

The study of natural kinds in the Academy  
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Most often in the literature we would find comparisons and contrasts between Plato and Aristotle, stressing how much Aristotle differs from, or how much owes to Plato. The contemporary cultural and philosophical matrix, however, was much-much richer.

As attested by a scene from a comedy of Epicrates, popular imagination had an unflattering view of what is going on in the Academy – much like in the case of Socrates' and Chaerephon's *Phrontistērion* in the *Clouds* of Aristophanes. But the stereotypes used by Aristophanes and by Epicrates are vastly different. In the *Clouds* Socrates and his associates are engaged in a travesty of research into natural phenomena, and sophistry. In Epicrates' skit the school activity is much more down to earth: The dialogue starts with a query about Plato, Speusippus and Menedemus. In reply to this a story is recounted, as a flock of youngsters, in the Academy, during the Panathenaea

in producing definitions about nature, were busy distinguishing the sorts of animals' lives, the nature of trees, and the kinds of vegetables.

And then, in the course of these, they were scrutinizing the gourd (τὴν κολοκύντην), what kind does it belong to.

{B.} ... περὶ γὰρ φύσεως ἀφοριζόμενοι  
διεχώριζον ζώων τε βίον  
δένδρων τε φύσιν λαχάνων τε γένη.

καὶ τ' ἐν τούτοις τὴν κολοκύντην  
ἐξήταζον τίος ἐστὶ γένους.

And what did they determine? To which kind did they assign the plant? Let me know, if you have something to say.

{A.} καὶ τί ποτ' ἄρ' ὠρίσαντο καὶ τίος γένους  
εἶναι τὸ φυτόν; δήλωσον, εἰ κάποισθὰ τι.

At first, they all were motionless then, and speechless, and gazing down they were giving the issue thought for a long time. And then, suddenly, while the boys were still gazing down, in search of the issue, one of them declared it was a round vegetable; a herb – someone else said; a tree – said yet another one.

{B.} πρώτιστα μὲν οὖν πάντες ἀναυδεῖς  
τότ' ἐπέστησαν, καὶ κύψαντες  
χρόνον οὐκ ὀλίγον διεφρόντιζον.  
καὶ τ' ἐξαίφνης ἔτι κυπτόντων  
καὶ ζητούντων τῶν μειρακίων  
λάχανόν τις ἔφη στρογγύλον εἶναι,  
ποῖαν δ' ἄλλος, δένδρον δ' ἕτερος.

The impasse is broken by a Sicilian physician, who farts in contempt at their silly talk. But to no avail:

This did not bother the boys at all: Plato was also there, and very gently, not being stirred at all, set them again to defining what kind it does belong to. And they went on dividing.

{B.} οὐδ' ἐμέλησεν τοῖς μειρακίοις·  
ὁ Πλάτων δὲ παρῶν καὶ μάλα πράως,  
οὐδὲν ὀρινθείς, ἐπέταξ' αὐτοῖς  
πάλιν . . .  
ἀφορίζεσθαι τίνος ἐστὶ γένους·  
οἱ δὲ διήρουν.

In public imagination, then, the Academy must have been busy trying to give accounts of natural kinds. At least as a didactic exercise. And the conceptual framework is also suggested by the terms Epicrates uses: the task is to give an account about the kind of life (*bios*) different animals lead, to determine the nature (*phusis*) of the trees, and the kinds (*genē*) of vegetables. The starting point of such an exercise is, or at least can be beyond dispute: The gourd which is to be accounted for here is a *plant*. But within that quite a few different options may be open. Indeed, the boys come up with different suggestions. But there is hope, Plato is unstirred by vulgar criticism, and directs the boys back to methodical procedure, of carrying out divisions.

Certainly, this last detail should be familiar to any reader of the *Sophist*. But this Epicrates text cannot guarantee that it is a faithful account of the activities of the

Academy, any more than the Aristophanes skit in the *Clouds* were such about Socrates. Just as Aristophanes, Epicrates too could attach to the butt of his ridicule any number of intellectual excesses, exaggerated at will, and taken from just about any contemporary intellectual strain.

