Freeing Aristotelian Epagōgē *from* Prior Analytics *II 23*[1]

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Interpretations of Aristotelian *epagōgē* (induction) have swung widely, and the largest factor in the variation has been the role played by *Prior Analytics* II 23. From Boethius in the sixth century to the medieval rediscovery of Aristotelian texts in the twelfth, this one short chapter was nearly all that was known of Aristotelian induction and was taken as saying that induction is a kind of deduction made valid by a complete enumeration of particulars. Scholastic logicians from Aquinas to Zabarella, though they had access to the full corpus, continued to treat *Prior Analytics* II 23 as the definitive text and to read it the same way. They overlooked or dismissed seemingly contradictory statements elsewhere in the corpus. Renaissance humanists, who gave the *Topics* and *Rhetoric* more attention, found there an image of induction more like Socrates' search for definitions than Aristotle's treatment of the syllogism. Francis Bacon's influential work on induction early in the seven-

teenth century contributed to a further minimizing of *Prior Analytics* II 23.[2] Efforts early in the nineteenth century to revive Scholastic logic included a project to reconcile induction as practiced by Baconian natural philosophers and induction as understood by the earlier logicians. *Prior Analytics* II 23 again became central, but discrepancies with the rest of the corpus still thwarted attempts to form a single, cohesive view of Aristotelian induction. Sir David Ross influentially held that Aristotle was simply confused about the matter.[3] More recent research has sought a unified, cohesive view behind a veil of disparity. A minority has suggested *Prior Analytics* II 23 has been misread, but this minority has failed to offer a fully persuasive replacement and with it a cohesive cross-corpus interpretation of Aristotelian *epagōgē*.[4] This essay adopts the minority suggestion while attempting to correct its shortcomings.

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2   For details on this history, see John P. McCaskey, 'Regula Socratis: The Rediscovery of Ancient Induction in Early Modern England' (Dissertation, Stanford University 2006).

3   W. D. Ross, 'Commentary', in *Aristotle's Prior and Posterior Analytics* (Oxford: Oxford University Press 1949), 47-51, 481-7

4   Recent treatments of Aristotelian induction have included Kurt von Fritz, *Die epagōgē bei Aristoteles* (München: Verlag der Bayerischen Akademie der Wissenschaften 1964); Walter Hess, 'Erfahrung und Intuition bei Aristoteles', *Phronesis* 15 (1970): 49-50; Nelly Tsouyopoulus, 'Die induktive Methode und das Induktionsproblem in der griechischen Philosophie', *Zeitschrift für allgemeine Wissenschaftstheorie* 5 (1974); D. W. Hamlyn, 'Aristotelian Epagoge', *Phronesis* 21 (1976); T. Engberg-Pedersen, 'More on Aristotelian Epagoge', *Phronesis* 24 (1979); Jaakko Hintikka, 'Aristotelian Induction', *Revue Internationale de Philosophie* 34 (1980); Thomas Upton, 'A Note on Aristotelian *Epagôgê*', *Phronesis* 26 (1981); Richard McKirahan, Jr., 'Aristotelian Epagoge in *Prior Analytics* 2.21 and *Posterior Analytics* 1.1', *Journal of the History of Philosophy* 21 (1983); Aristotle, *Prior Analytics*, trans. Robin Smith (Indianapolis and Cambridge: Hackett 1989), 219-21; F. Caujolle-Zaslawsky, 'Étude préparatorie à une interprétation du sens aristotélicien d'επαγωγη', in *Biologie, Logique et Métaphysique chez Aristote*, ed. Daniel Devereux and Pellegrin Pierre (Paris: Centre National de la Recherche Scientifique 1990); Terence Irwin, *Aristotle's First Principles* (Oxford: Clarendon Press 1988), 32-3; Simo Knuuttila, 'Remarks on Induction in Aristotle's Dialectic and Rhetoric', *Revue Internationale de Philosophie* 47 (1993); Ilkka Niiniluoto, 'Hintikka and Whewell on Aristotelian Induction', *Grazer Philosophische Studien* 49 (1994-95); and Greg Bayer, 'Coming to Know Principles in *Posterior Analytics* II 19', *Apeiron* 30 (1997). Of these, the Finnish and French scholars draw conclusions closest to mine. Hintikka, Knuuttila, and Niiniluto rightly consider *epagōgē* in the *Topics*. See especially Knuuttila, 'Remarks on Induction in Aristotle's Dialectic and Rhetoric'. Caujolle-Zaslawsky rightly sees Aristotelian induction as importantly related to Socratic induction.

A close and careful parsing of *Prior Analytics* II 23 will suggest how the chapter should be read, and a view of Aristotelian *epagōgē* that is unconstrained by the prior misreadings of *Prior Analytics* II 23 will be attempted. No evidence will be found that Aristotle was confused. He will be seen to hold that induction is simply the compare-and-contrast method practiced by Socrates, a process that if done properly leads to a mental conviction as trustworthy as the conclusion of a demonstrative deduction.

Prior Analytics II 23 has garnered attention largely because it appears so substantive and rigorous. Uses of the term *epagōgē* in the rest of the corpus are more cursory and individually of less substance. Fortunately, however, what little these others offer is regularly more straightforward and unambiguous than *Prior Analytics* II 23, and there are enough such mentions for us to piece together a consistent view. *Prior Analytics* II 23 after all contains only eight of the ninety-seven instances in the corpus of the noun *epagōgē* or the adjective *epaktikos* (as in *epaktikos logos*, 'inductive reasoning'). I propose that a survey of the most unequivocal of these taken together can provide bounds in which we should try to read *Prior Analytics* II 23, that the chapter can in fact be read so as to stay within those bounds, and that it can then contribute to an integrated and consistent view of Aristotelian *epagōgē*.

Details of *Prior Analytics* II 23 will be discussed more later. For now, we may simply review the most troubling aspect of it. Aristotle seems there to say that any valid induction ultimately gains its force by being convertible to a deductive syllogism. The conversion is effected by a complete enumeration of observed particulars. That is, if individual observed members of a kind all have some property and if the kind has no members other than those observed (or can be treated as such) then a first-figure syllogism can be constructed whose conclusion is that all members of the kind have the property. In modern, not Aristotelian, language: If we know G_1, G_2, and G_3 are F and we know there are no other Gs, then, and only then, we can be sure all Gs are F. Aristotle appears to thus claim that the only type of induction that can legitimately draw a certain conclusion is what is now called a 'perfect induction', that is, a complete survey of instances. Any inferentially valid induction could more precisely therefore be called, as the chapter says, 'a deduction from induction' (68b15). The conflict of this interpretation with other passages in the corpus will soon become apparent.

The Pilot and the Charioteer

The best place to begin a study of Aristotelian *epagōgē* is not the *Analytics*, but the *Topics* and the *Rhetoric*. These practical handbooks are less sophisticated than the theoretical treatises and include many plain statements about induction. Over forty percent of the surviving appearances of the word are in these two works. Early in Book I of the *Topics*, Aristotle makes two unambiguous claims about *epagōgē*:

> We need to distinguish [1] how many kinds of dialectical reasoning (*dialektikōn logōn*) there are. One kind is induction (*epagōgē*), another is deduction (*sullogismos*). [2] Now, what a deduction is has been explained earlier. Induction, however, is a proceeding from particulars to a universal. For instance, if the pilot who has knowledge is the best pilot, and so with a charioteer, then generally the person who has knowledge about anything is the best. (I 12, 105a10-19)[5]

Aristotle's first claim is that deduction (*sullogismos*[6]) and induction (*epagōgē*) are the two kinds of dialectical reasoning (*dialektikos logos*). In the rest of the corpus, Aristotle makes this distinction repeatedly and extends it beyond dialectical reasoning to rhetorical reasoning, persuasion, learning, teaching, belief, and obtaining premises — indeed to all reasoning *(logos)*.[7] Aristotle says that in a rhetorical context induction is

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5 Smith's translation, but with 'proceeding ... to a universal' for his 'proceeding ... up to a universal' for Aristotle's *epi ta katholou ephodos*; and 'inductive reasoning' for Smith's 'inductive argument' for Aristotle's *dialektikōn logon*. An odd aspect of this chapter may be noted. Book I, at least to this point, is well-structured, and Aristotle maintains a running commentary on where in an outline of his material he is. Yet Chapter 12 does not have a place in the narrated outline. Nor does the content fit neatly. The chapter is also short and succinct, even perfunctory. It seems to me that in it Aristotle is, for the sake of completeness, merely summarizing what he expects his readers to already know. More on this possibility below.

