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NECESSITY AND THE PHYSICALIST ACCOUNT IN ARISTOTLE'S *PHYSICS*. DIFFICULTIES WITH THE RAINFALL EXAMPLE[1]

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Abstract. The aim of the present article is to consider the shortcomings of the physicalist rainfall example set forth by Aristotle in *Physics* II.8. I first outline the ancient physicalist account of the coming-to-be of natural organisms and the accompanying rejection of the teleological character of such processes. Then I examine the rainfall example itself. The fundamental difficulty is that rainfall does not appear to have a proper nature. Hence it is not natural in the strict sense and cannot be used in arguments either for or against natural teleology. Rainfall can at most have an end in a weak sense, which makes it inadequate as a paradigm. Furthermore, the physicalist conception of action for an end is itself flawed. I argue that they construe it anthropomorphically and falsely presuppose a symmetry between coming-to-be and ceasing-to-be.

Keywords: Aristotle, ancient philosophy, causality, teleology, necessity, nature, physicalism, rainfall example.

Introduction

In *Physics* II.8 Aristotle presents and criticizes what he takes to be the ancient physicalist theory of the genesis and development of natural organisms.[2] Its proponents maintain that the material elements of such organisms are sufficient to determine their qualities and behavior. Aristotle argues that such an account is inadequate as an explanation of the genesis and features of natural substances.

[1] I would like to thank Hasse Hamalainen and Marcin Karas for looking at earlier drafts of this paper. I am also especially grateful for the numerous remarks and suggestions of three anonymous referees.

[2] *Physics* II.8 198b10-15. Martha Nussbaum calls the physicalist position the "Democritean challenge" and adds that "Aristotle repeatedly attacks them [his predecessors in natural science] for their lack of attention to formal and final explanation, insisting that form, and not matter, is the basic explanatory principle of living beings and their activities, and that, furthermore, the growth and motion of animals and plants must be explained with reference to an end-state—the mature functioning of the adult creature, as specified in its logos." Nussbaum [1978] p. 61.

He claims that one must rather look to the fully developed living organism that is found only at the end of the process.[3]

A part of Aristotle's criticism of the physicalist position is found in the so-called rainfall example, which is set forth as a paradigm of the physicalist account of natural coming-to-be and a refutation of the claim that nature acts for an end. Aristotle himself offers two explicit criticisms of the physicalist position in *Physics* II.8, one based on the existence of regularity in nature, the other on the presence of action for an end in nature. My purpose in the present paper is to examine the example itself in the context of the physicalist position and to consider the value of the argument that it offers. In the first part of the paper I attempt to reconstruct the physicalist account of which the rainfall example is an illustration. In the second part I analyze the example itself and consider some of its shortcomings.

The rainfall example has received quite a bit of attention in recent literature. It is clear that the physicalists in the argument offer rainfall as an example of a natural process that can be explained entirely in terms of the constituent materials and their natural activities, without any recourse to final causes. It is not clear, however, what Aristotle's views regarding rain were. Most of the discussion has thus revolved around whether he thought that rainfall has an end, and if so what he believed that end to be.[4]

My intention in this paper is not to contribute explicitly to the above discussion regarding Aristotle's views. I believe it is philosophically interesting to analyze the rainfall example itself as a potential model for explaining all natural processes and to uncover the structural differences between it and the phenomena that Aristotle clearly maintains to be fully explicable only in terms of all of the causes, but especially the final cause.

The physicalist account

In *Physics II.8* Aristotle claims and attempts to show that nature, as he understands it, indeed acts for an end, and that hypothetical necessity, the kind that corresponds to the final cause, is the principal type found in natural coming-to-be. He opens the chapter by presenting these two issues: "We must discuss first why

[3] A fair amount of research has been conducted in the last decades on Aristotle's teleology, stimulated at least in part by developments in modern biology. While there are dissenting views, numerous scholars – among them Allan Gotthelf, James Lennox, and David Balme – share the view that according to Aristotle the teleological aspect of natural organisms is ontologically irreducible to the non-teleological. *Cf.* Gotthelf, Lennox [1987b] p. 200.

