Book II: Nature, teleological explanation, chance and necessity

HS "Aristotle's *Physics*", HS 2017, Philipp Blum, October 16, 2017

What, on earth, are Aristotelian forms?

We have seen that Aristotle analyses the change of Socrates acquiring a musical ability as a process that is describable as all of the following:

(i) from *anthropon* to *musikon*;
(ii) from *mē musikon* to *musikon*; and
(iii) from *mē musikon anthropon* to *musikon anthropon*

He says that *mē musikon* and *musikon* are opposites and that they are the forms of the thing that comes to be, *musikon anthropon*. We have translated "musikon" as all of: "musical", "musician", "having musical knowledge" and "musicality" – these four correspond to four different views on the ontology of forms, *none* of which seems to be Aristotle's:

"musical" , the bare adjective is perhaps the best, but it misleadingly suggests that forms are qualitative features in-abstracto, especially when used, as "musikon" is in Greek, with the definitive article: "ton musikon" then becomes "the musical", which is too close to "musicality" to be acceptable.

"musician" is better because it may be used to designate, as expressions for forms can in Aristotle's Greek, the man over there who possess musical abilities, Socrates. It also matches with "man", avoiding the very misleading connotation that in change (i) Socrates changes into a quality. The problem is that it is not generally available: there is no expression in English that stands to "white" or "pale" (i.e. not sunburnt, one of Aristotle's favourite examples) in the way "musician" stands to "musical".

"having musical knowledge" or, more generally, expressings of the form "being *F*", "having the property of being *F*" are generally available, but they are not things that can be destroyed and can come into being in the way Aristotelian forms can.

"musicality" has the advantage that it allows for two readings, as universal and as trope as we would say nowadays, and that it may cease to be and come into being when read in the latter way (as it is in "Socrates' musicality"); but it has the important disadvantage that we must settle on one reading and thereby prejudge the difficult question how to interpret *Metaphysics* Z, where Aristotle discusses the question in what ways forms are not only universal but also particular, a question he does not take to be decided by their verbal expressions alone.

Nature, natures, and the natural

After having shown that the analysis of change in terms of variation and constancy requires a distinction between matter and form, Aristotle starts the second book with a different question. Rather than asking what the world must be like in order to exhibit change, we now ask what is characteristic of changing things and introduce the fourfold distinction of 'causes' or principles. According to Charlton, the leading question is: What is explanation in the natural sciences? Aristotle then takes us through the following steps:

II.1 its objects are natural things, distinguished from artefacts: things that have a nature = a source of their behaviour in themselves
II.2 natures can be form, but it can also be matter
II.3+7 fourfold classification of causes / types of explanatory factor
II.4-6 chance and luck can be fitted into this classification
II.8 validity of teleological explanation (= explanation by form)

Natural things and artefacts

A central conclusion of the whole of the *Physics* is that nature, *phusis*, itself is a final cause. "Nature" is used in two ways: as a subject of predication – nature is an internal source of movement and rest – and as a predicate, "…is natural" or "…has a nature": nature (in the first sense) is, according to some, the matter (and, according to others and Aristotle himself, the form) of things that have natures, i.e. things that are substances.

II.1 Some nature is a principle of change in the things in which it inheres (a) primarily (not in virtue of inhering in something else) and (b) per se, i.e. not per accidens (192b21–23). Both conditions distinguish natural things from product of craft: (a) artefacts, such as a bed or a coat, have inner principles of change, but only indirectly so, because their matter has them; (b) while healing of the doctor by herself also has an 'inner' principle, this is only accidentially so. Artifacts and natural beings are contrasted in terms of the efficient cause involved in their production: "None of them [that is, artifacts] has in itself the principle of its own production" (192a27–28).

Can we then conclude that a thing is natural iff it has an inner principle of change? Yes, if we understand "principle" in a broader sense than "efficient cause": while natural things may rely and depend on things external to them for exercising their natural capacities (as e.g. nutrition, perception, locomotion), the change is still appropriately 'internal' to them (and not to its external efficient cause) if the 'good of' the change (its telos) is internal to them.[1]

This is so even in substantial changes, i.e. where an animal or a plant 'brings forth' / produces an animal or a plant of the same kind. In such cases, "the nature of an entity is the element common between it and what generated it" (Stavrianeas 2015: 58) and is transmitted – this last feature is what distinguishes natural generation from the generation of artefacts, where the form is typically changed (medicine, e.g., brings about health, not medicine): Even though its efficient cause is the form of the parent, the coming-to-be of the child still has a principle that is 'in it', because it shares its form with the parent.

