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CHAPTER 9

Aristotle's architectonic sciences

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Aristotle rejected the idea of a single, overarching super-science or "theory of everything," and he presented a powerful and influential critique of scientific unity. In theory, each science observes the facts unique to its domain, and explains these by means of its own proper principles. But even as he elaborates a prohibition on kind-crossing explanations (*Posterior Analytics* 1.6–13), Aristotle points out that there are important exceptions – that some sciences are "under" others in that they depend for their explanations on the principles of a superior (more architectonic) science. In this chapter, I explore how subordination relations and architectonic structures apply to Aristotle's scientific practice – including not only the works of theoretical philosophy, which have already been discussed in this connection,[1] but also between these and the practical and productive sciences.

After reviewing essential Platonic background in part I, in part II I ask: What is the "most architectonic" science for Aristotle? Aristotle appears to give conflicting answers in the opening paragraphs of the *Metaphysics* and the *Nicomachean Ethics*. The apparent tension can be resolved by distinguishing two ways for sciences to be subordinate: (i) with respect to their ends, where one science exists for the sake of another; and (ii) with respect to their objects, where one science treats a subject matter at a higher level of generality than another, related science. In part III, I examine the ways in which Aristotle divides philosophy into the sciences and conceives of their interrelationship. Aristotle considers all productive sciences to be

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[1] See: McKirahan 1978, Lennox 1986, and Hankinson 2005.

subordinate to practical sciences on the basis of their ends (and thus the practical sciences are architectonic over them), but in turn all practical sciences are subordinate to theoretical sciences. The theoretical sciences are superior to the others on the basis of both ends and the generality of objects, being at once the most valuable, since they are intrinsic goods worthy of being pursued for their own sake; and at the same time the most general, concerned with the ultimate causes "for the sake of which." Thus the theoretical are, in the final analysis, the "most architectonic" sciences.

In part IV, I develop an experimental model of the architectonic structure of Aristotle's theoretical sciences in syllogistic form. In part V, I apply this model to show how theoretical and in particular natural science might function as architectonic over political science.

I

In the *Politicus*, Plato distinguishes between arithmetic and other "arts closely related to it stripped of practical activities, but that provide only thinking" (τέχναι ψιλαὶ τῶν πράξεών εἰσι, τὸ δὲ γνῶναι παρέσχοντο μόνον, 258d4–6) and "the kinds of art involved in carpentry and manufacture as a whole, that have their knowledge such that it is naturally grafted to practical actions, and that bring to completion those corporeal things that previously did not exist" (258d8–e2); and so he asks us to "divide all of science in this way, designating one kind the *practical*, but another kind the purely *intellectual*" (ταύτῃ τοίνυν συμπάσας ἐπιστήμας διαίρει, τὴν μὲν πρακτικὴν προσειπών, τὴν δὲ μόνον γνωστικήν, 258e4–5). The resulting division seems prima facie to anticipate Aristotle's distinction between "practical" and "theoretical" sciences, and so Rowe translates γνωστικήν as "theoretical" here (1997). But Aristotle's change of terminology is unlikely to be insignificant, and so I follow Fowler's translation "intellectual" (1925) in order to keep the term "theoretical" for Aristotle's θεορετική.

In a nearby passage, Plato articulates in rapid dialectical succession two theses, one that Aristotle vehemently rejects, and another that he emphatically embraces. So Aristotle opens *Politics* I with a rejection of the claim of the *Politicus* that: "surely there won't be any difference, as far as ruling is concerned, between the character of a large household, on the one hand, and the bulk of a small city, on the other" (259b9–10, tr. Rowe) and that, in consequence "there is one kind of expert knowledge concerned with all these things, whether one gives the name of expertise in kingship, or statesmanship, or household management" (259c1–4, tr. Rowe, adapted; contradicted by Aristotle at *Pol.* 1.1.1252a7–11b). We will return to

that argument in due course. I want now to point out that Aristotle agrees with the immediately following thesis: "this much is clear, that the power of any king to maintain his rule has little to do with the use of his hands or his body in general, in comparison with the understanding and force of his mind" (259c6–8, tr. Rowe), so that "the king is more closely related to *the intellectual kind of knowledge* than to the manual or wholly *practical kind*" (259c10–d2, tr. Rowe, adapted).

Now it is striking to see politics classified not as a *practical* science but as an "intellectual" (what Rowe calls "theoretical") science, especially for those students of Aristotle taught to sharply distinguish between these, where politics is invariably classed with the practical, not theoretical, sciences. But there is a very important sense in which Aristotle agrees with Plato, however, and realizing that must cause us to revise the conception of political science as simply and straightforwardly a practical science.

Plato associates practical science with the activities of manual laborers, and it is against this class that he opposes his "purely intellectual" sciences, which he instances with arithmetic and the art of calculation (259e5), but also with the activities of "all architects (ἀρχιτέκτων) too – since they don't act as workers themselves, but manage workers" (259e9–10); thus the architect "provides some understanding rather than manual labor" (259e11). But these two sciences, calculation and architecture, are distinguished insofar as "one makes judgments, while the other directs." These sciences, then, are the archetypes of the highest division of "purely intellectual" science: "referring to one as directive and the other as making judgments" (260b3–5, tr. Rowe, adapted). Let us outline these two divisions of the arts and sciences as follows:

(1) The practical (τὴν μὲν πρακτικήν), i.e. manual labor
(2) The purely intellectual (τὴν δὲ μόνον γνωστικήν):
    a. The directive (τὸ μὲν ἐπιτακτικὸν μέρος), e.g. architecture, statesmanship
    b. The critical (τὸ δὲ κριτικόν), e.g. arithmetic, calculation

But instead of a division, we should arrange these sciences into a hierarchy:

Intellectual science: 1. Architecture (e.g. directing the building of a temple)
Practical science: 2. Manual labor (e.g. creating bricks, moving bricks)

Such an arrangement then suggests the possibility that another "intellectual" science is somehow superordinate over architecture:

Intellectual sciences (critical):	1. Arithmetic, calculation, etc.
Intellectual sciences (directive):	2. Architecture, statesmanship, etc.
Practical sciences:	3. Manual labor

Such an "architectonic" arrangement of sciences, in effect, is embraced by Aristotle, and extended to several theoretical and practical sciences, or so I will argue in what follows.

