

Climate and Teleology in Aristotle's *Physics* II.8

“Climate is what we expect, weather is what we get”¹: this saying captures a key distinction—climate consists of weather, but the former is predictable while the latter often surprises. More generally, predictable processes often consist of relatively unpredictable elements. Aristotle’s discussion of natural teleology in *Physics* II.8 uses weather and climate as examples, and the discussion places great weight on predictability, on the question of whether or not things happen “always or usually.” That question, for Aristotle, helps distinguish accident from purpose and material necessity from teleology. In discussing such questions, he touches on strikingly contemporary questions concerning biology and the possibility of natural selection. Aristotle’s answers often make us uncomfortable, especially given the wealth of evidence for evolution. Looking at the distinction between climate and weather, however, should reveal a new avenue in the attempt to understand Aristotle’s teleology and evaluate its relation to contemporary science. The fact that climate appears regular and teleological while weather does not suggests that some teleological patterns might consist of chance elements.

The discussion of rain in *Physics* II.8 has rightly been called “one of the most vexing and important passages in Aristotle’s corpus.”² The text is important, of course, since it informs us both of the scope of Aristotle’s teleology and of some of his reasons for rejecting the proto-evolutionary view that he attributes to Empedocles. An apparent tension makes the passage especially vexing: the initial mechanical account of rain seems quite reasonable, and one is tempted to think that Aristotle endorses this explanation. The following discussion, however,

¹ Wikipedia (<http://en.wikipedia.org/wiki/Climate>) calls it a popular saying, and credits the National Weather Service with one instance of it. Other sources cite Robert Heinlein, *Time Enough for Love*, New York: Ace (1988), 352.

² Scharle, p.147.

cites frequent winter rainfall as an example of something that cannot be a chance event, which implies that Aristotle thinks that when it rains often in winter, it does so for the sake of some end.

Locating Aristotle in this discussion has become particularly vexing since 1985, when a brief piece by David Furley upset accepted interpretations. Some readers now argue that the initial material account of rain must be Aristotle's, and others point out that his claims about winter rain seem to demand understanding all or most rainfall as teleological.³ Further disagreements follow: if rain is not for an end, what natural events are? On the other hand, if rain is usually purposeful, what is its purpose?

My purpose here is to focus on the initial disagreement. What does Aristotle think about rain? All readers seem to agree that Aristotle must either think that it always or usually rains for a purpose or that it does not. I hope to show, however, that we should finally endorse both and neither of these answers. Frequent winter rain is for the sake of some end; at the same time, rain actually falls exactly where and when it does only by material necessity, and is beneficial only by chance.

I'm usually on campus in the fall, and I'm there for a reason; being there makes it likely that I'll run into former students. Nevertheless, almost every time I run into a former student (including times when I benefit from the encounter, by learning of a choir concert, say),⁴ it is by chance and not on purpose. On my reading of *Physics* II.8, rain works in the same way: conditions during winter make rain likely, and those conditions serve certain ends.⁵ When a drop of rain falls, however, it falls where and when it does of necessity rather than for an end, and any

³ For a recent and thorough accounting of various positions, see Scharle pp.148-150 and nn.2-5.

⁴ Some readers see benefit as essential to Aristotle's discussion of the difference between chance and teleology (Cooper 1982, p. 197-8; Furley, p. 179-80; Judson, pp. 345-7); others side with Scharle, who claims that, for Aristotle, things that occur regularly occur "non-coincidentally, and thus teleologically" (p. 149; Sedley, for one, agrees, at pp. 183-4). My discussion can accommodate both views, and so I remain neutral on this question.

⁵ I hope to discuss these ends in a longer version of this essay.

benefit it brings comes by chance. Both camps are partly right: Aristotle can accept the materialist account of rain at the start of the chapter, and he can also view frequent winter rain as purposeful. Teleology in climate is compatible with chance weather.