Consequently, we should not be taken in by the facility of supposing that Aristotle's philosophy of nature, and his metaphysics must have emerged in the context of an Academy happily defining away natural kinds. Hence, I will pursue here a survey of the testimonies we have about two key contemporaries of Aristotle, to see whether either of them can be credited with serious inquiry into natural kinds.

## 2

The first to discuss is Xenocrates, the companion of Aristotle when they both left the Academy after Plato's death. Xenocrates has pride of place both in Aristotle's and Theophrastus' assessment:

Some people [as contrasted to Speusippus and Plato] say that forms and numbers have the same nature, whereas the others are consequent upon them – lines and planes, up until the substance of the heavens and the perceptible things.  
(Aristotle, *Metaphysics* 1028b24–27)

ἔνιοι δὲ τὰ μὲν εἶδη καὶ τοὺς ἀριθμοὺς τὴν αὐτὴν ἔχειν φασὶ φύσιν, τὰ δὲ ἄλλα ἐχόμενα, γραμμὰς καὶ ἐπίπεδα, μέχρι πρὸς τὴν τοῦ οὐρανοῦ οὐσίαν καὶ τὰ αἰσθητά.

About the heavens, and the rest they do not make a mention – similarly, the circle of Speusippus – neither anybody of the others, with the exception of Xenocrates. For he assigns everything in some way around the cosmos, perceptible things similarly, and intelligible ones and mathematical ones,<sup>1</sup> and even the divine ones.  
(Theophrastus, *Metaphysics* 6b4–7)

τοῦ δ' οὐρανοῦ πέρι καὶ τῶν λοιπῶν οὐδεμίαν ἔτι ποιοῦνται μνείαν· ὡσαύτως δ' οἱ περὶ Σπεύσιππον, οὐδὲ τῶν ἄλλων οὐθεις πλήν Ξενοκράτης οὗτος γὰρ

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<sup>1</sup> Here the *kai* is most probably explicative – in which case intelligible entities are identified with the mathematical ones.

ἅπαντά πως περιτίθησιν περὶ τὸν κόσμον, ὁμοίως αἰσθητὰ καὶ νοητὰ καὶ μαθηματικὰ καὶ ἔτι δὴ τὰ θεῖα.

But even though Xenocrates is unique in setting out his metaphysical account down to the level of perceptibles and the heavenly bodies, we have very little in terms of an inquiry into natural entities in their own right. This may be a coincidence of the state of our sources, and so of the interest of the authors reporting on Xenocrates. But there is an interesting further detail to consider in this instance, this time about Xenocrates' epistemology. When Sextus (VII.147–148) gives a quick outline of Xenocrates' doctrines about the criterion, he submits that the three ontological realms – that of perceptible entities, that of intelligible entities, and that of believable entities have their own, dedicated mode of cognition. This is still very much in a Platonic mode, of the Divided Line, with some crucial differences. First, that there is no distinction in the upper segment of the Divided Line, between mathematical cognition (*dianoia*) and the direct grasp of ideas (*nous*), as Forms are identical to the mathematical entities by Xenocrates' lights.

But there is a further change on the lower segment, too. Instead of the contrast of *pistis*, directed at perceptible objects, and *eikasia*, the images of these objects, we have *doxa* and perception (*aisthēsis*), where *doxa* is directed at the heavenly realm. As such, it is a mixture of perception – the heavenly bodies are visible – and of a science (or knowledge), astronomy. A further distinction from the Platonic simile is its epistemological optimism: The criterion of the substance beyond the heavens is science or knowledge (*epistēmē*), that of the perceptible substance is perception. Perception *does* provide truth, but not in the way that epistemonical account does.

In the case of the mixed domain of the heavens we have both avenues of cognition, and they together provide for opinion (*doxa*), this can be both true and false.