II

Aristotle opens the *Nicomachean Ethics* by describing the subordination of certain arts and sciences on the basis of their ends:

> As there are many actions, arts, and sciences, their ends too are many; the end of the medical art is health, that of ship-building a vessel, that of strategy victory, that of economics wealth. But where such arts fall under a single capacity – as bridle-making and the other arts concerned with the equipment of horses fall under the art of riding, and this and every military action under strategy, in the same way other arts fall under yet others (κατὰ τὸν αὐτὸν δὴ τρόπον ἄλλαι ὑφ' ἑτέρας) – in all of these the ends of the architectonic arts are to be preferred to all the subordinate ends (ἐν ἁπάσαις δὲ τὰ τῶν ἀρχιτεκτονικῶν τέλη πάντων ἐστὶν αἱρετώτερα τῶν ὑπ' αὐτά); for it is for the sake of the former that the latter are pursued. It makes no difference whether the activities themselves are the ends of the actions, or something else apart from the activities, as in the case of the sciences just mentioned. (*EN* 1.1, 1094a6–18, tr. Ross, adapted; by Water's text)

All of the examples in these passages are of practical and productive sciences. Let us outline a hierarchy by means of one of the examples:

(Architectonic) Practical science:	1. Strategy
(Subordinate) Practical science:	2. Art of horse-riding
(Subordinate) Productive science:	3. Art of bridle-making

Science 3 is for the sake of science 2, which is in turn for the sake of 1 – a straightforward hierarchy based on the ends of the sciences. The bridle makers perform their activities for the sake of the horse riders (i.e. the cavalry) and not vice versa. The productive science is directed by a superior practical science, but one that is in turn subordinate to a still superior practical science: strategy. Both the content of the examples (strategy, cavalry, ship-building, etc.), and also the logical structure of the ranking,

suggest the kind of division of labor and hierarchy at home in military logistics.

Aristotle introduces the *Nicomachean Ethics* this way because he is building up to the question of what is the "most architectonic" science, which will have as its proper object the "chief" good:

> We must try, in outline at least, to determine what it is, and of which of the sciences or capacities it is the object. It would seem to belong to the most authoritative art and that which is most architectonic (δόξειε δ' ἂν τῆς κυριωτάτης καὶ μάλιστα ἀρχιτεκτονικῆς). And politics appears to be this kind of thing (τοιαύτη δ' ἡ πολιτικὴ φαίνεται); for this ordains which of the sciences should be studied in a state, and which each class of citizens should learn and up to what point they should learn them; and we see even the most highly esteemed of capacities to fall under this, e.g. strategy, economics, rhetoric; now, since politics uses the rest of the practical[2] sciences (χρωμένης δὲ ταύτης ταῖς λοιπαῖς πρακτικαῖς τῶν ἐπιστημῶν), and since, again, it legislates as to what we are to do and what we are to abstain from, the end of this science must include those of the others, so that this end must be the good for man. (*EN* 1.2, 1094a25–b7, tr. Ross, adapted)

Let us represent the kind of hierarchy described in the last two passages as follows:

Practical science:	1. Politics
Practical science:	2. Strategy
Practical science:	3. Art of horse-riding
Productive science:	4. Art of bridle-making

In this scheme, strategy is one of the highest-level divisions of a science over which politics is architectonic. Strategy, although subordinate to politics, is in its rank architectonic over the command of the cavalry and the associated productive sciences (e.g. bridle-making). On the same highest-level division as strategy would be economics, rhetoric, etc. Under each of these divisions are further divisions, and under those still further divisions and relations of subordination. Aristotle presupposes at least this level of complexity of architectonic sciences in the opening words of the *Nicomachean Ethics.*

[2] Reading πρακτικαῖς at 1094b4 (found in all MSS), deleted by Bywater (1984); Ross follows this in the Oxford translation (1925), as does Urmson in the Revised Oxford Translation (Ross 1984). It is also omitted (without explanation) from the translations of Rackham (1926) and Crisp (2000), but retained, rightly, in the translations of Irwin (1999) and Rowe (2002). Gauthier and Jolif in their commentary on 1094b4 are supportive of the deletion on the grounds that it appears to be an imprecise gloss, since it fails to mention Aristotle's productive sciences. But as I will argue below, Aristotle himself frequently resorts to a dichotomy between "practical" and "theoretical," using the term "practical" (and sometimes "productive") to include both the practical and productive sciences as a group.

Can this passage be read as evidence that Aristotle considered politics architectonic over all other arts and sciences without qualification? The reason he says politics appears to be so – because politics ordains which other sciences are to be studied and up to what point – would seem to support such a reading. But it is difficult to imagine that Aristotle would accept the politician directing the natural scientist or metaphysician in the manner that an architect would direct a manual laborer. And if we turn to the parallel text in *Metaph.* 1.2, we find Aristotle most definitely changing his tune:[3]

> Of the sciences, that which is more desirable for its own sake and thanks to the knowing (τὴν αὑτῆς ἕνεκεν καὶ τοῦ εἰδέναι χάριν αἱρετὴν) is more wisdom than that which is desirable for the sake of its results, and the more over-arching science is more wisdom than the subordinate science (τὴν ἀρχικωτέραν τῆς ὑπηρετούσης μᾶλλον εἶναι σοφίαν); for the wise man must not be directed but must direct (ἐπιτάττειν), and he must not obey another, but the less wise must obey him . . . The first principles and causes (τὰ πρῶτα καὶ τὰ αἴτια) are the most knowable; for by reason of these, and from these, all other things are known, but these are not known by the things underlying them (διὰ γὰρ ταῦτα καὶ ἐκ τούτων τἆλλα γνωρίζεται ἀλλ' οὐ ταῦτα διὰ τῶν ὑποκειμένων). And the science which knows that for the sake of which each thing is done is the most over-arching of the sciences (ἀρχικωτάτη δὲ τῶν ἐπιστημῶν) and is more over-arching than any subordinate one (μᾶλλον ἀρχικὴ τῆς ὑπηρετούσης) and this end is the good in each class and in general the supreme good in the whole of nature. Judged by all the tests that we have mentioned, then, the name in question falls to the same science; this must be a science that investigates the first principles and causes; for the good, i.e. that for the sake of which, is one of the causes. That it is not a *productive* science is clear even from the history of the earliest philosophers. (*Metaph.* 1.2, 982a14–19+982b2–12, tr. Ross, adapted)

EN 1.2 and *Metaph.* 1.2 parallel each other not only in being placed at the beginning of their respective inquiries, but also in the notable use of superlatives ("most architectonic"; "most over-arching") that indicate a single scientific hierarchy, and not a manifold of independent and non-overlapping

[3] Alan Code has stressed to me the importance of taking into account the different rhetorical situations of the *Ethics* and the *Metaphysics* and (as we will see later), of the *Protrepticus*. This is an extremely important point that I wish I had the space to comment on more extensively. Here I will only say that while the difference in audience is certainly a factor, the exact rhetorical genre of *EN* 1.1–2, *Metaph.* 1.1–2, and the *Protrepticus* is the same in each case: exhortation (discussed and defined by Aristotle at *Rhet.* 1.4–7). This goes a long way toward accounting for the similarities (e.g. why comparative and superlative terms abound in discussing the status of the activity in question). But this point about the rhetorical genre does not in itself address the differences in intended audience that Code mentioned, but only confirms it is important to take them into consideration.