Aristotle turns to the issue of purpose by presenting the following puzzle (ἀπορία):

ἔχει δ' ἀπορίαν τί κωλύει τὴν φύσιν μὴ ἔνεκά του ποιεῖν μηδ' ὅτι βέλτιον, ἀλλ' ὥσπερ ὕει ὁ Ζεὺς οὐχ ὅπως τὸν σῖτον αὐξήσῃ, ἀλλ' ἐξ ἀνάγκης (τὸ γὰρ ἀναχθὲν ψυχθῆναι δεῖ, καὶ τὸ ψυχθὲν ὕδωρ γενόμενον κατελθεῖν· τὸ δ' αὐξάνεσθαι τούτου γενομένου τὸν σῖτον συμβαίνει), ὁμοίως δὲ καὶ εἴ τῳ ἀπόλλυται ὁ σῖτος ἐν τῇ ἄλω, οὐ τούτου ἔνεκα ὕει ὅπως ἀπόληται, ἀλλὰ τοῦτο συμβέβηκεν

A puzzle now arises: what prevents nature from acting not for something or because it is better, but just as Zeus rains—not in order to make the grain grow, but of necessity. (For it is necessary that what has been drawn up is cooled, and that what has been cooled and become water comes down, and it is coincidental that when this happens the grain grows.) Similarly, if someone's grain is spoiled on the threshing floor, it does not rain in order to spoil the grain, but the spoilage is coincidental (198b16-23).⁶

As Lindsay Judson points out, this is most naturally read as Aristotle's own account of rain, rather than as a puzzle raised by an opponent. Proponents of the teleological rain reading—most notably Furley, whose brief discussion has convinced many contemporary readers—claim that Aristotle must here be speaking in the voice of an objector in order to reconcile this passage with the later claims about frequent winter rain. I will examine the issue of winter weather shortly, but it is worth noting that the initial text of the ἀπορία itself does not suggest this interpretation: it is only the later passage that convinces readers that an objector describes the rain at 198b16-23. As Judson puts it, “there is no hint that we are to understand the illustration of the aporia in this ‘distanced’ way.”⁷ Further, the spoiled grain is presented as a parallel, something

⁶ In translating the *Physics*, I have especially benefited from Fine and Irwin's translation, Gaye and Hardie's translation, Ross' commentary, the translations in Scharle's essay, and advice from Tom Tuozzo.

⁷ Judson, 346. Even Furley concedes that upon “first reading the passage one finds no signs that Aristotle presents the rainfall example as an inadequate explanation of the phenomena,” p.178.

happening in a similar way (ὁμοίως) (198b21-23).⁸ Sedley claims that infrequent and unusual summer rain is the cause of the spoiled grain,⁹ but Aristotle does not put things that way, and surely grain can spoil year-round.¹⁰

Infrequent summer rain nevertheless presents the biggest challenge to the claim that Aristotle accepts the materialist account of rain. He uses seasonal weather in his argument against the version of natural selection that he associates with Empedocles, which Aristotle rejects with the following argument:

ἀδύνατον δὲ τοῦτον ἔχειν τὸν τρόπον. ταῦτα μὲν γὰρ καὶ πάντα τὰ φύσει ἢ αἰεὶ οὕτω γίγνεται ἢ ὡς ἐπὶ τὸ πολὺ, τῶν δ' ἀπὸ τύχης καὶ τοῦ αὐτομάτου οὐδέν. οὐ γὰρ ἀπὸ τύχης οὐδ' ἀπὸ συμπτώματος δοκεῖ εἶναι πολλάκις τοῦ χειμῶνος, ἀλλ' ἐὰν ὑπὸ κύνα· οὐδὲ καύματα ὑπὸ κύνα, ἀλλ' ἂν χειμῶνος. εἰ οὖν ἢ ἀπὸ συμπτώματος δοκεῖ ἢ ἔνεκά του εἶναι, εἰ μὴ οἷόν τε ταῦτ' εἶναι μήτε ἀπὸ συμπτώματος μήτ' ἀπὸ ταῦτομάτου, ἔνεκά του ἂν εἴη. ἀλλὰ μὴν φύσει γ' ἐστὶ τὰ τοιαῦτα πάντα, ὡς κὰν αὐτοὶ φαῖεν οἱ ταῦτα λέγοντες. ἔστιν ἄρα τὸ ἔνεκά του ἐν τοῖς φύσει γιγνομένοις καὶ οὖσιν.

In fact, however, it is impossible for things to be like this [sc. as the Empedoclean account claims]. For these <teeth and other parts> and all natural things come to be as they do either always or usually, whereas no result of luck or chance comes to be either always or usually. For it does not seem to be from luck or coincidence that it rains often in winter, but only in summer; nor that there are heat waves in summer, but only in winter. If, then, these seem either to be coincidental or to be for something, and they cannot be coincidental or by chance, they are for something. Now surely all such things are natural, as even those making these claims <about necessity> would agree. The 'for the sake of something,' then, is in things that come to be and are by nature (198b34-199a8).