[4] Margaret Scharle offers a fairly complete overview of this discussion in: Scharle [2008]. Mariska Leunissen's recent treatment of the issue is also noteworthy. See: Leunissen [2010].

nature is a cause for the sake of something; then how necessity exists in physical things."[5] These issues are closely related to one another. For Aristotle the different sorts of necessity correspond to the different modes of causality, and therefore the kind of cause that is at work primarily in nature will determine the type of necessity that is dominant.[6]

The material and moving causes as he construes them necessitate simply, from antecedent to consequent, though Aristotle believes causal relationships to be not transtemporal, but contemporaneous: a past cause, for instance, cannot, strictly speaking, produce or account for a future effect.[7] And so, because the materials out of which something is made are now such and such, certain things necessarily follow here and now: because a statue is made out of marble, it is necessarily firm. Likewise, when a source of motion is acting upon something that is movable and there are no obstacles, movement necessarily takes place: a moving billiard ball necessarily causes another ball it strikes to move.

The final cause, on the other hand, necessitates hypothetically.[8] This is most clearly seen in the activity of a craftsman. The product he wishes to make, an idea or image of which he has in mind, is the final cause of the production process. It requires that the proper materials be present – materials with suitable natures – as well as the proper tools with which to work upon them. The idea or image does not by itself necessitate the coming-to-be of anything, but only if it is to be actualized – that is, brought into actual sensible or empirical existence by an activity ini-

[5] *Physics* II.8 198b10-12.

[6] For a classical overview of Aristotle's doctrine of the four causes and of the teleology vs. necessity dispute, *cf*. Ross [1995] p. 74–78 and 80–83, respectively.

[7] Temporal simultaneity applies in principle to all of the causes when they are spoken of in the strict sense. In practice this is an issue only for the efficient cause, since it is the only cause that actually produces change or motion. Matter is what something is presently made of. Form expresses just what something is now. The end might eventually pose a problem, but while it does refer to the effect an intrinsic efficient cause will bring about in the future, strictly speaking it is a feature that an object possesses now: the final cause does not itself produce motion or change. The efficient cause in the strict sense is always what is actually acting now. In the broad sense it is the potential cause, which has acted, will act, or generally can act. In this context, Jonathan Lear explains that "Aristotle does distinguish between the potential and the actual cause. The builder is the potential cause of the house, the builder building is the actual cause." Lear [1988] p. 30.

[8] It must be noted, however, that even in a hypothetical sense the final cause does not, strictly speaking, act. It is the correlate of an efficient cause, which is the agency responsible for the activity. The final cause simply expresses the proper terminus of that activity. There has been much discussion in the literature about the nature of the final cause in Aristotle's thought. In a now classic paper, Allan Gotthelf sets forth his influential "irreducible potential interpretation" of the final cause: to be for the sake of something is to possess a separate potential that is irreducible to the potentials of the elements out of which something, most notably a living organism, is constituted. *Cf*. Gotthelf [1976] p. 204–242. A summary of some of the initial views on the problem and of the nature of hypothetical necessity may be found in: Friedman [1986] p. 355–365.

tiated and sustained by a corresponding desire. For instance, the idea of a statue, the conception of the thing to be made prior to the production process, clearly does not necessitate that a statue be produced. Yet if an actual statue is to come to be, marble and tools must necessarily be present.[9]

Aristotle continues with the historical motivation for the discussion: Most thinkers reject the view that nature acts for an end, holding instead that it acts by necessity: "All thinkers make reference to this cause [necessity] by saying, for example, that since the hot and the cold and each of such things are by nature of such-and-such a kind, certain other things must exist or come to be."[10] The kind of necessity they are referring to is simple or mechanical necessity, because they ascribe natural changes to the antecedent natures of what they take to be the basic constituents of things, such as the hot and the cold, which are either fundamental material parts or basic qualities of natural things.[11]