Definitions of natural and of mathematical things

II.2. In what way does the study of nature(s) involve the study of form(s)? Aristotle tackles this question from a slightly oblique angle: in what way does the mathematician differ from the person who investigates nature? Aristotle generates a concern about this by highlighting two related but distinct points: First, the objects investigated by the mathematician, such as points, lines, planes, and solids are features of natural bodies; and second, it is apparently a goal of the natural scientist to grasp the nature of the sun and moon, and to determine whether the earth or the cosmos is spherical or not. But these would appear to be the concerns of the astronomer, who is a type of mathematician (193b22–30).

The distinction is made in terms of the *ways* in which mathematicians and natural philosophers respectively consider the objects of their study: mathematicians consider them as separable (whereas they are not), because they are separable-in-account, while the natural philosophers do not.

> περὶ τούτων μὲν οὖν πραγματεύεται καὶ ὁ μαθηματικός, ἀλλ᾽ οὐχ ᾗ φυσικοῦ σώματος πέρας ἕκαστον· οὐδὲ τὰ συμβεβηκότα θεωρεῖ ᾗ τοιούτοις οὖσι συμβέβηκεν· διὸ καὶ χωρίζει· χωριστὰ γὰρ τῇ νοήσει κινήσεώς ἐστι, καὶ οὐδὲν διαφέρει, οὐδὲ γίγνεται ψεῦδος χωριζόντων. ()
> "Now the mathematician, though he too treats of these things, nevertheless does not treat of them as the limits of a physical body; nor does he consider the attributes indicated as the attributes of such bodies. That is why he separates them; for in thought they are separable from motion, and it makes no difference, nor does any falsity result, if they are separated."

The abstraction mathematicians make of the objects of their study is in turn interpreted by Aristotle as an abstraction from change; natural things, on the contrary, cannot be abstracted in this way. Aristotle puts this rather enigmatically: expressions for natural things are like "snubnosed" and not like "concave":

> γίγνοιτο δ᾽ ἂν τοῦτο δῆλον, εἴ τις ἑκατέρων πειρῷτο λέγειν τοὺς ὅρους, καὶ αὐτῶν καὶ τῶν συμβεβηκότων. τὸ μὲν γὰρ περιττὸν ἔσται καὶ τὸ ἄρτιον καὶ τὸ εὐθὺ καὶ τὸ καμπύλον, ἔτι δὲ ἀριθμὸς καὶ γραμμὴ καὶ σχῆμα, ἄνευ κινήσεως, σὰρξ δὲ καὶ ὀστοῦν καὶ ἄνθρωπος οὐκέτι, ἀλλὰ ταῦτα ὥσπερ ῥὶς σιμὴ ἀλλ᾽ οὐχ ὡς τὸ καμπύλον λέγεται. ()
> ἐπεὶ δ᾽ ἡ φύσις διχῶς, τό τε εἶδος καὶ ἡ ὕλη, ὡς ἂν εἰ περὶ σιμότητος σκοποῖμεν τί ἐστιν, οὕτω θεωρητέον· ὥστ᾽ οὔτ᾽ ἄνευ ὕλης τὰ τοιαῦτα οὔτε κατὰ τὴν ὕλην. ()
> This becomes plain if one tries to state in each of the two cases the definitions of the things and of their attributes. 'Odd' and 'even', 'straight' and 'curved', and likewise 'number', 'line', and 'figure', do not involve motion; not so 'flesh' and 'bone' and 'man'—these are defined like 'snub nose', not like 'curved'.
> Since 'nature' has two senses, the form and the matter, we must investigate its objects as we would the essence of snubness. That is, such things are neither independent of matter nor can be defined in terms of matter only.

"Subnosed", *simos*, is said of Socrates because of and in virtue of his having a concave nose; or rather: because of and in virtue of *his nose* having concavity, being concave. This, according to Aristotle, brings out how the student of nature cannot abstract from the matter and concentrate only on the form (as the mathematicians do) bor abstract from the form and

1. Because the *telos* is not necessarily realised (and may even always fail to be realised), this must be modified: the principle of change is internal (at best) insofar as its telos *would* be realised in the thing changing in the 'natural' course of events, even if the efficient cause of the change is external. Two further modifications are then still necessary, as Stavrianeas (2015: 57–58) points out: Because not all change is even potentially good for the changing thing, its principle is internal at most in the sense that the change is constrained by the changing thing's "formal nature". Also, the effect produced in the changing thing must stand in a per se, i.e. non-accidental relation to the change.

concentrate only on the matter (as the atomists do). For if we do the former, we only have *nose* and *concave*, and we cannot, using just them, describe Socrates as having a concave *nose*, rather than, e.g., having a nose and a concave mouth. If we do the latter, we will similarly not describe him adequately, for we will attribute him both having a nose and being concave, but not having a nose of a certain form.