6 I follow the now current practice of using *deduction* for *sullogismos*. For justification, see Smith, notes to *Prior Analytics*, 106. In translations, the substitution will henceforth be made silently.

7 Rhetorical reasoning: *Posterior Analytics* I 1, 71a9-11; *Rhetoric* I 2, 1356b1. Persuasion: *Rhetoric* I 2, 1356b1, 1356b15. Learning: *Posterior Analytics* I 18, 81a40. Teaching: *Nicomachean Ethics*: VI, 1139b28. Belief: *Prior Analytics* II 23, 68b14. Obtaining premises: *Prior Analytics* I 25, 42a3; *Topics* VIII 1, 155b36; *Physics* VIII 1, 252a24. Reasoning *(logos)*: *Posterior Analytics* I 1, 71a6.

no less persuasive *(pithanos)* than deduction *(Rhetoric* I 2, 1356b23). In a dialectical context, both provide *pistis* (proof, legitimate conviction, justified persuasion) *(Topics* I 8, 103b2, b7). In the instances in which Aristotle says that something can be shown either by induction or by deduction, he makes no suggestion that one of the arguments is less reliable.[8] Whatever exactly induction is, it is one of two, and only two, kinds of valid reasoning, and deduction is the other. In no unambiguous passage anywhere in the corpus does Aristotle waver on this.

Of the two, Aristotle regularly gives priority to induction. He usually mentions it before deduction, and more importantly he consistently gives it logical precedence. Much of the *Topics* is a catalog of techniques and tactics for getting one's opponent to agree on one point and then, on the basis of that agreement, to a second. A frequent recommendation (as in Books II, IV, and VIII) is to get agreement on the first point by induction and then the second by deduction. For example, establish by induction that courage is desirable and use deduction to then conclude that cowardice is undesirable (II 8, 113b30), or secure the contrapositive of an intended statement by induction, then use *modus tollens* to establish the intended claim (II 8, 113b17-25). Aristotle offers about ten variations on this pattern, each using induction to establish the premise for a subsequent deduction.[9] In these examples he reaffirms that induction and deduction are complements and indicates that getting induction right is what makes subsequent valid deductions possible.

In the passage quoted above, Aristotle next says that induction is a proceeding from particulars to a universal, and he gives an example thereof. Note that in this example there are only two instances, that of a pilot and that of a charioteer. Following these Aristotle makes the tremendously broad statement that in any field the most knowledgeable person is the best in that field. Aristotle could not possibly have thought that these were the only two professions in the world or that a complete survey of all professions had been made in establishing the generalization. Compare this to *Rhetoric* II 23, a chapter that includes the only surviving presentation of several contiguous examples of what Aristotle considers to be inductions. Each includes a universal statement, and two to six particulars. The first is that all women can discern

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8   E.g., *Physics* V 5, 229b3.

9   *Topics* II 5, 111b38; II 5, 112a5; II 8, 113b17-25; II 8, 113b29; II 10, 115a5; IV 2, 122a19; IV 3, 123b7; VIII 1, 155b36; VIII 8, 160a38

the truth about a child's paternity, as happened in four particular cases Aristotle describes. The second example is that one should not entrust any property to someone who has mishandled horses and ships. The third is that all men honor the wise regardless of their shortcomings. The Parians honor the wise Archilochus though he was nasty, the Chians honor the wise but non-citizen Homer, the Mytilenaeans honor the wise Sappho though a woman, the Lacedaemonians the unschooled Chilon, and the Lampsacenes Anaxogoras though he was a foreigner. Fourthly, all people whose rulers are philosophers thrive, as Athenians did under Solon, Lacedaemonians under Lycurgus, and Thebans under their philosopher-rulers. As before, it is inconceivable that Aristotle thought these inductions were legitimate only because he, or someone he trusted, had or even could survey all the women who spoke in paternity cases, all irresponsible custodians, all wise men honored, and all the cities in the world with philosopher-rulers. In every example in the *Topics* and *Rhetoric* of what Aristotle labels *epagōgē*, the particulars subsumed by the generalization are, as here, countless.

There are similar examples throughout the rest of the corpus. In *Eudemian Ethics*, Aristotle says a universal statement about goodness *(aretē)* is justified by induction and cites goodness in a coat, a ship, and a house (II 1, 1218b39-19a5). In a discussion about causality and change in the *Physics*, he writes, 'Nor again is there anything intermediate between that which undergoes and that which causes alteration: this is clear from induction' (VII 2, 244b2), and then cites only the mechanisms of wind, sight, smell, and taste. In the same work, Aristotle makes claims about the nature of contrariety and lists examples of health, learning, and three kinds of locomotion (229a30-b9). The nature of goodness, causal interaction, or contrariety could not possibly be justified by an enumeration of all instances. Aristotle clearly believes that induction is a proceeding to a universal generalization that applies to particulars beyond those considered in forming the universal.

Aristotle also criticizes the practice of adding a phrase such as 'and so on in all cases such as these' (*Topics* VIII 2, 157a25). He says that many people do this (and in fact he himself does occasionally), and later commentators will say the phrase formally creates a complete enumeration and thus allows conversion of an induction to a deduction. But Aristotle says the phrase adds nothing to the content or validity of the argument for, he says, determining which particulars are 'such as these' is the very question at issue (157a26-7).

Interestingly, Aristotle does at one point, in *Posterior Analytics* I 5, discuss an argument by complete enumeration. That he there makes no

mention of *epagōgē* is suggestive but the substance of his comment even more so. In the chapter he says that knowing something to be true of scalene, isosceles, and equilateral triangles and knowing these are the only three kinds of triangles are not sufficient for knowing it to be true of triangles qua triangles. It may be known of every triangle considered individually, but not of triangles 'universally'(74a30). But Aristotle repeatedly defines induction as reaching a universal. Thus the complete enumeration in *Posterior Analytics* I 5 of three types of triangles is not an induction. If it were, it would have led to knowing 'universally', and it did not.

   If our short survey were extended to the full corpus, sans *Prior Analytics* II 23, what we have seen so far would be confirmed. Only if faced with unequivocal and forceful statements to the contrary should we abandon the belief that for Aristotle, whatever else induction is, it is different from and a complement to deduction, is a proceeding from particulars to a universal that results in a universal generalization that extends beyond the particulars that went into the generalization's formation, and obtains its force by some method other than a complete enumeration of particulars (or particular kinds). *Prior Analytics* II 23 seems inconsistent with all this. A close parsing of the chapter is required to determine whether it really is, and if not, what it actually says.

'Deduction from Induction'

Prior Analytics II 23 appears near the end of the work, after an extended treatment of the syllogism and a discussion on conversion. In five short concluding chapters (all unfortunately mere sketches and frequently difficult to follow) Aristotle relates other types of argument, such as induction and paradigm, to what has preceded. Referring to the subject matter of the immediately preceding chapter, he begins II 23 as follows: 'It is evident, then, how terms are related with respect to conversions and with respect to being preferable or more to be avoided' (68b8-9). Introducing a new subject, he continues, 'But now, it should be explained that not only dialectical and demonstrative deductions come about through the figures previously mentioned, but also rhetorical ones, and absolutely any form of conviction whatever, arising from whatever discipline' (68b9-13). Aristotle then repeats a claim like those made so many times, 'For we have conviction *(pistis)* about anything either through deduction or from induction' (68b13-14). This concludes what is regularly treated as the first paragraph of the chapter.