Aristotle believes that a thing necessarily acts according to its nature, if there are no obstacles, since he defines nature as the cause or source of the specific activities of the thing it belongs to, and these are a necessary part of what it is to be a thing of a particular kind.[12] It is, for example, an essential and necessary part of what it is to be an acorn to be able to produce an oak tree, and indeed, provided that the external conditions are favorable, a genuine acorn will always or for the

[9] It must be noted, however, that Aristotle's denial of necessity is not entirely unproblematic. Richard Sorabji considers some of the difficulties in: Sorabji [1980] p. 144 ff.

[10] *Physics* II.8 198b12-14.

[11] Aristotle mentions three kinds of necessity in *Metaphysics* V.5. One is what he elsewhere calls hypothetical necessity; the second is the necessity of compulsion; and the third is simple or absolute (*haplôs*) necessity, which is the primary sense of the term. The necessity in the passage in question here seems to be of yet another sort, which in the *Posterior Analytics* (II.11 94b38-95a1) he calls the necessity that is said to work "in accordance with a thing's natural tendency" and could perhaps be appropriately called natural necessity. If the list given in the *Metaphysics* is taken to be exhaustive, it would best fit into the category of simple necessity, possibly as an analogous type. In the physicalist context it is often well characterized as mechanical necessity.

[12] The notion of nature is obviously complex, controversial, and admits numerous interpretations. In a fairly simple sense, on the one hand, nature just refers to what a thing essentially is, and on the other, it is the internal source of a thing's being and behaving as it does. In the first sense it expresses the identity of a thing. In the second sense it would seem to have the character of an efficient cause of that identity. A serious problem, which I will not consider here, is the location of nature as an internal source. Sean Kelsey considers some of these problems and suggests a rather innovative interpretation in terms of authority or power. He claims that "when Aristotle says that natural things have in themselves a principle of movement, he means that they have a kind of 'authority' over their movement, title to which comes not with being its efficient cause, but with being its proper subject." Kelsey [2003] p. 83–84. Margaret Scharle considers Aristotle's views on the natures of the elements and believes that, contrary to many interpretations, they have natures with identifiable ends. Scharle [2008].

most part produce an oak. In other words, the acorn nature necessarily tends toward the oak, if nothing interferes.

The physicalist account of nature, however, involves a derivation of the properties and motions of natural substances – embraced by their form or nature – from the properties and motions of their constituent parts.[13] Such substances clearly possess many kinds of parts. If these are themselves in turn composed of material parts, then their natures and properties will likewise be derivable from those of their constituent parts. If this process is carried to its logical conclusion, we arrive at the ultimate material constituents of things, which in principle have no further material parts and whose natures are therefore not derivable from anything more fundamental. For physicalists, these are the true sources of the change and development of natural things.

The above reductive analysis implies that for the physicalists, although natural things might possess natures in the sense of specific characteristics of appearance and behavior, they do not possess their own *per se* natures in the sense in which Aristotle understands them, as intrinsic and proper principles of motion and rest. This is because the motion of any materially composite thing will always be explained as the result of the motions of its parts; the nature of the whole, therefore, is merely the sum of the natures of its parts. Only the ultimate parts, the elements, have *per se* natures.[14]

We thus have the physicalist explanation of what the nature of a natural thing consists of and how it operates. The principle of motion is a peculiar kind of sum of the natural motions of the constituent parts. The natural thing necessarily moves as it does because these parts of necessity move according to their natures and necessarily interact with one another. In particular, there is for them no one single object or factor that could be identified as the nature of a complex natural thing.

The physicalists, as Aristotle presents them, offer rainfall as an example of their account and as a paradigm for the way in which all natural processes take place.[15] In this example they claim that rain can be explained adequately in what

[13] Susan Sauvé Meyer argues that what is involved in the physicalist position is not so much a reduction of the properties of an organism to its elementary parts as an elimination of the notion of nature: "The rival thesis against which Aristotle defends natural teleology is not reductionism but a variety of eliminativism." Meyer [1992] p. 820.