When Aristotle presents a choice between things happening by chance or for something, the options seems exhaustive—indeed, in this context they must be exhaustive, otherwise proving that teeth do not show up by chance would still not prove that they show up for a purpose. If the

⁸ For further discussion of the spoiled grain, see Furley, 178-9, and Judson, 346-7.

⁹ Sedley 1991, 186.

¹⁰ Judson also imagines a scenario (involving disgruntled farm works) in which grain was regularly spoiled, which clearly causes trouble for Sedley's claim that rain regularly falls for the sake of the grain, p.347. For further objections to Furley, see Irwin, p.522 and Johnson, pp.152-8.

choices are exhaustive, then, and since winter rainfall is cited as an example of something that cannot happen by chance, winter rainfall must happen for a purpose. Readers have tried to avoid this result by restricting the scope of the things that are not chance and so for something at 199a3-5 to the things mentioned at 198b34-5, namely living things and their parts.¹¹ That restriction, however, makes the reference to frequent winter rainfall here a strange non-sequitur, and a “fatal weakening of Aristotle’s argument,” as Furley convincingly shows.¹² The fact that it rains often in winter, therefore, demands the conclusion that frequent winter rainfall is for the sake of something.

These two passages about rain suggest two relatively (!) clear readings, but those readings stand in tension with each other. On the one hand, Aristotle appears to view frequent winter rain as falling for the sake of something; he also, however, appears to think that when rain falls, it falls of necessity rather than for a purpose, and that any benefit it brings comes by chance. While previous readers have tried to eliminate this tension by showing that one of those two obvious readings is mistaken, I think both can be preserved. Individual rainstorms occur of necessity and are beneficial by chance, but teleology explains frequent winter rain. Climate is for the sake of something, even while weather is not.

The fact that Aristotle’s cites frequent (πολλάκις) winter rain and regular summer heatwaves, in the plural (καύματα) (199a1-2), has a significance that has been overlooked in much of the literature on this passage. Readers often speak as if Aristotle were saying that one winter rainstorm or a single summer heatwave cannot be a chance event, since such events occur

¹¹ For example Charlton, pp. 120-1 and 122-3.

¹² Furley, 180-1. Judson argues that Aristotle might view the inclusion of an example that is outside of the scope of the disjunct as beneficial, and that the restriction to natural (that is, for Judson, living) substances might strike Aristotle as self-evident (pp.349-350.). That strikes me as quite a lot of speculation without much textual evidence.

regularly, in contrast with a winter heatwave or a summer rainstorm.¹³ The text clearly focuses on patterns, though, and not on individual events. And this makes perfect sense: although it rains less often in summer than winter,¹⁴ summer rain is not so rare that a summer that contained a single rainstorm would be a surprise.

If it rained not once, but often in a given summer, then we would have an event¹⁵ uncommon enough to qualify as chance, as described in *Physics* II.4-6. Aristotle writes that chance events are the sort that do not occur always or usually (196b10-17), which is usually read as meaning events that occur less than half of the time.¹⁶ Frequent summer rain happens less than half of the time, but surely more than fifty percent of summers include at least one rainstorm.

Perhaps the thought is that *πολλάκις* here does the work of Aristotle's "always or usually" condition, so that his claim is that it does not seem to be chance that it rains always or usually in winter. Even Judson, who denies that rain falls for the sake of something, writes that it is "undeniable that [Aristotle] thinks that rainfall in the winter happens always or for the most part."¹⁷ This reading cannot hold up to scrutiny, however, since it would make Aristotle's

¹³ An exhaustive list here is perhaps beyond my abilities, but see for example, Ross, who claims that Aristotle's point is that "rain in winter is not a product of chance, but only rain in the dog-days" (p.357); Wardy, who says that the fact that "the rain fell *in August* is chance," even if its falling in certain circumstance is predictable (p. 22—original emphasis); Scharle, who claims that Aristotle maintains that "*winter* rain is teleological and that *summer* rain is infrequent and accidental" (p. 171—original emphasis); Sedley, who speaks of things that happen "occasionally and irregularly, like rain in August" (Sedley, p. 183); and of course Furley, who says that Aristotle offers a "a teleological explanation of winter rainfall" (p. 179), as opposed to an explanation of *frequent* winter rainfall. Judson gives a sympathetic translation of the key passage at p. 342 n.6, but he later says that it is "undeniable that [Aristotle] thinks that rainfall in the winter happens always or for the most part" (p. 345). I would submit, however, that what Aristotle thinks happens always or usually is that it rains *often* in winter—in other words, the climate is what is at issue, not the weather. Charlton's translation nicely captures the distinction I'm after: "We do not think that it is the outcome of luck or coincidence that there is a lot of rain in winter, but only if there is a lot of rain in August..."