The next few sentences are the problem. Let me present the conventional interpretation first. The paragraph begins, 'Induction, then — that is, a deduction from induction — is deducing one extreme to belong to the middle through the other extreme' (68b15-16). Aristotle presents this example:

	(1) Man, horse, and mule are long-lived.
	(2) Man, horse, and mule are bileless.
By conversion of (2):	(3) <u>Bileless animals are man, horse, and mule.</u>
By (1) and (3):	(4) Bileless animals are long-lived.

Aristotle is drawing a universal conclusion by deducing one extreme (long-lived) to belong to the middle (bileless) by means of the other extreme (particular types of animals). This is a first-figure syllogism in Barbara — all C is A, all B is C, therefore all B is A, with C being the union of the types man, horse, and mule. The syllogism is valid as long as the conversion from (2) to (3) is valid, and that conversion is valid if the only bileless animals in the world are men, horses, and mules. Aristotle asks us to presume this is true for purposes of the illustration. The paragraph ends, 'One must understand C as composed of every one of the particulars: for induction is through them all' (68b28-9). Aristotle is therefore saying that complete enumeration is what gives induction its force and a valid induction is ultimately therefore a kind of deduction. The conventional interpretation of this paragraph in *Prior Analytics* II 23 then is that an inductive argument, if valid, can be reduced to a deductive one.

The claim, however, that induction is a process of complete enumeration and is therefore a kind of deduction is an extraordinary one. Robin Smith called it 'surprising'.[10] Ross called it 'strange' and ascribes it to Aristotle being overcome with 'enthusiasm for his new-found discovery of the syllogism.'[11] The claim is completely out of character with every other case in which Aristotle says he is giving an example of *epagōgē*. Every such case involves a group of particulars that could not possibly be fully enumerated. His one clear case of complete enumera-

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10   Robin Smith, 'Notes', in *Prior Analytics* (Indianapolis and Cambridge: Hackett Publishing Company, 1989), 220

11   Ross, 'Commentary', 50

tion, Aristotle indicates, is not a case of induction. All the way up to the paragraph's preceding sentence (and as we will see continuing in the immediately succeeding paragraph), Aristotle has consistently, repeatedly, and unambiguously stated that there are two separate ways of acquiring knowledge, induction and deduction. He has also indicated that of the two, induction is more fundamental. If one depends on the other, we would expect it to be deduction that depends on induction, not vice versa. Even within the paragraph itself, the conventional interpretation is strained. Aristotle knew that other animals lack bile. In *On the Parts of Animals,* he lists several and gives no indication that the list is numerable.[12] If the whole point of the chapter is to show that induction is ultimately just complete enumeration, why did Aristotle not choose particulars that could plainly be completely enumerated, such as odd and even numbers or equilateral, scalene, and isosceles triangles? When the paragraph is considered in the full context of Aristotle's other comments on induction, it seems best to suspect that another interpretation is warranted.

An alternate interpretation can be found by reading the chapter from the outside in rather than from the inside out. Let me explain. The passage has three readily separable sections normally translated as paragraphs, the first of which (68b8-b14) I quoted in full above and the second of which (68b15-29) is the substantive core whose conventional interpretation I summarized. The third paragraph (68b30-8) is a concluding summary. The first and last paragraphs are typically read in light of the middle core. But instead, imagine that the middle paragraph has been lost and that we have to reconstruct it based on the surrounding sentences. What would we conclude it must have said?

Let us begin by ensuring we understand the first paragraph. Aristotle's previous chapter discussed conversion, and this one begins, 'It is evident, then, how terms are related with respect to conversions and with respect to being preferable or more to be avoided' (68b8). This review of the previous chapter lies not at the end of that chapter but is joined in a correlative *men-de* construction to the next sentence of this one. We should expect conversion to be intimately involved with the material of this chapter. The next sentence is more subtle than might first appear, and overlooking the subtlety can create a wrong expectation of what is to follow. The sentence reads (in my literal translation, follow-

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12 *On the Parts of Animals,* IV 2, 676a15-7b11, as Hintikka, 'Aristotelian Induction', 427
    notes. Mention is made of the deer, camel, mouse, and dolphin, among others.

ing the punctuation of Ross' Greek edition), 'We should therefore now say that not only the dialectical and demonstrative deductions come to be through the previously discussed figures, but also the rhetorical and in general any *pistis* and that [*pistis*] according to whatever method *(methodon)*' (68b10-13). This should not be read as saying that the three kinds of deduction are three forms of *pistis*. We have been told elsewhere and will be told again in the very next sentence that deduction *provides pistis*; it is not a *kind* of *pistis*. To make good sense of the passage, we need a fuller stop after 'rhetorical'. The passage and its subsequent sentence should be read as follows: 'We should therefore now say that not only the dialectical and demonstrative deductions come to be through the previously discussed figures but also the rhetorical [deductions as well]; in general any *pistis*, obtained by any method, [whether by the method of deduction, induction, or any of their variants, comes to be such by the previously discussed figures]. For we have conviction about anything *(hapanta gar pisteuomen)* either through deduction or from induction' (68b10-14). How deduction provides *pistis* through the three figures has already been explained. How induction does will now be. We should expect the two will be different, and we should expect the second will have something to do with conversion.

Continuing our strategy of reading the chapter from the outside in, let us skip the second paragraph, pretending its existence is known but its contents lost. The third paragraph begins, 'This is the sort of deduction that is possible of a primary and unmiddled premise' (68b30-1). What did we miss? It sounds as if the second paragraph presented an example of something Aristotle is calling the 'deduction of an unmiddled premise'. But what is that? The text continues, 'for the deduction of those [premises] where there is a middle term is by means of the middle term; but the deduction of those where there is not a middle term is by means of induction' (68b31-3).[13] So there are two kinds of deductions, deductions of middled premises and deductions of unmiddled premises. In the first, the premise is the conclusion of some syllogistic figure that has in it a middle term. In the second, the premise is also the conclusion of some syllogistic figure, but the role earlier played by a middle term is now played by induction. Let us call the first a deduction-from-a-middle and the second a deduction-from-induction. That second paragraph must have given an example of a deduction-from-in-

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13 Smith's translation, but with his addition of 'premises' bracketed, and 'where there is' for his 'of which there is'.

duction, whatever that is, instead of the more familiar deduction-from-a-middle, which has been the subject of the immediately preceding chapters.

Next comes a sentence I will skip and return to in a moment. It is followed by the final sentence of the chapter: 'By nature, then, the deduction through the middle term is prior and more familiar, but the deduction through induction is clearer to us' (68b36-7). Here again, Aristotle draws a distinction between what I have called deduction-from-a-middle and deduction-from-induction. Now that intervening, penultimate sentence is odd, for it presents a different dichotomy. All the rest of this paragraph concerns the dichotomy between deduction-from-a-middle and deduction-from-induction, but that penultimate sentence presents a dichotomy between deduction and induction: 'And in a way, induction is the opposite of deduction, for deduction proves the first extreme to belong to the third term through the middle, while induction proves the first extreme to belong to the middle through the third' (68b33-6). Ignore for now Aristotle's description of the difference, with its 'first extreme', 'third term', and so on, and simply note that Aristotle contrasts deduction and induction while the surrounding sentences contrast deduction-from-a-middle and deduction-from-induction. How are we to understand the discrepancy? Recall that the *Prior Analytics* is probably a lecturer's notes or other outline material and not a polished treatise and that these final chapters are particularly skeletal. I propose that Aristotle is using shorthand that would not be out of place in such writing. By 'deduction' he means deduction-from-a-middle (given what has come before in the *Prior Analytics*, interchanging 'deduction-from-a-middle' and 'deduction-from-deduction' would be unsurprising) and by 'induction' here he means deduction-from-induction. Thus this third paragraph, even with the jarring name change in the center sentence, is about the contrast between two kinds of deduction, deduction-from-a-middle and deduction-from-induction, and not about the contrast between deduction and induction. Now let us return to the chapter's central paragraph and see if we find there what our analysis of the outer paragraphs indicates should be there.