What may be relevant here is that the sublunary domain as such is the domain of perception, unaided by epistemonical accounts. Certainly this does not overrule the express claim that perception provides us with truths about sublunary objects, but it at the very least suggests restrictions on what kind of methodical acquaintance is possible with perceptible objects.

One should nevertheless resist attributing a happy and brute perceptualism to Xenocrates. Not only did he write a *Physics* in six books (or two *Physics*, in six books each), there are some claims about the sublunary world attributed to him in our sources. But they do not provide us with evidence about such inquiry into natural kinds. The testimonies amount to Xenocrates' doctrine of indivisible magnitudes, which surely has

relevance on corporeal existence. Then we have his definition of soul. Furthermore, his doctrine about the *daimones* is also one which covers entities in the sublunary realm. But in all these three cases perception does not play a role: indivisible magnitudes are indivisible because of considerations about extensions, also in the intellectual domain, the cognition of the soul – a self-moving number – is not the task of perception either.<sup>2</sup> And finally, one key feature of the *daimones* is that they are not present to perception as such.

3

We can turn now to Speusippus after Xenocrates. A less likely candidate of inquiry into natural kinds, as it was Xenocrates who was singled out for honourable mention for his reaching down to every part of the cosmos. But Aristotle's and Theophrastus' claim will turn out to dispute from Speusippus much less. What both of them stress is that Speusippus' account creates an episodic, unconnected cosmos. One in which the separate domains are not connected, or in which their connection is extremely tenuous.

Apart from this, however, there is no reason to think that Speusippus' attention would have excluded any domain. Granted, one Aristotelian list might mistakenly suggest that after a discussion of mathematical entities he provided only a discussion of the principles of soul, and did not reach any further:

Speusippus names even more substances (i.e. more than Plato, who according to Aristotle named three types – forms, mathematical substances and perceptible ones), starting from the one, and giving principles of each substance – a different one for numbers, a different one for magnitudes, and then [a different one] for soul. This way he extends substances. (*Metaphysics* Z.2 1028b21–23, continuing with Xenocrates )

Σπεύσιππος δὲ καὶ πλείους οὐσίας ἀπὸ τοῦ ἑνὸς ἀρξάμενος, καὶ ἀρχὰς ἐκάστης οὐσίας, ἄλλην μὲν ἀριθμῶν ἄλλην δὲ μεγεθῶν, ἔπειτα ψυχῆς· καὶ τοῦτον δὴ τὸν τρόπον ἐπεκτείνει τὰς οὐσίας. ἔνιοι δὲ τὰ μὲν εἶδη καὶ τοὺς ἀριθμοὺς τὴν αὐτὴν ἔχειν φασὶ φύσιν, τὰ δὲ ἄλλα ἐχόμενα, γραμμὰς καὶ ἐπίπεδα, μέχρι πρὸς τὴν τοῦ οὐρανοῦ οὐσίαν καὶ τὰ αἰσθητά.

But even though the remark might appear to contrast Speusippus and Xenocrates, that it was only Xenocrates who reached all the way down to perceptible entities, the claim

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<sup>2</sup> Indeed, Xenocrates must have taken the *Timaeus* as the key starting point of his psychology.

that Speusippus extended substances further *than Plato* suggests that according to Aristotle he also acknowledged Plato's third type – that of perceptible substances.

If we had any doubts about this, a different consideration would lead to the very same conclusion. Aristotle in *Metaphysics* Λ mentions that Speusippus is among those mistaken philosophers who propose that the excellent and the best are not in the origin

because the origins of plants and animals are their cause, but the excellent and the complete is what is developed from these (Aristotle, *Metaphysics* Λ.7 1072b30–34)

ὅσοι δὲ ὑπολαμβάνουσιν, ὥσπερ οἱ Πυθαγόρειοι καὶ Σπεύσιππος τὸ κάλλιστον καὶ ἄριστον μὴ ἐν ἀρχῇ εἶναι, διὰ τὸ καὶ τῶν φυτῶν καὶ τῶν ζώων τὰς ἀρχὰς αἴτια μὲν εἶναι τὸ δὲ καλὸν καὶ τέλειον ἐν τοῖς ἐκ τούτων, οὐκ ὀρθῶς οἴονται.