[14] Sarah Waterlow emphasizes the importance of what she calls *per se* natures for Aristotle's rejection of the physicalist position: "the condition for predicating *per se* unity of a complex natural being is identical with the condition for applying teleological explanation as Aristotle understands it." Waterlow [1982] p. 69–70.

[15] *Physics* II.8 198b17-18.

may be called mechanical terms and that there is no evidence that it acts for an end. Rain, they maintain, "does not fall in order that wheat may grow. For, one may say, what goes up must be cooled, and the resulting cold water must come down."[16] So according to them rain comes to be by necessity. Its motion is explained in terms of the necessary natural motions of its constituent parts, air and water. These parts themselves do have natural motions. In this case they are elements, whose natures and motions are fundamental and belong to them immediately and necessarily.

With the benefit of basic modern natural science, we can obviously supply a more complete mechanistic account of how rain comes about. It is interesting because of its overall similarity to the ancient physicalist account, being thus a sort of confirmation of it. Generally speaking, the heat of the sun acting on water necessarily causes it to become warm and evaporate.[17] It is likewise a necessary property of water vapor, which is a mixture of water and air, to rise when heated. Moreover, since the temperature of the atmosphere decreases with increasing altitude and the atmospheric pressure decreases, as the heated water vapor rises it necessarily cools. It is also a necessary property of water vapor to condense into water when cooled. Finally, the water which is formed in this way is denser than the surrounding air and hence necessarily falls.

If a natural object behaves as it does because it must, it appears counterintuitive to ask what it sought as an end. Something analogous to this can be found in human situations. Someone who has been physically forced is not asked why he acted as he did, since he clearly did not want to perform the action. He did not act with any goal in mind, and the presence of such a goal is generally considered to be what it is to have an end in the sense of a purpose. Why, the physicalists ask, cannot the same be true of natural things? After all, just as action in the case of coercion can be explained entirely by an antecedent moving cause,[18] so too in the case of rain the movement also seems capable of being explained by its antecedent moving causes – not by a desire for what followed, the growth of the corn. And so the physicalists maintain that, after it has rained

[16] *Physics* II.8 198b18-20.

[17] Aristotle held that the basic elements could be transformed into one another. Water could be transformed into air by the action of heat and back into water by cooling. See: Ross [1995] p. 107.

[18] Here the cause is construed in the broad potential, as opposed to the strict actual, sense.

> [...] the growth of the corn just happens; similarly, if a man's wheat is spoiled on the threshing floor, rain did not fall for the sake of spoiling the wheat, but this just happened.[19]

While the rain falls by necessity, it is by coincidence or by chance that the corn grows as a result of rainfall.[20] They hold that if rain indeed fell precisely in order to make the corn grow, it would never cause the corn to spoil. Yet in fact rainfall does sometimes cause corn to spoil. We cannot, therefore, maintain that it falls for the sake of growth, any more than we can say that it falls for the sake of spoilage. It rains because it must and its consequence, whether growth or spoilage, is coincidental: there is nothing desire-like in the nature of rain that inclines it more toward the one rather than the other.

Aristotle's physicalists claim that the rainfall example is a paradigm for the way in which all natural things behave, not for an end but by necessity. Organisms in their entirety are made up of elementary parts with natures that they obey necessarily. Any particular arrangement of these parts absolutely necessitates what follows. Applying this to nature in general they ask:

> [...] what should prevent the parts in nature, too, from coming to be of necessity in this manner, for example, the front teeth of necessity coming out sharp and so fit for tearing but the molars broad and useful for grinding food?[21]

The teeth here are said to be as they are because of the interactions of the parts out of which they came to be. These came together in a particular way because of their necessary motions and when together they acted upon one another to produce teeth. Because the parts were moving and acting necessarily, the teeth necessarily came out as they did. It is not the case that the animal needed sharp teeth in front and flat ones in back in order to survive and therefore produced such teeth. Instead, teeth simply came out as they did with mechanical necessity and happened to be of the sort that proved useful for eating and hence for survival.