Based on the report in the third, we expect the second paragraph to have presented an example of a deduction-from-induction, that is, an example that, as the third paragraph describes it, 'proves the first extreme to belong to the middle through the third.' We now drop our pretense about losing the second paragraph and look at it. It begins, '… a deduction from induction — is deducing one extreme to belong to the middle through the other extreme' (68b15-16). This is almost verbatim

what the third paragraph said the second was about. There is, how-
ever, one small difference, the words I omitted at the sentence's very
beginning. The first sentence of the central paragraph actually reads,
'Induction then — that is, a deduction from induction — is deducing
one extreme to belong to the middle through the other extreme.'[14] Com-
mentators have struggled with those first eight words. If read literally,
they form an infinite regress (induction is a deduction from induction,
which is a deduction from induction, which is ...), so a plain literal
reading cannot be right. If taken another way, they could indicate that
every time Aristotle used *epagōgē* in the corpus he really meant, 'the
kind of deduction known as induction'. But this would make nonsense
of his frequent and unambiguous contrasting of the two. Again, Aristo-
tle must be using some type of shorthand. Maybe it is just a lecturer's
or draft-writer's shorthand: 'Induction, then, [is now our next subject]:
A deduction from induction is ... '. Or maybe he is using one term in
two senses: 'Induction [considering *epagōgē* in one sense], or, deduction
from induction [considering *epagōgē* in some other sense], is ... '. To de-
cide which, we need to see that the ensuing example is not an example
of inference by complete enumeration. It is not an induction rendered
in the form of a deduction.[15] I propose that it should instead be read in
the following way.

From the opening of this paragraph and from what Aristotle said in
the preceding, introductory paragraph we know he wants to exhibit
how the *pistis* that we obtain by use of induction 'comes about through
the figures previously mentioned' (68b11), that is, through the syllogis-
tic figures. His tool for doing so will be conversion, the subject of dis-
cussion in the preceding chapter and the subject cited at the beginning
of this one. Aristotle's subject for the chapter's middle paragraph is

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14 The Greek is *Epagōgē men oun esti kai ho ex epagōgēs sullogismos to dia tou heterou
thateron akron tōi mesōi sullogisasthai.*

15 Few agree with me on this. In 1850, William Whewell did. William Whewell,
'Criticism of Aristotle's Account of Induction', in *William Whewell's Theory of Sci-
entific Method*, ed. Robert E. Butts (Indianapolis, IN: Hackett Publishing Company
1989), 311-21. It appears that he was ignored on this, but a few Aristotle scholars
have recently begun to entertain the possibility. Cf. Tsouyopoulus, 'Die induktive
Methode und das Induktionsproblem in der griechischen Philosophie', 107-14;
Engberg-Pedersen, 'More on Aristotelian Epagoge', 311-4; Hintikka, 'Aristotelian
Induction', 427; Niiniluoto, 'Hintikka and Whewell on Aristotelian Induction', 54-
60. None has precisely anticipated my proposal that the reference of C changes at
68b28.

how conversion is used to effect a deduction-from-induction and thus provide the *pistis* that induction can provide. Aristotle will first present the relevant syllogistic figure using a simple example, an example in which the conversion is justified by a method *other than induction*, in this case by surveying one or a few particulars or kinds of particulars. He will then expand the example by replacing a conversion justified by survey with a conversion justified by induction. He will spend the bulk of the paragraph setting up the simple example and discussing the role that conversion plays. He will execute the expansion tersely, almost casually, in the paragraph's final words.

   Aristotle's example is an application of the conversion rule he introduced and proved in the preceding chapter: 'When A and B belong to the whole of C and C converts with B, then it is necessary for A to belong to every B' (68ba21-4).[16] He begins: 'Induction, then — that is, a deduction from induction — is deducing one extreme to belong to the middle through the other extreme, for example, if B is the middle for A and C, proving A to belong to B by means of C' (68b15-19). This, we see, is going to be an application of that earlier proved conversion. Continuing, Aristotle reminds us, 'for this is how we produce [deductions-from-]inductions' (68b19).[17] His example will be a biological one. 'For instance, let A be long-lived, B stand for not having bile, and C stand for a particular long-lived thing, as a man, a horse, or a mule' (68b19-21). It is not wholly clear whether Aristotle means one particular thing or several, and whether he means particular things or particular kinds of things. Translators have rendered various combinations.[18] But Aristotle *does not mean* that men, horses, and mule are the only long-lived (or long-lived and bileless) animals in the world, nor does he want us to

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16   Here is an illustrative example (not Aristotle's): Having angles that sum to 180° (A) and having three sides (B) are both properties of all triangles (C); C converts with B, that is, not only do all triangles have three sides, but everything with three sides is a triangle; therefore, it is necessary that having angles that sum to 180° (A) is a property of everything having three sides (B). A is proved of B by means of C. If there were three-sided things (B) other than triangles (C), C would not convert with B and the conclusion that A is a property of every B could not be drawn. To validate the conclusion, one must have a way to validate the conversion, that is, show that B does not 'reach beyond' (as Aristotle says it, 68b24) C.

17   My insertion.

18   The unclear Greek is *to kath' hekaston makrobion hoion anthrōpos kai hippos kai hēmionos*.

pretend that they are. C is a surveyable and finite list of things or kinds of things. We would call it a sample. Now for reasons that are not important here Aristotle knows that all particulars in his sample are both long-lived and bileless. 'Now, A belongs to the whole C ... ; but B (not having bile) belongs to every C' (68b21-3). Every particular in the list is both long-lived and bileless. Since the list is of finite size, and everything on it is bileless, it is valid to convert C with B (68b23-8).[19] By the conversion then, all B is C, and by the rules of the syllogistic figure, all B is A:

	(1) All C is A.
	(2) All C is B.
By conversion of (2):	(3) All B is C.
By (1) and (3):	(4) All B is A.

	(1) All the particular things on the list are long-lived.
	(2) All the particular things on the list are bileless.
By conversion of (2):	(3) All bileless things are all the particular things on the list.
By (1) and (3):	(4) All bileless things are long-lived.

That is, in the sample of particular things (or kinds of things) that Aristotle defined up front, everything bileless is long-lived.

Aristotle has a fine first-figure deduction from a surveyed list. He does not yet have a deduction-from-induction, but he sees that as a simple extension. He wraps up the paragraph by redefining C: 'But one must understand C as composed of every one of the particulars: for induction is through them all' (68b28). But every one of which particulars? Earlier Aristotle had said that an induction-from-deduction is deducing A to belong to B through C, and that C was 'a particular long-

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19   I take *kai* at 68b23 to be 'that is', not 'and'. Aristotle is not setting up two conditions that must be met, C converting with B and also the middle not have wider extension. The second, rather, is the crucial factor that makes the first true. The alternate makes little sense, for if C converts with B, then by the nature of conversion, the middle does not have wider extension. The conditional is met first by enumeration of a limited sample, then by induction.

lived thing, as a man, a horse, or a mule.'[20] He now means C to be *all* particular long-lived things, for a deduction-through-induction is not a deducing through just a surveyed list, but 'through them all'. Aristotle is finished and proceeds to the next paragraph, 'This is the sort of de-duction that is possible of a primary and unmiddled premise ... .' He has exhibited how a deduction-from-induction comes about through a syllogistic figure by use of a law of conversion, as he indicated he would.