This, combined with the similarly damning verdict of Theophrastus suggests that this region of excellence is in the sublunary domain (Theophrastus, *Metaphysics* 11a22–25)

εἰκῆ γὰρ οἱ περὶ τῆς ὅλης οὐσίας λέγοντες ὥσπερ Σπεύσιππος σπάνιον τι τὸ τίμιον ποιεῖ τὸ περὶ τὴν τοῦ μέσου χώραν, τὰ δ' ἄκρα καὶ ἐκατέρωθεν.

This means that we have no reason to suppose that Speusippus' interest would have excluded physical reality.

For what it is worth, in a description of the articulation of mathematical principles, extant in the *De communi mathematica scientia* ch. 4, which follows the episodic structure of Speusippus' account, after the level of numbers and extensions (lines, surfaces, solids), two further levels of reality are indicated, complete with their own elements as an episodic account should have it.

What these levels of reality are is not indicated in this portion of the text. All we are told is that they are the fourth and the fifth kinds, and that they are the last ones

but at the extreme, among the fourths and fifths, which are combined from the last elements, it is possible that deviousness comes to be, not in a principal fashion, but from something falling away from and failing to hold on to some things<sup>3</sup> which belong to its nature (*De communi mathematica scientia* 4, p. 18, 9–12)

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<sup>3</sup> τινα – a plurality..

ἐπ' ἐσχάτῳ δὲ ἐν τοῖς τετάρτοις καὶ πέμπτοις  
τοῖς συντιθεμένοις ἀπὸ τῶν στοιχείων τῶν τελευταίων  
κακίαν γενέσθαι οὐ προηγουμένως, ἐκ δὲ τοῦ ἐκ-  
πίπτειν καὶ μὴ κατακρατεῖν τινα τοῦ κατὰ φύσιν.

The report closes then with an explicit enumeration

From these it is also clear what difference the mathematical principles have as contrasted to the other ones. For they precede the last principles, because whereas those are somehow corporeal, they [the mathematical principles] are incorporeal, and [they precede] the principles contemplated according to life, because whereas those are characterised according to motion, they are immobile, and [they precede] the intelligible principles, because whereas those are previously partless, they [the mathematical principles] provide them with the principle of composition and division.

Let this be the determination of our general account about the mathematical principles, and the specific one about each one of them. How they differ from the other principles, let that be distinguished in this way. (*De communi mathematica scientia* 4, p. 18, 13–23)

Ἐκ δὴ τούτων φανερόν ἐστι καὶ τίνα ἔχουσι τὴν  
διαφορὰν αἱ μαθηματικαὶ ἀρχαὶ πρὸς τὰς ἄλλας· τῶν  
μὲν γὰρ τελευταίων προέχουσι, διότι σωματικῶν πως  
ἐκείνων οὐσῶν αὐταὶ εἰσιν ἀσώματοι, τῶν δὲ κατὰ  
τὴν ζωὴν θεωρουμένων, διότι κατὰ κίνησιν ἐκείνων  
χαρακτηριζομένων αὐταὶ εἰσιν ἀκίνητοι, τῶν δὲ νοη-  
τῶν, διότι ἀμερίστων ἐκείνων προὔπαρχουσῶν αὐταὶ  
συνθέσεως καὶ διαιρέσεως ἀρχὴν παρέχονται.

οὕτως

ἡμῖν ὁ κοινὸς λόγος περὶ τῶν μαθηματικῶν ἀρχῶν  
καὶ ὁ ἴδιος περὶ ἐκάστων ἐχέτω διορισμόν· πῆ τε  
διαφέρει τῶν ἄλλων ἀρχῶν, οὕτωςι διακεκρίσθω.