scientific domains. And thus there seems to be a tension between the suggestions in the *Ethics* that the "most architectonic" science is politics, but in the *Metaphysics* that the "most over-arching" science is metaphysics (i.e. "the science which investigates first principles and causes"). After all, Aristotle elsewhere makes it clear that politics and wisdom are not the same thing:

> It would be absurd to think that the art of politics, or intelligence (τὴν πολιτικὴν ἢ τὴν φρόνησιν), is the most important thing (σπουδαιοτάτην), since man is not the best thing in the world . . . It is evident also that wisdom and the art of politics cannot be the same (οὐκ ἂν εἴη ἡ σοφία καὶ ἡ πολιτικὴ ἡ αὐτή); for if the state of mind concerned with a man's own interests is to be called wisdom, there will be many wisdoms; there will not be one concerned with the good of all animals (any more than there is one art of medicine for all existing things), but a different wisdom about the good of each species. (*EN* 6.7 = *EE* 5.7, 1141a20–33, tr. Ross, adapted)

And back in the *Metaphysics* he refers to this discussion in the *Ethics* as if it had resolved the issue of the relative merits of the different kinds of science:

> We have said in the *Ethics* what the difference is between art and science and the other kindred faculties; but the point of present discussion is this, that all men suppose what is called wisdom to deal with the first causes and principles of things. This is why, as has been said before, the man of experience is thought to be wiser than the possessors of any perception whatever, the artist wiser than the men of experience, the architect than the manual laborer (χειροτέχνου δὲ ἀρχιτέκτων), and the *theoretical* sciences to be more of the nature of wisdom than the *productive* sciences. Clearly then wisdom is knowledge about certain causes and principles. (*Metaph.* 1.1, 981b25–982a3, tr. Ross)

Notice that Aristotle utilizes the Platonic distinction (in the *Politicus*) between directive "architectonic" arts on the one hand, and practical "manual" arts on the other, in order to rank-order and at the same time motivate the study of theoretical science. Aristotle in effect subsumes Plato's hierarchy in his own rank-ordering of sciences:

(1) Theoretical sciences (science of first principles and causes, natural science, etc.)
(2) Productive science:
    a. Architectonic (politics, strategy, economics, etc.)
    b. Manual (bridle-making, etc.)

The key to resolving the apparent tension between the *EN* 1.2 passage and *Metaph.* 1.2 on the issue of the "most architectonic" science is to emphasize the "appears" (φαίνεται) in the statement "politics *appears* to be this kind of thing" (1094a27–28). The reality, it becomes clear, is quite different. The fact that politicians direct which sciences are to be studied in the state and to what extent makes it appear that politics is the most architectonic science, but the truth is that politics, although the most architectonic practical science, is itself subordinate to theoretical science, and in at least two ways. First, because the "science of first principles and causes" investigates "the good in each class and the supreme good in nature," and so it investigates the more general cause of which the political good is either a part or a species. Second, because theoretical science, unlike the practical and productive sciences, is an end in itself and desirable for its own sake, so that political science must ultimately exist for the sake of producing theoretical science. For both reasons, then, philosophy is the "most directive," "most commanding," and "most architectonic" science. Such a view is clearly expressed in a passage of the *Protrepticus* wherein Aristotle describes the productive sciences as in general subordinate to the practical,[4] and asserts that philosophy is the master science of them all:

> There is a difference between the kinds of science that produce (αἱ ποιοῦσαι) each of the things of which we want to have more and more in our way of life, and the kinds of science that make use of these (αἱ χρώμεναι ταύταις); and the ones that are subordinate (αἱ ὑπηρετοῦσαι) are different from the others that direct (αἱ ἐπιτάττουσαι); and in these as it were more commanding kinds (ἡγεμονικωτέραις) exists what is good in the strict sense. If, then, only that kind of science which does have correctness of judgment, and does use reason, and observes the good as a whole – that is to say, philosophy – is capable of using everything and issuing orders in accordance with nature,

[4] Here are two other passages that make it clear that productive sciences are in general subordinate to the practical:

> The arts which govern the matter and have knowledge are two, namely the art which uses the product, and the art which directs the production of it (αἱ ἄρχουσαι τῆς ὕλης καὶ αἱ γνωρίζουσαι τέχναι, ἥ τε χρωμένη καὶ τῆς ποιητικῆς ἡ ἀρχιτεκτονική). That is why the using art is in a sense directive; but it differs in that it knows the form, whereas the art which is directive as being concerned with production knows the matter. For the helmsman knows and prescribes what kind of form a helm should have, the other from what wood it should be made and by means of what operations. (*Phys.* 2.2, 194a36–b7, tr. Hardie and Gaye, adapted)

> Intellect itself, however, moves nothing, but only the intellect which aims at an end and is practical; for this rules the productive intellect as well (διάνοια δ' αὐτὴ οὐθὲν κινεῖ, ἀλλ' ἡ ἕνεκά του καὶ πρακτική· αὕτη γὰρ καὶ τῆς ποιητικῆς ἄρχει). For everyone who produces does so for the sake of something, and the product is not the end absolutely, but only relative to something; for the absolute end is what is to be done (ἀλλὰ τὸ πρακτόν), because acting well is the end, and desire is for this. (*EN* 6.2 = *EE* 5.2, 1139a35–b4)

> by all means one ought to do philosophy, since only philosophy includes within itself this correct judgment and this intelligence to issue orders without errors. (Aristotle, *Protrepticus*, apud Iamblichus, *Protr.* 6.37.11–22, tr. Hutchinson and Johnson, adapted)

Aristotle has superimposed on the Platonic distinction between "ordering sciences" (αἱ ἐπιτάττουσαι) and "subservient sciences" (αἱ ὑπηρετοῦσαι) his own distinction between "productive sciences" (αἱ ποιοῦσαι) and the practical sciences, which are here called "those that use the productive sciences (αἱ χρώμεναι ταύταις)."[5] In discussing the distinction between art and action in the *Ethics*, Aristotle may refer to this passage.[6] Whereas Plato had identified the practical and productive sciences (or rather, failed to distinguish them) and treated them as subordinate to "intellectual" science, Aristotle divides off the sciences that *produce* material goods from those that *use* them in order to bring about the good life, calling the productive subservient to the practical. Like Plato in the *Statesman*, however, Aristotle in the *Protrepticus* blurs the distinction between the theoretical and practical sciences by arguing that the ultimate "directive" and "most commanding" art is not a practical science but a theoretical one, which he repeatedly calls philosophy.[7]

[5] Recall that in *EN* 1.2 Aristotle asserts that "politics uses the rest of the practical sciences" (1094b4–5, according to the reading of the MSS, see above on Note 2).