I am not sure, however, that the requirement to specify the matter is specific in the way Lennox (2015: 20) seems to think it is:

> It is of the very essence of a living thing, and more generally of any natural object, to move, behave, act, and change in specific ways; in fact, in specifying what it is to be an eye or a leaf – or even air – one must mention capacities to function or change in specific ways. But it is also the case that those capacities are the capacities of specific materials, and thus any such definition must refer to a material structure constituted in precisely the way it must be in order to have the capacities to move and change as an eye or a leaf.

Whether or not the matter of form/matter composites is itself an object of physical study, form certainly is. But how is physics concerned with (immutable) forms if it is to study the principles of change in things? According to Lennox (2015: 23), it is this quite formal characteristic of physical inquiry (stemming from Aristotle's definition of what a science is) which is responsible for Aristotelian physics asking teleological questions and giving teleological answers:

> …the natural philosopher's investigation of form is distinct from that of the metaphysician. Specifically the natural philosopher is to study the formal nature *in so far as it is that for the sake of which the materials that make up the material nature are present*. Thus, the natural scientist should study matter to the extent that it is for the sake of the form. (Lennox 2015: 23)

The four causes

In II.3, we find an enumeration of different sorts of things which may be given as *aitia*. Again, Aristotle is not seeking to decide between them, but just lists the different ways in which something may be said to be an *aition* of something else:

> ἕνα μὲν οὖν τρόπον αἴτιον λέγεται τὸ ἐξ οὗ γίγνεταί τι ἐνυπάρχοντος, οἷον ὁ χαλκὸς τοῦ ἀνδριάντος καὶ ὁ ἄργυρος τῆς φιάλης καὶ τὰ τούτων γένη· ἄλλον δὲ τὸ εἶδος καὶ τὸ παράδειγμα, τοῦτο δ᾽ ἐστὶν ὁ λόγος ὁ τοῦ τί ἦν εἶναι καὶ τὰ τούτου γένη (οἷον τοῦ διὰ πασῶν τὰ δύο πρὸς ἕν, καὶ ὅλως ὁ ἀριθμός) καὶ τὰ μέρη τὰ ἐν τῷ λόγῳ. ἔτι ὅθεν ἡ ἀρχὴ τῆς μεταβολῆς ἡ πρώτη ἢ τῆς ἠρεμήσεως, οἷον ὁ βουλεύσας αἴτιος, καὶ ὁ πα τὴρ τοῦ τέκνου, καὶ ὅλως τὸ ποιοῦν τοῦ ποιουμένου καὶ τὸ μεταβάλλον τοῦ μεταβαλλομένου. ἔτι ὡς τὸ τέλος· τοῦτο δ᾽ ἐστὶν τὸ οὗ ἕνεκα, οἷον τοῦ περιπατεῖν ἡ ὑγίεια· διὰ τί γὰρ περιπατεῖ; φαμέν "ἵνα ὑγιαίνῃ", καὶ εἰπόντες οὕτως οἰόμεθα ἀποδεδωκέναι τὸ αἴτιον. καὶ ὅσα δὴ κινήσαντος ἄλλου μεταξὺ γίγνεται τοῦ τέλους, οἷον τῆς ὑγιείας ἡ ἰσχνασία ἢ ἡ (195a.) κάθαρσις ἢ τὰ φάρμακα ἢ τὰ ὄργανα· πάντα γὰρ ταῦτα τοῦ τέλους ἕνεκά ἐστιν, διαφέρει δὲ ἀλλήλων ὡς ὄντα τὰ μὲν ἔργα τὰ δ᾽ ὄργανα. τὰ μὲν οὖν αἴτια σχεδὸν τοσαυταχῶς λέγεται, ()