We, however, are left hanging. It seems we missed a step. How did Aristotle justify conversion of B and C after he changed the meaning of C? What is Aristotle taking for granted that we missed? To understand Aristotle's move here, we should not presume that the move works for all inductions. Though inductions lead to universals, not all universals convert. All men are mortal, but the subject and attribute do not con-vert. Not all mortal things are men. Some attributes, however, do coun-ter-predicate with their subjects. Definitions are an example. Man is the rational animal, and the only rational animals are men. If something is one, then it is the other also. But definitions are only a special case. An animal by nature civilized and an animal receptive of knowledge both counter-predicate with man, and Aristotle gives these two as examples of this non-definitional kind of universal.[21] (After Porphyry's *Isagoge*, the ability to laugh became the stock example.) In the *Topics*, Aristotle calls such a universal an *idion kata hauto* (an attribute that distinguishes by the nature of the thing) and in the *Posterior Analytics* a *proton katholou* (primitive universal).[22] Such an attribute counter-predicates and con-verts just as a definition does, but is not itself part of the definition. Because it can indicate the referents of a term, an *idion kata hauto* can tell us in a sense what a term means, even if it does not provide the term's definition. In *Posterior Analytics*, Aristotle explains that such a predicate

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20 Or particular long-lived things or kinds of things, depending how you read *to kath' hekaston makrobion hoion anthrōpos kai hippos kai hēmionos.*

21 E.g., *Topics* V 130a29, 132a5, 130b9, 132b1.

22 The idea is introduced at *Topics* I 4, 101b 19-23 and *Topics* I 5, 102a26 where it is also called *idion haplos* (distinguishing without qualification). The synonym *idion kata hauto* is introduced in *Topics* V and forms the subject of that book. Because of its importance, later commentary equated *idion kata hauto* with *idion*, but in Aristotle there are in fact several types of *idion*. The idea is approached from a different direction under the name *proton katholou* and with an unfortunate lack of clarity in *Posterior Analytics* I 4 and 5.

meets two requirements. It holds 'when it is proved of an arbitrary and primitive case' (73b32-3). The first criterion says that the property holds of every and any instance of the subject. For our purposes in *Prior Analytics* II 23, that would include any instances not surveyed. The second criterion says that the property is unique to the subject. Having angles that add to two right angles holds of all scalene triangles, but not primitively so, since it holds of other kinds of triangles as well. The property is unique not to scalene triangles but to triangles. It thus holds primitively of triangles. These two conditions correspond to the two conditions in *Prior Analytics* II 23, C is 'through them all' (68b29) and 'the middle term does not reach beyond the extreme [the particulars]' (68b23-4). In that chapter's final syllogism, Aristotle assumes that being bileless is a distinguishing characteristic, a primitive universal, an *idion kata hauto*, of all and only all long-lived animals. We will see later why he might be confident in presuming that, but for his purposes in this chapter, those reasons are not important. He merely takes it for granted.

Once we now rightly understand the terms, structure, and justification of this chapter's troublesome syllogism, we are in a position to reflect on the chapter's overall point. At its beginning, Aristotle indicated that he would discuss how conversion and use of the syllogistic figures allows induction to provide the *pistis* that it does. Unfortunately, he does not sufficiently explain what *pistis* we obtain when we know that long-lived belongs to bileless that we did not have when we only knew that a mule or a man is bileless and long-lived. Presumably we are more or more justifiably convinced of something the more it appeals to the general rather than to the particular.[23] But what do we have after the conversion and completion of the syllogism that we did not have with just 'induction is through them all' and 'the middle term does not reach beyond the extreme'? What did the syllogism add?

In the syllogism, all C is A and all C is B, all the animals are both long-lived (A) and bileless (B). But this can mislead. C's relationship with A and C's relationship with B are quite different. When Aristotle defined his terms, he said, 'let A be long-lived ... and C stand for a particular *long-lived* thing *(to kath' hekaston makrobion)*, as a man, a horse, or a mule.' That is, let A be long-lived, and let C be an instance (or instances) of A.

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23   *Posterior Analytics* I 2, 72a 25-38 supports this, as does a theme running throughout
the *Topics* and *Rhetoric* that when persuading others, one should justify a particular
claim by appeal to a more general principle.

C is not a particular later found to be long-lived (and then also bileless). It is a particular specifically chosen knowing A belongs to it. In the final resulting syllogism, the first premise is '(1) All the particular long-lived things (men, horses, mules, and others) are long-lived'. This is justified merely on the principle, *dictum de omni et nullo,* that what is true of the whole is true of the individuals. The relationship of B with C, however, is different. That all the particular long-lived things have no bile is justified outside the chapter, first by investigation of the few selected and then by an induction not described here. The induction justifies, by the nature of its resulting universal *(proton katholou),* both the second premise, '(2) All the particular long-lived things (men, horses, mules, and others) are bileless', and its conversion, '(3) All things bileless are all the particular long-lived things (men, horses, mules, and others)'. Even after this induction, however, we have statements only about particulars. To get the *pistis* he wants, Aristotle needs to have the particulars drop out, so to speak,[24] and leave a relation of universals. That is what the deduction accomplishes. In the end it is not that every particular bileless animal is also long-lived, but that '(4) All things bileless are long-lived', or as Aristotle would regularly say when making general statements without reference to particulars, 'Long-lived belongs to bileless'. The syllogism has changed statements about particulars into a statement relating universals.

Even if it can mislead, Aristotle's equating of induction with deduction-from-induction does in the end make some sense, even if in a way not normally thought. In the chapter, he is in fact using *epagōgē* in two different senses. To see the difference, we should first recognize an ambiguity in the claim that induction is a progressing from particulars to universals. Do particular and universal here refer to terms or to propositions? Aristotle uses the words both ways, but the first is more fundamental. Aristotle's standard description of a universal is that it can be predicated of many particulars, such as the universal predicate 'man' of the particulars Callias, Socrates, and Coriscus.[25] In his criticism of Plato's view on the matter, Aristotle insists, 'The universal is always

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24   In the next chapter, *Prior Analytics* II 24 69a18, Aristotle says the induction leaves the particulars and the deduction disconnected *(ou sunēpte),* and I suspect this is what he is referring to.

25   *de Interpretatione* VII, 17a39; *Metaphysics* E 13, 1038b12; *de Partibus Animalium* I 4, 644a28; *Posterior Analytics* B 19, 100a7

predicated of some subject.'[26] Fundamentally, a universal is a predicate term in a proposition; it is not the whole proposition. Such a universal predicate can in turn then form the subject of another proposition, first 'Callias is a man', then 'man is an animal'. How, if at all, that term is qualified (with, for example, 'every', 'some', and 'no') determines whether the resulting proposition may itself be fairly called universal (*de Interpretatione* VII, 17b1-25).

Fundamentally, the particulars in the syllogism in *Prior Analytics* are not particular propositions. They are individual animals (or kinds thereof). The fundamental proceeding from particulars to a universal is not operating in the syllogism, but in establishment of the second premise and justification of conversion of the second to the third. That induction is the predicating of bileless to many long-lived particulars and the discovery that no other animals have this property. It is coming to find that every particular C is B and that no particular not a C is B. It is a discovery of a *proton katholou* property of particulars, that is, one that is true in every case and is true primitively. But to fully hold the conclusion, to be convinced, to be persuaded, to have *pistis*, one needs the conclusion not in the language of particulars but in the language of a fully universal proposition, one that though true of particulars can be made without specific reference to them. The predicate may be universal, as in any induction it would, but the subject must be, too. To effect that, we bring in the syllogism's first premise, '(1) All the particular long-lived things are long-lived'. In the syllogistic figure, the extreme C, 'All the particular long-lived things' now drops out and we are left only with universals. 'Long-lived belongs to bileless'. An induction predicating something of many particulars was performed outside the syllogism, but the conversion of that predication to a predication of a universal was performed by the syllogism. The induction was, in effect, completed or finalized by the deduction. The deduction itself was not ampliative. It did not infer to many from a survey of some. Nor did it draw a conclusion from a complete enumeration of particulars. Rather it placed the results of an induction of particulars into the universal propositional form that allows the result to provide the mental conviction, the *pistis*, that it does.