Here the inclusion of intelligible principles, with their own principles is suspect. It seems like an attempt on the part of the author of *De communi mathematica scientia* at arriving five distinct levels of reality, not counting the initial principle, the One. If intelligibles were to feature in Speusippus, that would mean a reassessment of the

ontological status of Platonic forms, and not their exclusion in favour of the mathematical entities, as Aristotle reports.

But otherwise the identification of the fourth and fifth realm as that of life – i.e. that of soul – and that of corporeality makes perfect sense, especially in view of the fact that these should be the levels where deviousness, as falling away from excellence should be present.

Furthermore, this assessment is matched also by Sextus' report on Speusippus account of the criterion, which Sextus gives just before his report about Xenocrates (VII.145–146). The crucial difference between Xenocrates and Speusippus on this score is twofold. First, Speusippus introduces only two kinds of criteria, one for intelligible entities, and another one for perceptible ones. This means that apparently he does not make a special epistemological pleading for astronomy.

Moreover, the criterion for perceptible reality is not just perception. Rather, it is perception of a specific kind: cognitive perception, perception informed and imbued with reasoning. This kind of perception partakes of the truth which can be grasped through reason, but nevertheless it remains on the level of perception. The simile Sextus employs is that of the artful musician, whose fingers obey patterns which do not originate from themselves, but rather from the practice according to reasoning.

The simile may in all probability go back to Speusippus. A trained musician has to be knowledgeable about the arithmetical structures governing harmonies, to the extent that he or she can follow them just out of the flow of music, without engaging in reasoning about them. While in the process of learning and practicing they may very well need to address issues of arithmetic. Once their practice and training is completed, however, their cognitive perception will take over, and they will be able to concentrate on the reality they are engaged with.

Aristotle may very well demur – as he does – that Speusippus' account does not explain how arithmetical knowledge can be operative in this way.<sup>4</sup> Nevertheless, Speusippus' intention is fairly clear. Just as his ontological framework is one of a descending order of levels of reality, where the connections between the different levels remain less than pellucid, his epistemological account also provides for such cognitive connections, through which perception is able to address and recognize cognitive contents not directly accessible to it.

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<sup>4</sup> See *Metaphysics* 1090a13–15..



It remains to be seen how stringent such cognitive perception is, to what extent such cognitive perception is practicable and attainable. Aristotle criticises those according to whom in order to know anything one needs to know all the differences it may have from anything else – for that, however, we would need to know all the things there are.

There is no need for one who is defining and dividing to know everything there is. Yet some say that it is impossible to know a thing's differences from something without knowing that thing; but that without knowing the differences one cannot know that thing – for it is the same as that from which it does not differ and different from that from which it does differ. (*Posterior analytics* II.13 97a6–11)

οὐδὲν δὲ δεῖ τὸν ὀρίζομενον καὶ διαιρούμενον ἅπαντα εἰδέναι τὰ ὄντα.  
καίτοι ἀδύνατόν φασί τινες εἶναι τὰς διαφορὰς εἰδέναι τὰς πρὸς ἕκαστον μὴ  
εἰδόμενα ἕκαστον· ἄνευ δὲ τῶν διαφορῶν οὐκ εἶναι ἕκαστον εἰδέναι· οὗ γὰρ μὴ  
διαφέρει, ταὐτὸν εἶναι τούτῳ, οὗ δὲ διαφέρει, ἕτερον τούτου.

This impossibly stringent requirement on knowing anything is ascribed to Speusippus by the commentators on the authority of Eudemus.<sup>5</sup> Indeed, ascription to Speusippus is already a tacit relaxation of the claim. In a strictly levelled universe, with episodically independent domains the relevant differences should be the ones in the same ontological domain, even if in order to assess these one needs access to some higher entities, like in the case of epistemonical or cognitive perception.

