλον ἀκολουθοῦσαν τὴν σοφίαν πᾶσι τοῦτο δ' ὅτι οἱ μὲν τὴν αἰτίαν ἴσασιν οἱ δ' οὐ. (*Met* A1 981a24-28)

[11] And again we do not regard any of the senses as wisdom; yet surely these give the most authoritative knowledge of particulars. But they do not tell us the “why” of anything—e.g. why fire is hot; they only say that it is hot.

ἔτι δὲ τῶν αἰσθήσεων οὐδεμίαν ἡγούμεθα εἶναι σοφίαν καίτοι κυριώταταί γ' εἰσὶν αὐταὶ τῶν καθ' ἕκαστα γνώσεις ἀλλ' οὐ λέγουσι τὸ διὰ τί περὶ οὐδενός, οἷον διὰ τί θερμὸν τὸ πῦρ, ἀλλὰ μόνον ὅτι θερμόν. (*Met* A1 981b10-13)

[12] Concerning action, craft does not seem to differ in any way from experience—in fact we even see the experienced succeed more than those who have an account without experience.

πρὸς μὲν οὖν τὸ πράττειν ἐμπειρία τέχνης οὐδὲν δοκεῖ διαφέρειν, ἀλλὰ καὶ μᾶλλον ἐπιτυγχάνουσιν οἱ ἐμπειροὶ τῶν ἀνευ τῆς ἐμπειρίας λόγον ἔχόντων (*Met* A1 981a13-15)

The sort of wisdom distinctive of those who are properly said to *understand*, then, is a wisdom that consists in an understanding of the explanations why things are the way we take them to be. This wisdom issues “from” various forms of knowledge *that* something is the case. But this initial knowledge *that* is in no

⁵⁰One possible exception: the syllogism “that arises from induction” described at *APr* B23. But see my (redacted) for an argument that Aristotle does not *identify* induction with the sort of inference sanctioned by such a syllogism. Of course, Aristotle does relate the grasp of some concept to the grasp of propositions involving that concept—on which point see for instance Kahn (1981: 393–95) or Modrak (1987: 164). So it may be possible to *extract* some story about beliefs from his discussion. My point here is that the relationships between our beliefs are plainly not his focus.

⁵¹Here I adapt Ross' translation. See also *Met* A1 981a30ff, and *Met* A2 982a10ff.

need of further justification: perception was already “most authoritative,” and our practical experience already guided our actions in a fully reliable way.

So it’s true, of course, that we’re justified in believing the conclusions of scientific demonstrations. But on Aristotle’s view our belief that these conclusions were true was fully justified before we learned how to demonstrate them—and indeed, before we engaged in any sort of reasoning about what might explain them.⁵² What we gain when we present such conclusions in a formal demonstrative system is an understanding of their *place* in the science under consideration, and in particular, for Aristotle, an understanding of their explanatory role—our goal as learners is not to *justify* this or that belief, but rather to learn why things are the way we already know them to be, or why we should behave as we already know we should.

If this is right, understanding what explains our beliefs does not confer upon these beliefs an upgrade in justificatory status. The beliefs of an experienced doctor are as secure and reliable as they can be—and, as is clear from [12], such a doctor’s experience is what makes them so. The ability to give an account of the causal mechanisms underpinning various diseases and their symptoms is indeed a form of cognitive progress, but a form of progress that is not aptly described by using our modern notion of justification.⁵³

One final reason for resistance. We typically speak of justification as a norm that applies to *beliefs*, and think of beliefs as attitudes individuated by their propositional contents. But propositionally-situated attitudes of this sort do not serve as basic entities in Aristotle’s epistemology. It’s true, of course, that Aristotle’s demonstrative theory helps us see how we might understand some given *proposition*. But this theory implicitly relies on a prior understanding of the *domain* to which the proposition belongs: to understand some proposition we must understand its explanatory role *within some domain*, and therefore know something about the domain’s explanatory structure. For instance, to *understand* first principles we must recognize them as explanations for everything they serve to explain, and know that they aren’t explained by any of them—which will in

⁵²In this respect the relationship between prescientific knowledge and scientific understanding is similar to the relationship between our knowledge that $1 + 1 = 2$ and the knowledge we acquire once we derive this fact within a formal mathematical system: clearly we’re *justified* in believing that $1 + 1 = 2$ before we come up with an axiom system in which it can be derived, and scientific understanding is no more a prerequisite for the justification of scientific claims than the development of some formalism for the justification of mathematical ones.