A claim that induction is a deduction from induction would be a contradictory and infinite regress unless the term *epagōgē* were being

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26 *Metaphysics* VII 13, 1038b16. Translation by Hugh Tredennick (Cambridge, MA and London: Harvard University Press, Loeb Classical Library 1933).

used in different senses in each place, and in *Prior Analytics* II 23 it is. In the chapter's illustrative syllogism, a premise in which one universal is predicated of many particulars is used to justify a conclusion in which one universal is predicated of one universal. Either proposition may be said to have been reached by induction but it is the first that is more fundamental. The first does the heavy epistemological work, while it is the second that provides mental conviction. Just as there is usually little harm in conflating 'Man is mortal' with 'Every man is mortal', there is usually little harm in conflating the two senses of *epagōgē*. But if the chapter is read as saying Aristotle believed induction is fundamentally a kind of deduction that gains inferential force by a complete enumeration, Aristotle would be gravely misunderstood.

The Pilot, the Doctor, and the Cowherd

We are left wondering why Aristotle was confident in the induction that led him to believe being bileless was an *idion kata hauto* of every particular long-lived animal. We may have discovered what Aristotle did not mean by *epagōgē*, but we have yet to determine what he did mean. Our big problem is simply that Aristotle never treats the subject directly and substantively. This fact, however, may be our best evidence. It is remarkable that Aristotle's ninety-one uses of *epagōgē* and six of *epaktikos* are so incidental. He never catalogs and analyzes, as he does with so many other subjects, preceding or competing views of *epagōgē*. He always introduces the term without preface or explanation and uses it to explain some point presumably less clear. Aristotle never suggests his understanding of *epagōgē* is new, unusual, or disputed. Even *Prior Analytics* II 23 is after all not primarily a treatment of induction but an appeal to what is known about induction to explicate features of syllogistic figures and conversions. In *Topics* VIII 1, Aristotle suggests techniques appropriate for various debating situations. He discusses each briefly, but about induction says only, 'What sort of thing induction is, is clear' (157a8). Throughout the corpus, Aristotle assumes his readers or listeners already know what *epagōgē* is.

What conception of induction would a fourth-century Athenian student have had? In the *Metaphysics*, Aristotle attributes the introduction of 'inductive reasoning *(epaktikos logos)*' to Socrates (XIII 4, 1078b28), again without suggesting the term is unfamiliar. In the *Topics* (VIII 14, 164a16), Aristotle says that effective use of comparisons *(parabolai)* is characteristic of a good inductive reasoner and in the *Rhetoric* (II 20,

1393b5) that the use of such *parabolai* was Socrates' distinctive method. In the *Rhetoric* (II 20, 1393b4-8), Aristotle gives an example of what he says is a Socratic induction,[27] and it is comparable to many of Aristotle's own, including the one described earlier involving the pilot and the charioteer. The similarity between that example and the countless portrayals in Plato's early dialogues of Socrates' search for universal definition is undeniable. To one of Aristotle's students, Socrates would have been a figure of the fairly recent past and his style of arguing, at least as it was preserved in the Academy, well enough known. Unless we find evidence to the contrary, we should presume that when Aristotle used the word *epagōgē*, he expected his students to understand it to be none other than what they would have known to be Socratic induction.[28]

I believe the most insightful understanding of Socratic *epagōgē* remains that of Gregory Vlastos.[29] Vlastos uses *Ion* 540b-d to make his case. In that passage, Socrates argues as follows (quoting Vlastos' paraphrase):

(1)   The pilot is the one who knows best what should be said to the crew of a storm-tossed ship.

(2)   The doctor is the one who knows best what should be said to the sick.

(3)   The cowherd is the one who knows best what should be done to calm angry cattle.

(4)   The expert in wool is the one who knows best what should be said to women working wool.

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27   The example is actually of a paradigm, which Aristotle explains is a 'rhetorical induction' (*Rhetoric* I 2, 1356b5). In such an induction, the universal is left unstated but silently presumed in subsequent arguments.

28   That *epagōgē* was characteristically a tool of Socratic rather than Aristotelian reasoning was the standard view until late antiquity. See, e.g., Cicero, *Topica*, §42, *de Inventione*, 1 35; Quintilian, *Institutio Oratoria*, 5 10 73.

29   Gregory Vlastos, 'Editor's Introduction', in *Protagoras* (Upper Saddle River, NJ: Prentice Hall 1956), xxix, n 18; Gregory Vlastos, *Socrates: Ironist and Moral Philosopher* (Ithaca, NY: Cornell University Press 1991), 267-8. For others on Socratic induction, see Richard Robinson, *Plato's Earlier Dialectic* (Oxford: Oxford University Press 1953), Gerasimos Santas, *Socrates: Philosophy in Plato's Early Dialogues* (London and Boston: Routledge and K. Paul 1979), Norman Gulley, *The Philosophy of Socrates* (London and New York: Macmillan and St. Martin's Press 1968), and the unpublished Mark L. McPherran, 'Socratic *Epagoge* and Socratic Induction', (2004). See also Hamlyn, McKirahan, and Caujolle-Zaslawsky, cited above.

> (5)   The military expert is the one who knows best what the general should say to his troops.[30]

The universal conclusion is that the master of any craft 'is the one who knows best matters falling within its subject-matter.'[31] But on what authority does this universal statement rest? Vlastos observes that this is *not* a case of inferential induction as commonly understood today. It is neither the case that all crafts have been surveyed nor is it the case that some craft could possibly be found in which experts are not the ones who know best. There is no Humean fear that because they have not all been surveyed, the next craft observed could refute a tentatively established universal conclusion. Socrates is not presenting observations to confirm an hypothesis. The conclusion, Vlastos claims, is not really an inference at all but an elucidation of what it means to be a 'master'. That is, the instances in a Socratic induction do not *prove* the universal conclusion; they *exhibit its meaning*.[32] If we take 'meaning' here not as necessarily definitional or essential but as indicating the properties that have a one-to-one correspondence with a term's referents and are thus able to uniquely identify those referents, then I think we have gotten to the heart of Aristotelian *epagōgē*, at least when it is used to provide *pistis*.

   Aristotelian induction is not a kind of inference, though since the earliest Scholastic textbooks it has been standard to present it as such. The canonical treatment is familiar. For each type of inference, several propositions are presented, and what conclusion does or does not follow is then stated. All men are mortal; Socrates is a man; this is a valid syllogism; therefore we can conclude Socrates is mortal. All mothers are women; all mothers have children; it would be invalid to conclude that all women have children. Socrates runs; Plato runs; Cicero runs; this is an induction and unless there are no other men it does not follow that all men run. The examples are centuries old, and the taxonomy is even nowadays many a budding philosopher's early exposure to 'Aristotelian' logic. But it misrepresents Aristotle's view of induction. If inference is a kind of reasoning by which, if the premises are true, something else follows from them specifically because they are true, not only is

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30   Vlastos, *Socrates: Ironist and Moral Philosopher*, 267-8

31   Ibid., 268

32   Ibid. Italics in Vlastos' statement.

this not Aristotle's view of induction, it is his very definition of induction's opposite, i.e., of deduction.[33] In *Prior Analytics* II 23, Aristotle does not argue that something is true of man, horse, and mule and *therefore* true of all bileless animals. He does not in the *Topics* say that *because* something is true of the pilot and charioteer, it is true of all professions. In the *Rhetoric*, he does not say that he knows all cities governed by philosophers-kings prosper *because* he knows it of some. In Aristotelian *epagōgē* the truth of a generalization does not follow — and Aristotle does not claim that it follows — directly from particular premises being true. In the examples cited so far, he does not explain what justifies the generalization. Fortunately, however, there are other passages in the corpus where he does.