[6] > Among things that can be otherwise are included both things produced and things done; producing and acting are different, *we are convinced about these things even in the exoteric works;* so that the reasoned state to act is different from the reasoned state to produce. Nor are they included one in the other; for neither is acting producing, nor is producing acting. Now since building is an art and is essentially a reasoned state to produce, and there is neither any art that is not such a state nor any such state that is not an art, art is identical with a state to produce involving a true course of reasoning. (*EN* 6.4 = *EE* 5.4, 1140a1–10, tr. Ross, adapted and emphasis added)

[7] This conceptual scheme of despotism and leadership as applied to psychological and epistemological issues is common not only in Plato but also in Isocrates, who wrote in the *Antidosis*:

> Our nature is compounded of two parts, the bodily and that of the soul, and no one would deny that of these two the soul is more of a natural leader (ἡγεμονικωτέραν πεφυκέναι τὴν ψυχήν) and is of greater worth; for it is the function of the soul to deliberate both on personal and on public questions, and of the body to be servant (ὑπηρετῆσαι) to the judgments of the mind. (*Antidosis* 180)

Compare Aristotle in the *Protrepticus*:

> Everything is well disposed when it is in accordance with its proper virtue, for to obtain this is good. Moreover, it's when a thing's most authoritative and most estimable parts have their virtue that it is well disposed; therefore the natural virtue of that which is better is naturally better. And that which is by nature more overarching and more deserving of command (ἀρχικώτερον καὶ μᾶλλον ἡγεμονικόν) is better, as a human is than the other animals; thus soul is better than body – for it is more overarching (ἀρχικώτερον γάρ) – as is the part of the soul which has reason and thought, for this kind of thing is what prescribes and proscribes and says how we ought or ought not to act. Whatever, then, is the virtue of this part is

III

In the first two chapters of the *Metaphysics* Aristotle contrasted and hierarchically arranged the theoretical and productive sciences, and in the parallel chapters of the *Nicomachean Ethics* he did the same for the practical and productive sciences. In the *Metaphysics* he groups the practical and productive sciences in order to strongly contrast these with the theoretical ones, offering a dichotomy. Elsewhere this same dichotomy is invoked, but the term "practical" is substituted for "productive," as in the opening of *Metaph.* 2.1: "Philosophy should be called knowledge of the truth. For the end of *theoretical* science is truth, while that of *practical* science is action; for even if they consider how things are, practical men do not study what is eternal but what stands in some relation at some time" (993b19–23, tr. Ross, adapted). For the purposes of this kind of dichotomous contrast the terms "practical" and "productive" can be used interchangeably, but the dichotomous contrast between these productive-practical and the theoretical sciences is stark. For one thing, theoretical sciences have eternal objects, but the practical-productive ones have only temporary things. Aristotle, surprisingly, suggests that the practical man can succeed without having any theoretical knowledge himself. It is vital to my argument, however, that this not be taken to imply that the practical man, such as the politician, can succeed in complete independence of theoretical philosophy – for it may well be that politicians depend on theoretical scientists (i.e. philosophers) as advisors, even if they do not themselves need theoretical knowledge. Nevertheless, when Aristotle argues against Socratic intellectualism he again draws a sharp contrast, this time using the term "productive" to stand in for both the practical and productive sciences in contrast to the theoretical:

> Socrates the elder thought that the goal was knowledge of virtue . . . Hence Socrates used to investigate what virtue is, but not how and by what means it comes about. His approach is applicable to the *theoretical sciences*, since there is nothing more to astronomy or to natural science or geometry than knowing or studying the objects of these sciences. Of course there is no reason that they should not also incidentally be useful to us for many of the necessities of life. But with the *productive sciences*, the goal is distinct from knowledge and understanding. For example, health is the goal of medicine,

necessarily the most valuable virtue of all, both for everything in general and for us; in fact, I think one might actually take the position, that we are this part, either alone or especially. (*Protr.* 7.41.22–42.4, tr. Hutchinson and Johnson)

The continuation of this line of thought (in both Isocrates and Aristotle's *Protrepticus*) is a comparison between gymnastics and philosophy.

> and good order or something of that sort the goal of political science. Now it is indeed a fine thing to know each fine thing. Nonetheless, when it comes to virtue, knowing what it is is not the most valuable point, but understanding what brings it about. For we do not want to know what courage is, but to be courageous, nor to know what justice is, but to be just, as we want to be healthy rather than understand what being healthy is, and be in good physical condition rather than understand what being in good physical condition is. (*EE* 1.5, 1216b2–25, tr. Inwood and Woolf, adapted)

In such a context, where Aristotle operates with the traditional dichotomy between theoretical and "productive" science, there is no mention of the distinction between practical and productive sciences. When the important point is that a science aims at some result other than knowledge, whether a science is classified as productive or practical "makes no difference," as he puts it in *EN* 1.1, 1094a16. Theoretical sciences have no other end than knowledge of their objects, and any benefits they produce are incidental to the science. By contrast, productive sciences have as their end some result beyond knowledge, and thus these sciences must know not only what their objects are, but also how they are produced and used. Mere knowledge of the city, the citizens, political constitutions, etc. is not the end of political science, any more than mere knowledge of bodies and diseases is of medicine. In both cases the end is rather something else that is produced: health for the body, law and order for the body politic. Theoretical and practical uses of intelligence must therefore be sharply distinguished.[8]

Elsewhere Aristotle offers a trichotomous division of science: "this is classed as theoretical, practical, and productive, and each of these denotes a relation; for it theorizes about something, or produces something, or does something" (*Top.* 6.6, 145a15–18, tr. Pickard-Cambridge, adapted). This trichotomy is invoked in the beginning of *Metaphysics* VI and XI, where it is said to be an exhaustive division:

> In general every science which is intellective or at all involves intellect (πᾶσα ἐπιστήμη διανοητικὴ ἢ μετέχουσά τι διανοίας) deals with causes and principles, exact or indeterminate, but all these sciences mark off some particular being – some genus and inquire into this . . . Since natural science,

[8] Aristotle applies the distinction between theoretical and practical to operations of the mind in distinguishing between understanding and intelligence:

> Understanding is about the same objects as intelligence, but understanding and intelligence are not the same (οὐκ ἔστι δὲ τὸ αὐτὸ σύνεσις καὶ φρόνησις). For intelligence is directive, since its end is what should and should not be done; but understanding only judges (ἡ μὲν γὰρ φρόνησις ἐπιτακτική ἐστιν· τί γὰρ δεῖ πράττειν ἢ μή, τὸ τέλος αὐτῆς ἐστίν· ἡ δὲ σύνεσις κριτικὴ μόνον). (*EN* 6.10 = *EE* 5.10, 1143a6–10)

> like other sciences, confines itself to one kind of being (i.e. to that kind of substance which has the principle of its movement and rest present in itself), evidently it is neither *practical* nor *productive*. For the principle of production is in the producer – it is either reason or art or some capacity, while the principle of action is in the doer – viz. choice, for that which is done and that which is chosen are the same. Therefore if all thought is either *practical* or *productive* or *theoretical*, natural science must be *theoretical*. (*Metaph.* 6.1, 1025b5–9+18–26, tr. Ross, adapted; cf. *Metaph.* 11.7, 1063b36–4a19)