Nevertheless, complete coverage may be elusive even when restricted to independent domains. Perhaps a complete coverage of the separate branches of mathematics is attainable, once the necessary starting points and the valid inferential procedures are available.<sup>6</sup> This, however, most probably should not be expected for perceptible entities.

Hence I suggest that the not inconsiderable evidence we have of Speusippus drawing up divisions and establishing similarities may be something like a second sailing. The

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<sup>5</sup> Eudemus fr. 24 Wehrli.

<sup>6</sup> Here it is relevant that Speusippus does not allow for an open-ended process of constructions in mathematics. All there is to geometry is theorems of what there is to be grasped, see Proclus *In prim. Eucl.* 77, 15–20: ἤδη δὲ τῶν παλαιῶν οἱ μὲν πάντα θεωρήματα καλεῖν ἠξίωσαν, ὡς οἱ περὶ Σπεύσιππο καὶ Ἀμφίνομον, ἡγούμενοι ταῖς θεωρητικαῖς ἐπιστήμαις οικειοτέραν εἶναι τὴν τῶν θεωρημάτων προσηγορίαν ἢ τὴν τῶν προβλημάτων, ἄλλως τε καὶ περὶ αἰδίων ποιουμέναις τοὺς λόγους.

very existence of several books of similarities might in itself suggest that these are not just any kinds of similarities among some biological kinds (and dissimilarities, contrasting these kinds to some, or all the other kinds). And indeed, at least one testimony in Athenaeus suggests that the point of enumerating these similarities is to effect some kind of ordering, some kind of rudimentary taxonomy:

Speusippus in Book II of *Similar Things* says that trumpet shells, purple shellfish, whelks, and conchs are very much alike. ... Furthermore, Speusippus again lists individually in order conchs, scallops, mussels, pinnas and razor-shells, and in another class oysters and limpets (Athenaeus, *Deipnosophistae* II 86c-d, Speusippus fr. 8 Tarán)

Σπεύσιππος δ' ἐν β' Ὀμοίων παραπλήσια εἶναι κήρυκας, πορφύρας, στραβήλους, κόγχους. [...]  
ἔτι ὁ Σπεύσιππος ἐξῆς πάλιν ἰδία καταριθμεῖται κόγχους, κτένας, μῦς, πίννας, σωλήνας, καὶ ἐν ἄλλῳ μέρει ὄστρεα, λεπάδας.

This activity of finding similarities and dissimilarities may also have included the tentative demarcation of larger animal kinds. Perhaps we have evidence of this in another passage in Athenaeus, if indeed the terminology of *malakostraka* goes back to Speusippus himself:

Speusippus in Book II of *Similar Things* says that of the crustaceans that resemble one another are the crayfish, lobster, *numphē*, bear-crab, crab (*karkinos*), and common crab (*pagouros*) (Athenaeus, *Deipnosophistae*, 106b)

Σπεύσιππος δὲ ἐν β' Ὀμοίων παραπλήσιά φησιν εἶναι τῶν μαλακοστράκων κάραβον, ἀστακόν, νύμφην, ἄρκτον, καρκίνον, πάγουρον.

Use of this terminology cannot be excluded, even though the testimony about Speusippus is followed closely at 106c-d by quotes of several points from Aristotle, *Historia animalium*, Book V, again about the crustaceans.<sup>7</sup>

The meagre evidence we have, then, suggests considerable interest on Speusippus' part in research into natural kinds. Aristotle's silence about this then must be motivated by the conviction that his whole metaphysical outlook in general, and also, in particular, the underlying presuppositions of this enterprise are wrong-headed. Better then

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<sup>7</sup> These include: the way some of the crustaceans copulate (549b19–24 and b13–17), .the places some of these crustaceans are found (549b28),

someone like Xenocrates, who provides some metaphysical continuity in this enterprise, even if his contribution on particular detail may be not so detailed as Speusippus'.