The first such passages are those citing *parabolai* (the Socratic comparisons). For coming to knowledge of a universal, Aristotle assigns no particular value to enumeration; he does, however, to comparison and the resulting recognition of similarity. He says that the mark of a good inductive reasoner is skill at drawing comparisons between particulars and then noting the similarities (*Topics* VIII 14, 164a16). He writes, 'We bring in the universal by means of an induction of the particulars according to what is similar' (*Topics* I 18, 108b10-11).[34] When describing induction in *Posterior Analytics* II 19, Aristotle says that a universal arises when from the memory of multiple particulars one recognizes 'whatever is one and the same in all these items' (II 19, 100a8). To discern similarities, Aristotle offers little advice in the *Topics* other than to look and see, using verbs such as *skeptesthai* or *synoran*, 'to look at carefully', or using the noun, *theoria*, 'a looking at'. In the *Posterior Analytics*, he says, 'for this is the way perception instils universals' (II 19, 100b5). The identification of similarities, Aristotle thus suggests, is not primarily a contemplative process but virtually a perceptual one. As he said early in the *Topics*, induction is grasped 'in the way perception is' (I 12, 105a10-19). The repeated claim that performing an induction involves juxtaposing particulars and seeing similarities is never contradicted.

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33   *Prior Analytics* I 1, 24b19; *Rhetoric* I 2, 1356b16; *Topics* I 1, 100a25; *Posterior Analytics* II 5, 91b15

34   My translation of *kath' hekasta epi tōn homoiōn epagogēi to katholou axioumen epagein.* It is ambiguous whether 'what is similar' refers to particulars that are similar or to their common attributes. Note that *epagein*, 'to bring in', does not mean 'to perform an induction'. The object of *epagein* is the universal; the object of an *epagōgē* is the particulars.

An association between induction, similarity, universals, and coming to know kinds is drawn several times in the *Topics*. The first is an incidental but pregnant remark in I 14. Aristotle there discusses three types of something and then remarks, 'As for what each of the aforementioned kinds is, it is not easy to state that in definitions about them, and one must try to recognize each of them with the familiarity which comes through induction, studying them in light of the examples given' (I 14, 105b25-9).[35] Aristotle appears to believe that by using induction, one can obtain a sufficient grasp of a kind to discern whether something is a member of the kind, even if the kind has not been defined. It is very valuable, he says however, for each kind to at least have a name. Late in the *Topics* (VIII 2), Aristotle considers the situation in which the questioner in a debate has marshaled several similar cases. The debater wants to bring in *(epagein)* a universal, but he is having difficulty because the group of particulars has no name. One could proceed by simply adding 'thus in all such cases' (157a25), but, as we heard earlier, 'this is one of the most difficult of things, to determine which of the cases brought forward are "such" and which are not' (157a25-6). If a universal term is not already available, 'you should try in all such cases to make up a name yourself' (157a29-30). That is, to complete the induction it is important to have a name for the kind, even if not a definition. This helps the debaters grasp the universal and its constituent particulars.

A passage in the *Posterior Analytics*, even though it makes no mention of induction, may help us understand this. Following a discussion about the nature of universals, Aristotle says that the principle of alternation (i.e., if A:B::C:D then A:C::B:D) was in the past proved separately for numbers, lines, solids, and durations, since there was no one name for all of these. But it is now proven of them 'universally', for, he implies, there is now one term that subsumes them all, and that term can be used in a demonstration that then applies to all (I 5, 74a21-3).[36] It is immediately following this that Aristotle makes his comment that even if one proved something true of equilateral, scalene, and isosceles

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35   Smith's translation, but with 'is' for his 'is like'.

36   Aristotle does not say what the newly introduced term is, possibly *poson*. Cf., *Categories* VI 4b20-5; Thomas L. Heath, *Mathematics in Aristotle* (Oxford: Clarendon Press 1949); and James G. Lennox, 'Divide and Explain: The *Posterior Analytics* in Practice', in *Philosophical Issues in Aristotle's Biology*, Allan Gotthelf and James G. Lennox, eds. (Cambridge: Cambridge University Press 1987), 115.

triangles, one would not know it to be true of triangles universally, that is, of triangles as triangles.

We can now spot an important difference between Aristotle's conception of induction and the typical modern one.[37] Suppose we cast an inductive question as follows. 'This one is F; that one is F; the other one is F; are all such things F?' A problem presents itself. What are 'all such things'? Knowing this, as Aristotle says, 'is one of the most difficult of things.' Modern notions of induction generally presuppose that we already know they are, say, Gs. We pose the question as 'G₁ is F; G₂ is F; G₃ is F; are all Gs F?' Aristotle, on the other hand, seems to propose that identifying all the particulars as of a kind G constitutes much, if not all, of the battle. He says in *Topics* VIII 2 that once the kind has been identified and the name assigned, the debater is justified in asking his opponent to accept the proposed universal (157a34-5).

A second group of passages helpful for understanding how Aristotle justifies an inductive conclusion appears in *Eudemian Ethics*, the *Physics*, and the *Metaphysics*.[38] In each, Aristotle claims to explain how the truth of some proposition is clear by induction. But then the explanation seems either lacking or not an induction. Of an instance in the *Metaphysics* (X 8, 1058a9), the Loeb translator Tredennick remarks, 'Aristotle does not use induction to prove his point; indeed he does not prove it at all,'[39] and the attitude is typical.[40] But the problem is not Aristotle's. It is our tendency, under the long shadow of *Prior Analytics* II 23's misreading, to treat Aristotelian *epagōgē* as a kind of inference. We need to break that tendency if we are to understand these passages.

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37   Cf. Smith's commentary. Aristotle, *Topics: Books I and VIII*, trans. Robin Smith, *Clarendon Aristotle Series* (Oxford: Clarendon Press 1997), 116.

38   Examples include *Eudemian Ethics* II, 1219a1; *Physics* VII 2; 244a26/b3; and *Metaphysics* X 3, 1054b33; 4, 1055a6, b17, and 8, 1058a9.

39   Hugh Tredennick, notes to *Metaphysics: Books X-XIV* (Cambridge, MA and London: Harvard University Press, Loeb Classical Library 1960), 42.

40   Ross' paraphrases of all these passages in the *Metaphysics* simply leave out Aristotle's mention of induction. Regarding an instance at the core of *Physics* 7, Wardy says Aristotle only 'goes through the motions of defending [his] thesis,' he simply presents no argument where we expect one, and 'from our perspective, Aristotle's performance in this instance is weak.' Robert Wardy, *The Chain of Change* (Cambridge: Cambridge University Press 1990), 150.

Each of the passages follows a pattern. Aristotle first makes a universal statement, such as that goodness is a certain disposition, state, or faculty (*Eudemian Ethics* II 1, 1218b39) or that contrariety is a difference (*Metaphysics* X 3, 1054b33; 1055a6). He then says: 'This is clear from induction *(dēlon ek tēs epagōgēs).*' Seeing that what follows is not an inference, translators, and commentators tend to read this phrase as 'This is clear from examples'. But that is not what Aristotle says, and what follows are not examples. The examples come later, if at all. What follows instead is an explanation for the universal, but an explanation cast in the language of particulars. It begins 'for in all cases ... '.[41] If an induction were for Aristotle justified by complete enumeration, we would expect 'for in all cases' to be followed by a survey of all cases, something like, 'for all cases of contrariety are of three kinds; in all three kinds, contrariety is a difference; therefore in all cases contrariety is a difference'. But we do not get this at all. Instead we get a claim that two properties are equally distinctive — that is, though the phrases are not used here, equally *idion kath hauto*, equally *proton katholou* — of some group, usually with a justification, sometimes lengthy, for the claim. In *Eudemian Ethics* II, 1219a1, Aristotle says, that for things that have a use or work, goodness and being the best disposition, state, or faculty are equally distinctive. Things of this type that are good have the best disposition, state, or faculty, and things of this type that have the best disposition, state, or faculty are good. In this case, Aristotle offers little explanation and several illustrative examples. In *Metaphysics* X 4, 1055a6-17, using an appeal to principles involving the nature of completeness, difference, and greatness, Aristotle explains that in things that differ, contrariety, maximum difference, and complete difference mean the same thing. Anything that is one is also the other. He gives no examples. In *Physics* VII 2, 244a26/b3-245a11/26, Aristotle explains that in things subject to alteration, the property with respect to which the alteration takes place is also the property which causes the alteration. Aristotle's explanation takes over a hundred and fifty words, after which he claims his validation is complete. Only then does he offer illustrative examples. In these passages and other instances of 'This is clear from induction, for in all cases ... ', Aristotle's project is to show that two or more properties can be counter-predicated of some kind. In his justification, Aristotle picks particulars of a kind that have