¹⁴ I'll simply assume that the climate is as Aristotle describes. For information and speculation concerning Aristotle's climate, see Sedley, pp.185-7 and Judson 2005, p.341 and n.1.

¹⁵ I follow Judson 1991's use of "event" as a blanket term to cover "the whole range of things which might be said to come to be either rarely or regularly—events, processes, states of affairs, activities" (p.76).

¹⁶ See Judson 1991, p.76 and n.5

¹⁷ Judson 2005, p. 345.

reasoning either inconsistent or implausible. If *πολλάκις* meant “always or usually,” and if (as I read it) it attaches to both summer and winter rain, then Aristotle would be claiming that it’s not by chance that rain falls always or usually in winter, but it would be chance if it fell always or usually in summer, which is obviously absurd. If happening always or usually disqualifies an event from being a result of chance, then usual summer rain would no more be chance than usual winter rain. If *πολλάκις* does not attach to summer rain, on the other hand, then Aristotle would be claiming that a summer with even one rainstorm is a chance event—and, again, summer rain is not so unusual that one storm would be remarkable.

Indeed, Aristotle’s *Meteorology* contains an explanation of the pattern that leads to summer rain: “in the warmer seasons the cold is concentrated by the surrounding heat and causes the cloud to go over into water suddenly” (I.12, 348b5-8).¹⁸ The fact that Aristotle can give a scientific account of summer rainstorms must show that a summer that includes a rainstorm is not a purely random anomaly, since “chance has no account” (*εἶναι τι παράλογον τὴν τύχην*) (*Physics* II.5, 197a18-20).¹⁹ Margaret Scharle says that the *Meteorology* offers “what we might call a ‘science of the accidental,’” since it addresses accidental occurrences,²⁰ but in fact there can be no such science. As Scharle herself notes,²¹ Aristotle describes the subject matter as “things that happen in accordance with nature” (*συμβαίνει κατὰ φύσιν*) (338b20)—or, we might even say, “accidents that accord with nature.” The science of meteorology, though, must concern the nature, not the accidents. Shooting stars (*Meteorology* I.4) and earthquakes (II.

¹⁸ I shall make use of E. W. Webster’s translation of the *Meteorology*. For a rather different account of the relevance of this passage, see Scharle, pp.177-180.

¹⁹ See also *Posterior Analytics* I.30, 87b19-27 and *Metaphysics* E.2, 1027a19-23, as well as Sauvé Meyer, pp. 822-4 and Judson 1991, p. 84 with n.27 and pp. 91-2.

²⁰ Scharle, p. 176 n.75

²¹ Scharle, p. 175.

7-8) may be accidental occurrences, but the account that Aristotle gives is of the natures at work that give rise to such occurrences.

There are natures at work, and given the sun's movement, we can expect that it will rain more often in winter.

Now when the sun in its circular course approaches, it draws up by its heat the moist evaporation: when it recedes the cold makes the vapor that had been raised condense back into water which falls and is distributed over the earth. (This explains why there is more rain in winter and more by night than by day...) (*Meteorology*, 359b34-360a3).

The nature of the sun and the nature of water give rise to a certain climate. That climate, in turn, makes certain weather more or less likely. Rain in summer, however, does fall, and Aristotle explains why, which means that the general phenomenon of summer rain is not a result of pure chance. Instead, the general principles that govern the interaction of water and air, warm and cold enable Aristotle to explain summer rain in *Meteorology* I.12.

When rain falls—both in summer and in winter—it falls by necessity. The account of rainfall in the *Meteorology* appears purely mechanistic: moisture

is made to evaporate by the sun's rays and the other heat from above, and rises. But when the heat which was raising it leaves it... then the vapor cools... and condenses again and turns from air into water. And after the water has formed it falls down again to the earth (346b24-31).

This description is remarkably close to the description of rain from the start of *Physics* II.8 ("it is necessary that what has been drawn up is cooled, and that what has been cooled and become water comes down" (198b19-20)), which gives us good reason to think that Aristotle endorses the view of rain found at the start of *Physics* II.8.