⁵³It is open to foundationalists to reply that understanding the explanatory role of some belief just *is* what justification amounts to—for some arguments in this direction in the case of Plato’s *Meno*, see Fine (2004) (and see Schwab (2015) for some recent criticism of this move). My claim here is only that this is an unusual way of thinking about justification, as the notion is employed today.

turn require some understanding of the explanatory structure of some scientific domain *as a whole*. Aristotle's epistemic ideal is therefore not defined on the basis of beliefs, considered as piecemeal bearers of epistemic value: we must understand of some *domain* to understand any of its propositional parts.

In this regard, Aristotle's holistic conception of scientific understanding is similar to Plato's.⁵⁴ In the *Theaetetus*, for instance, it's agreed that someone who *knows* how to spell "Theaetetus" but thinks "Theodorus" must start with a τ does not in fact *understand* the first syllable of either name (*Theaetetus* 207e5-208a5). It's further agreed that this argument can be repeated for each of the syllables in Theaetetus' name, so that even someone who knows the ordering of each of its letters (and grasps why this ordering must proceed as it does) would nonetheless fail to *understand* its spelling if she could not also spell similar names like "Theodorus." In other words, someone must understand *spelling* before she can properly be said to understand the spelling of any specific word, even if she is correct about that specific word's spelling, and grasps why it must be spelled as it is.⁵⁵ An account of what it takes to understand the spelling of specific words could surely be given—but it would assume a prior understanding of *grammar*, an art applicable to words of any sort. Likewise, Aristotle's demonstrative account explains what it takes to understand some specific conclusion—but assumes a prior understanding of the domain to which it pertains.⁵⁶

Of course it might be possible to *recast* such holistic views using our contemporary notions of belief and justification. My claim is only that this is an unnatural thing to do. For it's a requirement on understanding some proposition that this proposition be grasped *as part of some domain*, and by default this is not a feature of our contemporary notion of justification: we justify beliefs, and these beliefs are typically individuated by their propositional contents, considered independently of the role they might play in some particular science.

5 Conclusion

Aristotle has often been cast as an early precursor of epistemic foundationalism. It's easy enough to motivate this sort of view: Aristotle tells us that an expert's knowledge of her demonstrated conclusions depends on her intuition of certain

⁵⁴A similarity also noted by Burnyeat (1981: 135–136). On holistic epistemology in Plato, see for instance Harte (2002: 148–49, 206–7), Nehamas (1985: 20), or Smith (1998: 159–61).

⁵⁵At *Philebus* 18c7-d2 Socrates says that the god who invented letters saw that "none of us could gain any knowledge of a single one of them, taken by itself, without understanding them all," and called "the one link that somehow unifies them all" the art of literacy (*γραμματική τέχνη*).

⁵⁶This is also the case for non-ideal cognitive states like *ἐμπειρία*, a state that might well involve some kind of propositional knowledge but is primarily described as a form of practical experience one might have in some *domain* (e.g. practical experience *curing feverish patients*, in *Met A1*).

principles, and that this intuition does not itself depend on any of its demonstrative consequences. He tells us that an expert will be unshakably convinced of the truths she can demonstrate—and of the truth of her principles above all. The *structure* of scientific understanding is given by an asymmetric and transitive priority relation, which is ultimately grounded in our noetic grasp of principles.

The main claim in this paper is that we should not think of this relation as a form of *justification*. What Aristotle has to say about the priority of first principles, and the sense in which our understanding *depends* on them can be well understood in terms of these principles' explanatory role. Likewise his remarks about an expert's conviction. If anything, on a common way of thinking about justification, an expert's intuition of principles *can* be justified—or defeated by countervailing evidence.

But such talk of justification generally doesn't sit well with Aristotle's epistemological writings, and should be resisted. Not only because scientific understanding is not knowledge, as we think of it today. But also, more broadly, because Aristotle's epistemology doesn't focus on *beliefs* as independent bearers of epistemic value, and takes as its main mark of progress a grasp of *explanations* for phenomena we are already fully justified in taking to be true. Interesting questions might still be raised about the sources and nature of this initial justification, and how it might differ from the justification conferred by a demonstration. What I hope to have shown is that these questions are not Aristotle's.

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