The trichotomy is especially useful when discussing the objects of the sciences, the particular genera that each science "marks off" and inquires into. In the most general terms, the productive sciences look to the principles employed by the *producers* in a given domain; the practical look to the principles employed by the *doers*. The theoretical sciences look to the principles employed by the *explainers* (or observers) of some particular being, such as a star, a number, a figure, or an animal. On the basis of this distinction between their objects, it is possible to rank-order not only the highest divisions of science (theoretical, practical, and productive), but also the highest divisions of theoretical science:

> There must be three theoretical philosophies, mathematics, natural science, and theology (since it is obvious that if the divine is present anywhere, it is present in things of this kind). And the highest science must deal with the highest genus, so that the theoretical sciences are superior to the other sciences (αἱ μὲν οὖν θεωρητικαὶ τῶν ἄλλων ἐπιστημῶν αἱρετώταται), and theology to the other theoretical sciences. (*Metaph.* 6.1, 1026a18–23, tr. Ross, adapted; cf. *Metaph.* 11.7, 1064b1–6)

As a result, we can formulate the following hierarchy:

(1) Theoretical Sciences:
   a. Theology (i.e. metaphysics, the science of first principles and causes)
   b. Mathematics
   c. Natural science
(2) Practical sciences
(3) Productive sciences

This entire network of evidence, then, indicates that Aristotle considers the theoretical sciences to be superordinate to the practical and productive sciences as a whole. The practical sciences are superordinate to the productive sciences. The theoretical sciences are superordinate to the practical, in turn, because (i) they are more general, and the causes and principles of the theoretical sciences govern the causes and principles of the practical

sciences (including the cause for the sake of which), and (ii) because they are more final, since they are themselves intrinsically valuable, for the sake of the knowledge alone, and thus the productive and practical sciences are ultimately carried out for their sake.

IV

The picture that I have just drawn of a hierarchically arranged and highly interdependent set of sciences might be thought to be at odds with Aristotle's well-known critique of scientific unity. In the present section I will argue that, on the contrary, Aristotle's position is flexible enough to accommodate my interpretation, and I will attempt to show this by exhibiting the syllogistic structure to which all the proposed architectonic sciences should conform.

In the *Metaphysics* and *Topics* passages just discussed, Aristotle's insistence that each science covers only the objects in its own domain corresponds to a methodological prohibition on kind-crossing explanations:

> The items from which the demonstrations proceed may be the same; but where the kinds are different, as with arithmetic and geometry, you cannot attach arithmetical demonstrations to what is incidental to magnitudes – unless magnitudes are numbers. But I shall explain later how in some cases this is possible. (*APo.* 1.7, 75b2–6, tr. Barnes)

Let us consider the prohibition by contrasting two kinds of syllogistic explanation:

Syllogism 1 (valid)

1. A <a> B (geometrical principle)
2. B <a> C
3. A <a> C (geometrical fact)

Syllogism 2 (invalid; kind-crossing)

1. A <a> B (arithmetical principle)
2. B <a> C
3. A <a> C (geometrical fact)

Notice that in the above passage, Aristotle announces the prohibition but immediately points out the existence of exceptions to it (even possibly for the very example – arithmetic and geometry – that he gives

to make his point). Later he describes in some detail at least four such exceptions.[9]

> The reason why differs from the fact in another way insofar as each is studied by a different science. These are the cases which are related to each other in such a way that the one falls under the other (θάτερον ὑπὸ θάτερον), e.g. optics to geometry, mechanics to solid geometry, harmonics to arithmetic, star-gazing to astronomy. Some of these sciences bear almost the same name as one another – e.g. mathematical and nautical astronomy, and mathematical and acoustical harmonics. Here it is for the empirical scientists to know the fact (τὸ μὲν ὅτι) and for the mathematical scientists to know the reason why (τὸ δὲ διότι). The latter possess demonstrations which give the explanations, and often they do not know the fact – just as people who study universals often do not know the particulars through lack of observation. The items in question are things which, being something different in their essence, make use of forms. For mathematics is concerned with forms; its objects are not said of any underlying subject – for even if geometrical objects are said of some underlying subject, still it is not as being said of an underlying subject that they are studied. Related to optics as optics is related to geometry, there is another science – namely the study of the rainbow. Here it is for the natural scientists to know the fact and for the students of optics – either of optics simpliciter or of mathematical optics – to know the reason why. (*APo.* 1.13, 78b34–79a13, tr. Barnes)

Although Aristotle usually refers to a simplified bipartite conception of subordinate sciences in his examples, this passage shows that he also developed a more complex tripartite conception of some of them.[10] In the bipartite version, a subordinate science describes the empirical fact (τὸ ὅτι), which the superordinate science is in charge of explaining by providing the reason why (τὸ διότι). In the tripartite version, an intermediate or mixed "mathematical-physical" science (e.g. optics) supplies a middle term that allows the application of the axioms of an autonomous mathematical science (e.g. geometry) to the explanation of a phenomenon described by empirical science (e.g. meteorology). Thus the first, independent science stands in a relation of architectonic superiority to two subordinate sciences in the following examples:

[9] Henry Mendell pointed out to me that Aristotle, although announcing his prohibition on kind-crossing in apparently strict theoretical terms, is in practice extremely casual in his own allowance of kind-crossing explanations.

[10] McKirahan 1978, 206–16 has persuasively argued that point. Both he and Hankinson 2005, 47–50 have pointed out difficulties with subalternate triples that I cannot here enter into. See also Lennox 1986, 42–44.

	Example 1:	Example 2:	Example 3:
Mathematical science:	1. Arithmetic	1. Stereometry	1. Geometry
Physical science:	2. Harmonics	2. Mechanics	2. Optics
Empirical science:	3. Acoustics	3. Levers	3. Meteorology

Let us examine in a little more detail the third example: an empirical science ("meteorology") supplies the facts, for example about lunar halos, that another science ("optics") explains by applying geometrical axioms. Both meteorology and optics are subordinate to a mathematical science ("geometry"), a science that possesses its own principles. Because these three sciences are properly arranged in this order of subordination, it is possible to construct a syllogism to explain a meteorological phenomenon, namely why the lunar halo is always a perfect circle:

Geometry:	1. Circle <a> Figure with limits all equidistant to a single point
Optics:	2. Figure with limits all equidistant <a> Light reflected by tiny, uniform mirrors
	3. Circle <a> Light reflected by tiny, uniform mirrors (by 1+2)
Meteorology:	4. Light reflected by tiny, uniform mirrors <a> Shape reflected in the clouds
	5. Circle <a> Shape reflected in the clouds (meteorological fact, by 3+4)

The overarching major premise is simply an undemonstrated geometrical axiom (definition), the minor premises are theorems of optics or meteorology, and the conclusion is a description of the empirical phenomenon to be explained. Each proposition can be understood to belong to a different science, namely, geometry, optics, and meteorology, so long as these are understood to stand in these exact relations of subordination. The middle terms provide the causes (formal and efficient) of the phenomenon: it is because the light is reflected by tiny, uniform mirrors that the resulting figure is one with all its limits equidistant, and this in turn is the reason that the shape (the halo) always forms a complete circle.