Most authors—even those who argue that Aristotle ultimately believes that rain is teleological—agree that the text of the *Meteorology* offers only mechanistic accounts of rain.²² Scharle, however, argues that the explanation of regular winter rain means that Aristotle is endorsing a teleological view in that work.²³ The text is perhaps compatible with a teleological account, but if Aristotle thought one was necessary it is surprising that the only thing that he says here is that of the “processes attending the formation of water above” (τῶν συμβαινόντων περὶ τὴν ἄνω γένεσιν αὐτοῦ [sc. ὕδατος]), the “efficient and chief and first of the principles [that leads to rain] is the circle in which the sun moves” (346b20-23).

As a result of the sun’s movement, “moisture is always raised by heat and descends to the earth again when it gets cold” (*Meteorology*, 347a8-10). Susan Sauvé Meyer describes these sorts of results as having causes that “overdetermine” the results: “[w]hether a cause has this property depends on what would happen in counterfactual situations in which not all the initial conditions are the same.”²⁴ In contrast with the accidental, lucky encounter between the borrower and the lender in *Physics* II.5 (196b33-197a5), which might easily have not occurred with any small change in the initial conditions, the sun’s movement and the water cycle both appear overdetermined.

An individual rainstorm, on the other hand, does not at all appear overdetermined. Various factors involving clouds, winds, and so forth might change, and a given rainstorm might easily not occur. A great impediment would be required to alter climate, and such an event might lead to accidental, anomalous results, like frequent rain in summer or heatwaves in winter. Small differences, on the other hand, might change an afternoon’s weather. Indeed, Thomas R. Martin

²² Furley, p.181; Cooper, p.218; Charlton, xvii; Johnson, p. 150.

²³ Scharle, pp.176-7.

²⁴ Sauvé Meyer, p. 804; see also pp. 801-3.

writes that in a Mediterranean climate such as Aristotle's "the amount of annual precipitation was highly variable, [and so] farming was a precarious business of boom and bust, with draught and flood both to be feared."²⁵ Climate, therefore, acts always or usually, and acts for the sake of the benefits it produces. Weather, in contrast, happens by necessity, and any benefit results from chance rather than purpose, just as Aristotle says at the beginning of *Physics* II.8.

Aristotle in other contexts recognizes that chance results can be part of larger patterns: even though individual chance events have no account and no knowledge, the larger processes can be studied and explained, just as here in the case of weather and climate. We even find cases where chance events are especially beneficial, and where patterns might be designed around such benefits. For example, in the *Poetics* Aristotle says that "matters of chance seem most marvelous if there is an appearance of design as it were in them; as for instance the statue of Mityls at Argos killed the author of Mityls' death by falling down on him when a looker-on at a public spectacle" (1452a6-9).²⁶ Again, the *Nicomachean Ethics* discusses the relationship between chance and happiness (for example in I.8-9), and although chance events cannot produce happiness they clearly can play a role.²⁷ Perhaps the most remarkable (and perhaps the most troubling) example comes in Aristotle's discussion of spontaneous generation. In the *Generation of Animals* Aristotle gives a theoretical explanation of the process of spontaneous generation (762a18-27),²⁸ which regularly produces animals, and even ones that are good to eat (εὔχυμα)

²⁵ Martin, sec. 2.5. I am grateful to Johnson for drawing my attention to this passage, at p.152 n.31.

²⁶ Translated by Ingram Bywater.

²⁷ For a thorough defense of the claim that chance plays a role in happiness, see Verbeke.

²⁸ For more on the nature and significance of Aristotle's discussion of spontaneous generation, see especially Lennox and Stavrianeas. The fact that these processes appear both regular and beneficial suggests that those two conditions do not entail teleology, as Lennox implies in his account of chance (at pp.232-236), but I intend to maintain my neutrality on that question.

(763b6-7), which again suggests that a regular and beneficial process might consist of chance elements.

Weather, including rain, happens as a result of natural and teleological processes, but that is compatible with the claim that rain falls not for the sake of something, but of necessity, and any benefit from the rain comes by chance. Aristotle need not embrace the conclusion, therefore, that it rains for the sake of the crops. Climate, on the other hand, is regular and beneficial. If the disjunct from *Physics* II.8 holds, climate ought to be for the sake of something even while rain is not. A teleological process might consist of elements that operate by chance and necessity.

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