> In one sense, then, (1) that out of which a thing comes to be and which persists, is called 'cause', e.g. the bronze of the statue, the silver of the bowl, and the genera of which the bronze and the silver are species. In another sense (2) the form or the archetype, i.e. the statement of the essence, and its genera, are called 'causes' (e.g. of the octave the relation of 2:1, and generally number), and the parts in the definition. Again (3) the primary source of the change or coming to rest; e.g. the man who gave advice is a cause, the father is cause of the child, and generally what makes of what is made and what causes change of what is changed. Again (4) in the sense of end or 'that for the sake of which' a thing is done, e.g. health is the cause of walking about. ('Why is he walking about?' we say. 'To be healthy', and, having said that, we think we have assigned the cause.) The same is true also of all the intermediate steps which are brought about through the action of something else as means towards the end, e.g. reduction of flesh, purging, drugs, or surgical instruments are means towards health. All these things are 'for the sake of' the end, though they differ from one another in that some are activities, others instruments. This then perhaps exhausts the number of ways in which the term 'cause' is used.
> One way in which cause is spoken of is that out of which a thing comes to be and which persists, e.g. the bronze of the statue, the silver of the bowl, and the genera of which the bronze and the silver are species. In another way cause is spoken of as the form or the pattern, i.e. what is mentioned in the account (logos) belonging to the essence and its genera, e.g. the cause of an octave is a ratio of 2:1, or number more generally, as well as the parts mentioned in the account (logos). Further, the primary source of the change and rest is spoken of as a cause, e.g. the man who deliberated is a cause, the father is the cause of the child, and generally the maker is the cause of what is made and what brings about change is a cause of what is changed. Further, the end (telos) is spoken of as a cause. This is that for the sake of which (hou heneka) a thing is done, e.g. health is the cause

> of walking about. 'Why is he walking about?' We say: 'To be healthy'—and, having said that, we think we have indicated the cause. (Phys. 194b23–35)

In *Met.* Δ, we have the following list:

material "constituent out of which" (1013a24)
formal "form and pattern" (1013a26)
motive / efficient "first origin of alteration or rest" (1013a29)
final "a thing's fulfilment" (1013a32)

To the question, "why is this a statue?", Aristotle can give four sorts of answers: This is a statue because it is made of marble; because it is in the shape of David; because Michelangelo sculpted it; because Michelangelo wanted to depict the figure of David in marble (because he needed the money, perhaps).

Shields 2015 illustrates and summarises this as follows:

> Aristotle's attitude towards explanation is best understood first by considering a simple example he proposes in *Physics* ii 3. A bronze statue admits of various different dimensions of explanation. If we were to confront a statue without first recognizing what it was, we would, thinks Aristotle, spontaneously ask a series of questions about it. We would wish to know what it is, what it is made of, what brought it about, andwhat it is for. In Aristotle's terms, in asking these questions we are seeking knowledge of the statue's four causes (aitia): the formal, material, efficient, and final. According to Aristotle, when we have identified these four causes, we have satisfied a reasonable demand for explanatory adequacy.
> More fully, the four-causal account of explanatory adequacy requires an investigator to cite these four causes:
>
> **material** that from which something is generated and out of which it is made, e.g. the bronze of a statue.
> **formal** the structure which the matter realizes and in terms of which it comes to be something determinate, e.g., the shape of the president, in virtue of which this quantity of bronze is said to be a statue of a president.
> **efficient** the agent responsible for a quantity of matter's coming to be informed, e.g. the sculptor who shaped the quantity of bronze into its current shape, the shape of the president.
> **final** the purpose or goal of the compound of form and matter, e.g. the statue was created for the purpose of honoring the president.
>
> In *Physics* ii 3, Aristotle makes twin claims about this four-causal schema: (i) that citing all four causes is necessary for adequacy in explanation; and (ii) that these four causes are sufficient for adequacy in explanation.

Chance and necessity

II.4 asks whether there is chance, II.5 what it is and II.6 then distinguishes two type of chance: luck, and *to automaton*.

He starts in II.4 by pointing out that even if, as many believe, everything has a cause, there might still be chance. But even if there is chance, it is not responsible (II.5) for things which come to be almost of for the most part in the same way.

The things that come to be 'for something' are the outcome either of nature or of thought. Things that come to be by chance belong to the latter group, and, within it, are those that come about by virtue of concurrence, i.e. are the things which, though they might have been done for something, in fact were not. So we get as the Aristotelian definition of chance: a cause by virtue of concurrence of things which come to be neither always nor for the most parts and are such as to be for something.

References

Lennox, James G., 2015. How to Study Natural Bodies: Aristotle's *methodos*. In Leunissen (2015), pp. 10–30.

Leunissen, Mariska (editor) , 2015. *Aristotle's* Physics. *A Critical Guide*. Cambridge Critical Guides, Cambridge: Cambridge University Press.

Stavrianeas, Stasinos, 2015. Nature as a Principle of Change. In Leunissen (2015), pp. 46–65.