This theoretical model is successful on its own terms, and was successfully applied by Aristotle to meteorology and by Aristotle (or his immediate successors) to the domain of mechanical problems, optics, and musical

theory.[11] But there is of course plenty of room for doubt that anything like this can be made to apply outside these very close-knit mathematical-physical sciences to other theoretical sciences (such as metaphysics), or to these in relation to the productive-practical sciences. Certainly there have been interpretations of Aristotle's metaphysics, biology, and teleology that have not observed Aristotle's methodological restrictions on kind-crossing closely enough.[12]

V

In this section, I will nevertheless argue that in Aristotle's actual scientific practice, in the *Politics* at least, the subordination of politics to theoretical science is presupposed. In accordance with the structure just described, then, it must then be possible to demonstrate or explain political facts by means of natural scientific or otherwise theoretical principles. The challenge of the present section, then, is to show how one could possibly fill in the blanks of the following kind of syllogism:

[11] On optics and music, see McKirahan 1978. On meteorology, see Johnson 2009, and forthcoming, "Aristotelian Mechanistic Explanation." For an enlightening discussion of the influence of this model, see Lennox 1986.

[12] See the criticisms of Nussbaum 1978 in Kung 1982 for a well-argued example. Robert Bolton has recently argued that for Aristotle metaphysics and biology are wholly autonomous sciences, and that the results of neither science can place any constraints on the results of the other, and this fact has far-reaching implications for a number of recent studies that have unmethodically linked Aristotle's discussion of substances in both cases (Bolton 2010; see my review of the volume, Johnson 2011). A related case is the attempt to interpret Aristotle's teleology as anthropocentric on the basis of the *aporia* raised in *Phys.* 2.8 about whether regular winter rainfall is due to strictly necessary causes, or is for the sake of crop growth and human nutrition, which I have discussed at greater length in Johnson 2005. Were we to admit the anthropocentric teleological explanation as a theoretical proposition, we would have to find a way to subordinate meteorology (the science that states the facts about rainfall) to either the productive art of agriculture (rustic anthropocentrism) or to metaphysics (urbane anthropocentrism). But rainfall is explained by Aristotle on the basis of meteorological principles alone, which refer to the material and moving causes. There seems to be nothing insufficient about Aristotle's explanation of rainfall, and nothing to be gained by subordinating the moving-material explanation to a metaphysical principle. Thus there seems to be no justification here for violating the prohibition on kind-crossing. A more difficult case that I have also discussed in Johnson 2005 is *Pol.* 1.8, when Aristotle seems to infer from a principle of the biological sciences that "sustenance is provided by nature from birth to all," to the conclusion that "after the birth of animals, plants exist for their sake, and the other animals for the sake of humans" (1256b20–26). This inference cannot possibly be accepted as a principle of the biological sciences, since it is made in the context of a discussion of the acquisitive arts, which Aristotle explicitly says are subordinate to economics and hence politics (see 1256a5–10, where Aristotle distinguishes between two ways in which it may be understood to be subordinate). Since, as I will argue below, politics is itself subordinate to theoretical science (including natural, biological science), the acquisitive arts can only receive from, but not supply principles to, biological science, barring an inversion of the architectonic relation between these sciences (and thus a violation of the prohibition on kind-crossing). This is why there are no texts that support the anthropocentric notions in the biological works, and we only find such claims in the *Politics*.

1. A <a> B (theoretical principle of metaphysics, mathematics, or natural science)
2. B <a> C
3. A <a> C (political fact)

Indications in this direction come from a controversial passage from the *Protrepticus* that describes the relationship between politics, legislation, and natural science:

> Just as in the other productive skills the best of their tools were discovered on the basis of nature (for example, in the builder's skill, the carpenter's line, the standard ruler, the string compass) <. . . *a line of text is missing*. . . > for some are grasped with water, or with light and rays of sunshine, and it is by reference to these that we put to the test what is sufficiently straight and smooth to our senses – in the same way, the statesman must have certain criteria taken from nature itself, i.e. from the truth, by reference to which to judge what is just and what is good and what is advantageous . . . And in the other skills people pretty much know that they do not get their tools and their most precise calculations from the primary things themselves; they get them from what is second or third hand or at a distant remove, and they get their calculations from experience, whereas the imitation is of the precise things themselves only for the philosopher, for the philosopher's vision is of these things themselves, not of imitations. So just as no one is a good builder who does not use a standard ruler or any other such tool, but approximates them to other buildings, so too presumably if someone either puts laws to use in states or performs actions by looking at and imitating other human actions or political systems, whether the Spartan or that of the Cretans or of any other such state, he is neither a good lawmaker nor is he an excellent statesman; for an imitation of what is not beautiful cannot be beautiful, nor can an imitation of what is not divine and stable in nature be immortal and stable. But it is clear that the philosopher is the only producer to have both laws that are stable and actions that are correct and beautiful. For he is the only one who lives looking toward nature and toward the divine and, just as if he were some good navigator who hitches the first principles of his life onto things that are eternal and steadfast, he moors his ship and lives life on his own terms. (*Protr.* 10.54.22–56.2, tr. Hutchinson and Johnson)

In this passage, the model of architecture is used to construct an image of the architectonic superiority of philosophy over politics. The philosopher, who has theoretical knowledge, is said to be the only one of the "manufacturers" (δημιουργῶν) to produce secure laws and correct and beautiful actions. The philosopher is a good legislator (ἀγαθὸς νομοθέτης), and it is in fact his possession of *theoretical* knowledge that puts him in the position

of an architect to command and control the subordinate arts, beginning with politics.