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41   *Eudemian Ethics* II 1, 1219a2: *'epi pantōn gar'. Physics* VII 2, 244b4: *'en hapasi gar'. Metaphysics* X 3, 1054b34: *'panta gar'. Meteorology* IV 1, 378b15: *'gar en pasin'.*

one of the properties. He then explains that each of the particulars has the other property and that the property does not extend beyond the particulars. These are the characteristics that establish two properties as being *proton katholou* of a kind, just as long-lived and bileless were in *Prior Analytics* II 23.

Induction is thus an operation that can make clear that two or more properties are distinctive by nature — are *idion kath hauto*, are primitively universal, are *proton katholou* — of a kind. How one identifies such properties is explained in Book V of the *Topics*. The introductory paragraphs describe different types of a distinguishing characteristic, different types of *idion*, including *idion* at a time, *idion* always, *idion* in all cases, *idion* in most cases, *idion* usually, *idion* relative to something else, and finally *idion* by nature, *idion per se*, *idion kath hauto*. The introduction concludes by saying that in dialectical competitions, all these but the last should be treated as if the property were an accidental property, a property predicated *kata sumbebekos*. Then, in about fifty pairs of rules, guidelines, and suggestions, the rest of Book V explains how to rightly identify a *idion kath hauto* and how to spot one wrongly proposed to be such. The first prescription is that the property should not be less comprehensible than the subject kind. Aristotle's example is the subject 'fire' and the predicate 'to be like the soul' (129b9-11). This property may not rightly be predicated as an *idion kath hauto* of fire, for 'we know better what "fire" is than what "soul" is' (129b12). The second prescription is that it must be readily comprehensible that the predicate is a property of the subject at all, even before it can be determined whether it is an *idion kath hauto*. Again, 'soul' as a predicate of 'fire' fails this test. Other tests are that no terms in the predicate may be ambiguous and none be used repeatedly, as when saying fire is a 'body which is lightest of bodies' (130a38). If a property applies to a qualified type of some kind, say to 'white man' or 'isosceles triangle', but also to the kind without the qualification, 'man' or 'triangle', then the property may be *proton katholou* of the kind, it may be *katholou* of the qualified kind, but it is not *proton katholou* of the qualified kind (133b20). Predicates and subjects should also be tested against their contraries. Because 'evil' and 'good' are contraries, and 'object of avoidance' and 'object of choice' are contraries, and 'object of choice' is *idion kath hauto* of 'good', 'object of avoidance' is *idion kath hauto* of 'evil' (35b14-17). Many of these prescriptions, as Aristotle notes throughout the book, overlap with the rules for good definitions, and again, as he reminds us, definitions are special cases of properties *idion kath hauto*. While definitions identify the essence, properties that are merely *idion kath hauto* do not. But as

with definitions and their subjects, properties *idion kath hauto* counter-predicate amongst themselves and with the subject. They meet the properties of well-performed inductions. Even though Aristotle does not use the term *epagōgē* in it, Book V of the *Topics* is in fact Aristotle's fullest treatment of how one properly performs an induction, and most importantly an induction that can yield *pistis.*[42]

'What Sort of Thing Induction Is, Is Clear'

Aristotle thought that what *epagōgē* is would be plain enough to his students. Maybe with a fresh look at his use of the term throughout the surviving corpus one could conclude, as I do here, that for Aristotle *epagōgē* is a process of comparing and contrasting by which we identify the properties that some particulars have in common and then also those that distinguish the particulars from all other things, that is, the properties by which we group those particulars together and give them names and then definitions. But even if such a conclusion is correct, it is certainly not obvious. And reaching it without benefit of the *Topics,* Aristotle's main work on *epagōgē,* would be most difficult indeed.

The *Topics* was for a long time an unknown or neglected work, and without it, readers of Aristotle got a distorted view of *epagōgē.* In late antiquity, the *Organon* took on a canonical order. It began with the more abstract and formal and moved incrementally to the more concrete and practical: *Categories, On Interpretation, Prior Analytics, Posterior Analytics, Topics, Sophistical Refutations,* and *Rhetoric.* The Neoplatonist Porphyry's *Introduction (Isogōgē)* prefaced the collection. As we have seen, *epagōgē* is not discussed evenly throughout the corpus. It is not mentioned in the *Isogōgē* and only once in the *Categories* and *On Interpretation.* In the next work, the *Prior Analytics,* the only substantive appearances of *epagōgē* are at the end of the second book. The *Posterior Analytics* includes several comments, though many rather ambiguous. The primary and least ambiguous of Aristotle's treatments appear in the last three works, especially the *Topics* and *Rhetoric.* Now in both the Latin and the Arabic traditions, study of the *Organon* fell off back to front. The works placed first in the *Organon* remained available and studied. The final two were

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42   Book V of the *Topics* may fruitfully be compared to Book 2 of Francis Bacon's *Novum Organum* (London 1620).

soon dropped. Aristotle's *Topics* was supplanted by Boethius' *De Topicis Differentiis*. In both the East and West, the *Posterior Analytics* fell into disuse under the influence of theological censure. Before it was completely replaced by Boethius' *On Categorical Syllogisms*, a scholar who got to the end of the *Prior Analytics* was advanced indeed. Thus, nearly the first mention of *epagōgē* that even an advanced thinker would encounter would be that troublesome 'Induction, then — that is, a deduction from induction — is deducing one extreme to belong to the middle through the other extreme'. It is only natural that such a reader would conclude that induction is a kind of inference that can be cast as a deduction. In the West in fact, this is what he would find in the works of Boethius and in both East and West what he would find in the Neoplatonic commentaries of the fifth-century Alexandrians.

In Europe the medieval rediscovery of Aristotle and discovery of Aristotelian Arabic commentary had no effect on conceptions of induction. Induction remained a kind of syllogism made good by complete enumeration. The Arabic commentators and the Latin Scholastics concurred. *Prior Analytics* II 23 remained the definitive treatment, inconsistencies between it and other passages ignored or explained away, and Boethius' alternate to Aristotle's *Topics* the standard work on that subject. Jean Buridan in the fourteenth century was the first to challenge the eight-hundred-year-old consensus and to draw attention to an alternate conception of induction. Unfortunately when his *Summulae* got published, his revolutionary views on induction were not included. Finally, humanists such as Lorenzo Valla and Rudolph Agricola in the fifteenth century rediscovered with a vengeance Aristotle's *Topics* and the writings of Cicero. This last presented induction much as I have described it above. In 1542, in his commentary on the *Topics*, the influential Paduan writer Agostino Nifo reported there to be great disagreement about what induction is. Even if it once was, what induction is, was no longer obvious.[43]

The dominant view since late antiquity has been that *Prior Analytics* II 23 is Aristotle's most definitive treatment of induction and that the conventional reading of that chapter an accurate presentation of his view. But a fresh and fuller look at the chapter and Aristotle's mentions of *epagōgē* throughout the corpus suggest future research into Aristotelian induction — indeed into conceptions of induction throughout

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43   Again, for details on this history, see John P. McCaskey, 'Regula Socratis: The Rediscovery of Ancient Induction in Early Modern England'.

history — should be freed from the long-standing constraints of mis-reading the text, function, and import of *Prior Analytics* II 23.

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