Werner Jaeger predicated a large part of his theory of Aristotle's development on his interpretation of this passage as "pure Plato" that "necessitates the dualist metaphysics of the forms as the theoretical basis."[13] Now to interpret the passage along Platonic lines is reasonable not only because the *Protrepticus* dates to Aristotle's Academic period, but also, more importantly, because of the Platonic style, as in the explanation: "for an imitation of what is not beautiful cannot be beautiful, nor can an imitation of what is not divine and secure in nature be immortal and secure." Here I set aside all questions of Aristotle's development and focus on the interpretation of the *Protrepticus* passage and its application to Aristotle's scientific practices in the *Politics*. For Jaeger the key to the comparison between the arts (i.e. architecture) and philosophy in the passage "comes from the account of the theory of Forms in the tenth book of the *Republic*."[14] Just as the carpenter of *Republic* X imitates not another couch or table, but looks to the ideal form of the couch or table, so the good architect imitates not another building, but looks to the ideal form of the building. Therefore the philosophical legislator should not imitate the form of existing states (like Sparta or Crete), but should look to the ideal form of the state. Such an interpretation of the *Protrepticus* passage could be supported by considering Aristotle's remark in *Politics* 4.1 that both legislation and politics must observe not only the "best" constitution, but also the one realizable in a particular political situation:

> In the case of a constitution also it belongs to one and the same science to examine all of the following. (1) Which is the best constitution? That is, what kind of constitution would be most desirable if there were no external hindrances to its realization? (2) Which constitution suits which persons? Since for many people it is perhaps impossible to achieve the best, the good legislator and the true politician must know both what is best absolutely and what is best in the circumstances. (*Pol.* 4.1, 1288b22–27 [in part], tr. Robinson, adapted)

One might ask, however, what would be the point of requiring two independent sciences to have parallel inquiries into both the ideal constitution and the most suitable constitution. The answer is that the two sciences are not independent; rather there is an architectonic structure according to which politics is subordinate to legislation. Aristotle makes this clear in

[13] Jaeger 1948, 90–91. [14] Jaeger 1948, 92.

the second common book of the *Ethics* in a way that sustains the analogy with architecture from the *Protrepticus*:

> Of the things concerned with the city, the intelligence which is architectonic is legislation (τῆς δὲ περὶ πόλιν ἡ μὲν ὡς ἀρχιτεκτονικὴ φρόνησις νομοθετική), while that which is related to this as particulars to their universal is known by the general name politics (πολιτική); this has to do with action and deliberation, for a decree is a thing to be carried out in the form of an individual act. This is why exponents of this art alone are said to take part in politics; for these alone act as manual laborers do (μόνοι γὰρ πράττουσιν οὗτοι ὥσπερ οἱ χειροτέχναι). (*EC* 2.8 = *EE* 5.8 = *EN* 6.8, 1141b24–29, tr. Ross, adapted)

Let us, then, consider how such an architectonic science might work in practice. Consider a sample syllogism built out of materials from *Pol.* 4.7, 1293b14–16:

Legislation (theoretical):	1. Aristocracy <a> Government with regard to wealth and excellence of whole populace
Politics (practical):	2. Government with regard to wealth and excellence of the whole populace <i> Carthage
Constitutional history:	3. Aristocracy <i> Carthage (political fact, by 1+2)

The third proposition belongs to an empirical science of politics that gathers facts about the history of political constitutions.[15] The second belongs to a political science that explains particular political facts by reference to an axiom (definition) of legislative science. Thus the reason Carthage (i.e. Carthage at a certain point in time) was an Aristocracy is that its constitution had concern for the wealth and excellence of the whole population. Although one would need to develop much more complex syllogisms than I have presented here in order to do justice to the scientific content of the *Politics* (e.g. with modal operators, careful attention to the quantities of the connectives, etc.), it is possible that such a logical structure could bring clarity to otherwise confused political matters. But whether or not it would do so, this experiment does show a way in which the *Protrepticus* passage can be interpreted along Platonic lines in a way consistent with Aristotle's later political science. The theoretical science

[15] The enterprise of a large-scale study of the history of political constitutions is mentioned at *EN* 10.9, 1181b12–22, and the *Ath. Pol.* is a surviving (fragmentary) example, whether it is by Aristotle or a follower. Substantial fragments of dozens more histories of constitutions that originate from the Peripatetic school survive; see Gigon 1987, 561–722.

grasps the form of the ideal state, and political science tries to bring about an imitation of this ideal state in a particular political situation – and not an imitation of an actually existing state, like Sparta. There thus appears to be an architectonic structure corresponding to a causal division of labor between (1) the legislator and architect, who supply the formal and final causes, and (2) the politicians and manual laborers, who supply the material and moving causes in order to bring about an imitation of these formal and final causes in a particular political situation.

The problem with such an interpretation, however, as Kurt von Fritz and Ernst Kapp pointed out in their introduction to Aristotle's *Constitution of Athens*, is that Aristotle does not actually say in the *Protrepticus* passage that the architect imitates the ideal form of the house, or that the legislator imitates the ideal form of political constitution, and in fact the technical language of the theory of Forms does not appear at all. Instead, Aristotle refers to the architect producing buildings by using accurate "instruments" calibrated not from other buildings but from nature itself. As von Fritz and Kapp say, the key questions are what nature means in this context, and what in political science corresponds to the accurate "instruments" of the architect.[16] In the rest of this chapter I will try to develop an answer to these questions.

But before doing so, I want to point out that, even though we cannot read the *Protrepticus* passage as "pure Plato" or as having anything to do with the theory of Forms, as Jaeger supposed, nevertheless the argument of the *Protrepticus* does conform to Platonic views in a more subtle way, considering the distinction of the *Politicus* between the "practical-manual" and the "directive-intellectual" sciences, which are also distinguished from the "calculative-intellectual" sciences. In what follows, I will argue that Aristotle seems to adopt the kind of hierarchy we wondered about in connection with the *Politicus*, according to which the architect directs the manual laborers, but is in turn subordinate to a higher non-directive ("critical") art, similar to calculation in that it is purely theoretical.

The good architect does not take the standards of straightness and smoothness by looking at other existing buildings, but by looking to nature, and calibrating instruments by means of the sun, water, etc. So too the good legislator does not take his standards of goodness and rightness by looking at other human actions and existing constitutions (like those of Sparta or Crete), but by looking to nature, and developing the standards by looking to natural (and "divine") things. As a result of knowing about these things, the good legislator is able to create "laws that are secure and

[16] Von Fritz and Kapp 1950, 34–35.

actions that are correct and beautiful." What is needed to make sense of this is to ask what kind of instruments legislators could possibly obtain from philosophy and natural science. And the answer stares us in the face in *Pol.* 1, which opens by criticizing "those who hold that statesman, king, household manager, and slave-master are the same" (1252a7–9), a view upheld by the interlocutors in Plato's *Politicus*, "supposing there were no difference between a large household and a small state" (1252a12–13; cf. Pl., *Polit.* 259b9–10). This position, Aristotle asserts "is not well put" (1252a9), and he promises to make the point clearer – the first stated purpose of the *Politics* – following a certain method. He then describes the method. Below I translate an extended passage – running over into the second chapter:

> The point will be clearer if we examine the matter according to the method that has guided us (κατὰ τὴν ὑφηγημένην μέθοδον). For *in the other cases* (ἐν τοῖς ἄλλοις) we have to analyze a composite into its irreducible elements (τὸ σύνθετον μέχρι τῶν ἀσυνθέτων ἀνάγκη διαιρεῖν), the smallest parts of the whole (ταῦτα γὰρ ἐλάχιστα μόρια τοῦ παντός). So let us in the same way examine the component parts of the state also, and we shall see better both how these too differ from each other and whether we can acquire some skilled understanding of each of the roles mentioned [sc. statesman, king, household manager, and master of slaves]. Now in this as *in other cases* (ὥσπερ ἐν τοῖς ἄλλοις) one would get the best view of things if one were to look at their natural growth from principles (ἐξ ἀρχῆς τὰ πράγματα φυόμενα βλέψειεν). *First: those which are incapable of existing without each other must unite as a pair.* For example, (a) male and female, for the sake of breeding... (b) that which naturally rules (ἄρχον δὲ φύσει) and that which is ruled (ἀρχόμενον) for preservation (διὰ τὴν σωτηρίαν). For that which can use intellect to look ahead (δυνάμενον τῇ διανοίᾳ προορᾶν) is by nature ruler and by nature master, while that which has the bodily strength to labor is ruled, and is by nature a slave. Hence master and slave benefit from the same thing. (*Pol.* 1.1–2, 1252a17–34, tr. adapted from Saunders)

Aristotle states that he will employ a method that is already familiar to the audience and, he seems to assume, presents no particular difficulties. And commentators have by and large treated Aristotle's remark as transparent and unproblematic, and so they have compiled references to other purported employments of this method in this and other books of the *Politics*, other works of practical science (such as the *Ethics*), or productive science (such as the *Poetics*), and of natural science (such as *On the Soul* and the biological works).[17] It seems to have caused little concern

[17] One who follows up all these references will find a great variety of "methods" being applied to a great variety of subject matters. A more systematic analysis of the expression κατὰ τὴν ὑφηγημένην μέθοδον throughout the corpus yields the same result: Aristotle uses this expression to refer to a variety of different local methodologies, some involving division, some part–whole analyses, and others entirely different methods.

that this apparently familiar Aristotelian methodology bears little prima facie resemblance to the prescribed method of the *Analytics*: there is no mention of syllogisms, middle terms, principles, causes, etc.; and in fact one might reasonably ask, as in so many other cases, whether the method employed in *Politics* I is not in tension with his views in the *Analytics*, where he expresses little enthusiasm for demonstration by division (*APr.* 1.31, *APo.* 2.5).

But of course Aristotle does recognize an important methodological role for division, as he states in *APo.* 2.13.[18] What he describes there seems to be a fair description of what Aristotle actually does in *Pol.* 1.1, if we do not cut off his description of the method at the end of the conventional chapter one, but take the beginning of chapter two to be a continuation of the description of the method, as seems reasonable from the fact that in both places Aristotle uses the expression ("in the other cases": 1252a18 and 25). Thus Aristotle analyzes the state into its atomic or indivisible elements: men, women, slaves. These items are then recombined into the pairs men/women and masters/slaves, according to the *metaphysical principle* that "those which are incapable of existing without each other must unite as a pair" – an indemonstrable axiom.[19] Aristotle then goes on to discuss the combination of these pairs into the triplet man/woman/slave, which generates the household (1259b9–15, oxen in lieu of slaves in poor households). Later he discusses the combination of households that generates the village (1252b15–27), and finally the combination of villages that generates the city (1252b27–1253a1). We can express these ideas into propositional and syllogistic form:

Metaphysics: 1. Combination <a> Pair that cannot exist in isolation

Natural science: 2. Pair that cannot exist in isolation <i> Male and female

[18] When you are dealing with some whole, you should divide the kind into what is atomic in form, i.e. into the primitives (διελεῖν τὸ γένος εἰς τὰ ἄτομα τῷ εἴδει τὰ πρῶτα), e.g. number into triplet and pair. Then you should try to get definitions of these items, e.g. of straight line and circle and right angle. After this, having got what the kind is, e.g. whether it is a quantity or quality, you should study its proper attributes through the primitive common items. For the characteristics of the items compounded from the atoms will be plain from the definitions, because definitions and what is simple are principles of everything, and it is of the simples alone that the characteristics hold in themselves – they hold of the other items in virtue of the simples. Divisions made according to differences are useful in this pursuit (αἱ δὲ διαιρέσεις αἱ κατὰ τὰς διαφορὰς χρήσιμαί εἰσιν εἰς τὸ οὕτω μετιέναι). (*APo.* 2.13, 96b15–26, tr. Barnes)

[19] Robert Bolton has pointed out to me the dubiousness of this "principle," a fair point that I do not here have the space to discuss.

Natural history:	3. Combination <i> male and female (= family, from 1+2)
Natural science:	4. Pair that cannot exist in isolation <a> Master and slave
Natural history:	5. Combination <i> Master and slave (= natural slavery, from 1+4)
Economics:	6. Pair that cannot exist in isolation <a> The male/female combination and master/slave combination
Economic history:	7. Combination <i> Male/female combination and master/slave combination (= household, from 1+6)
Economics:	8. Pair that cannot exist in isolation <a> Households
Economic history:	9. Combination <i> Households (= village, from 1+8)
Economics:	10. Pair that cannot exist in isolation <a> Villages
Political history:	11. Combination <i> Villages (= city, from 1+10)

Political and economic facts, observed in political and economic histories or researches, are here explained, ultimately, by means of metaphysical and natural scientific principles. The overarching principle – itself indemonstrable – is that pairs that cannot exist in isolation must combine (or perhaps *should* combine for the sake of the good life – this raises complexities about the modal aspects of these syllogisms that I cannot enter into here). Other supposedly natural scientific principles, such as the axiom of "natural slavery" (#4 in the above scheme), are invoked to explain the fact of the emergence of familial and civilized life. These, I propose, are the kind of "instruments" taken from nature that the good legislator, like the good architect, must use in order to understand political reality and thus to construct laws that are secure and actions that are just.

Admittedly, this conception of politics is bound to appear excessively demonstrative and overly schematic as I have presented it here. I have tried to emphasize that I have only offered these as experimental examples, and I have to admit that they do not as yet get us very far into Aristotle's political science. But since Aristotle says in the second common book of the *Ethics* that science is a disposition or capability to demonstrate,[20] we should at least attempt to relate Aristotle's political science to the method

[20] *EN* 6.3 = *EE* 5.3, 1139b31–32.

of his *Posterior Analytics* if at all possible. Otherwise we will have either to revise our concept of science, or to stop thinking of political science as a science altogether. Neither of those are particularly attractive options. In fact, what is ultimately needed are *practical syllogisms* that either prescribe or justify certain kinds of action, that is, that explain certain actions, laws, or constitutional structures on the basis of ethical, economic, or political theorems. These theorems, however, will in turn have to be demonstrated on the basis of natural scientific and theoretical principles. Whether or not such a syllogistic conception of Aristotle's political science pans out, I have tried to show that an architectonic conception of philosophy in which theoretical science is authoritative is essential to any interpretation of Aristotle's practical sciences.

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