In *Physics* II.9 Aristotle offers another illustration of how the physicalist account works, intended to show the difficulties involved in their doctrine. The

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[19] *Physics* II.8 198b20-23.

[20] Aristotle's notions of coincidence and chance are presented in *Physics* II.5 and 6. Waterlow summarizes his position as follows: "[Aristotle uses] 'coincidence', and also 'by chance' and 'by spontaneity', to refer (a) to a set of simultaneous phenomena each of which has an independent antecedent cause, and (b) to the (desirable) outcome of the concurrence. […] 'coincidence' means only that the result represents a convergence of mutually independent diachronic causal lines." Waterlow [1982] p. 76.

[21] *Physics* II.8 198b24-26.

physicalist view, he says, locates necessity "in generation". Aristotle argues that it is as if one were to explain that a wall comes to be because of the natural motions of its parts rather than through the activity of a builder: the stones are necessarily carried downward to the foundation because they are heaviest; the earth, out of which bricks are made, being lighter, forms the walls; and the wood, which is lightest, is carried upward to form the roof. And so the entire complex structure comes to be necessarily through the actions of the simple elements.[22]

So far the ancient physicalist account is remarkably similar to what modern science proposes: that nature and natural things work very much like complex mechanical systems whose parts act upon one another and by this type of interaction bring about the whole organism and are responsible for its activity. The ancient physicalists, however, inject an element which later physicalists would restrict only to certain contexts. They hold that natural things universally – that is, not merely kinds, but even individuals – come to be and behave not only by necessity but also by coincidence.[23] The difference between the ancient and modern accounts surfaces in the explanation of the ordinary coming-to-be of individual organisms, as opposed to the initial genesis of kinds. Coincidence makes sense now only when accounting for the original evolutionary coming to be of kinds, not that of individuals of a given kind once constituted. The ancient physicalists appear to have conflated the two processes; in the passage at hand Aristotle explicitly addresses and objects to their explanation of the latter.

The reason for introducing coincidence is clear: necessity alone does not suffice to explain how natural organisms come to be (both in the ancient and in the modern accounts). Although the elements do move necessarily, there is clearly no necessity that they enter into any particular combination with other elements so as to produce any definite organism. While the natures of the elements do necessitate simple motions, they do not necessitate anything more than these motions: nothing in the nature of water or air necessitates rain at any particular time, nor is it part of the nature of earth to form teeth.

And so the physicalists explain that when the elements are in isolation they move independently of one another. During these random motions some elements

[22] "Nowadays it is thought that what exists by necessity does so in generation, as if one were to consider the wall as having been constructed by necessity, since what is heavy travels down by its nature and what is light travels up by its nature, and so the stones and the foundations are down, then earth right above because it is lighter, and finally wood at the very top since it is the lightest." *Physics* II.9 200a1-5.

[23] "the front teeth of necessity […] [come] out sharp and so fit for tearing but the molars broad and useful for grinding food, not however for the sake of this but by coincidence. […] [And similarly] with the other parts in which final cause seems to exist." *Physics* II.8 198b24-29.

combine by chance to form more complex substances. The product of the combination has no single proper cause, since it is the result of multiple independent causal sequences.[24] As a result of further similar interactions ever more complex substances are produced. Eventually, living organisms will be produced. Most of these, having been produced randomly, will be monstrosities and will perish. Only those that are put together suitably will survive:

> [...] whenever all the parts came together as if generated for the sake of something, the wholes which by chance were fitfully composed survived, but those which came together not in this manner, like the man-faced offspring of oxen mentioned by Empedocles, perished and still do so.[25]

The above is a sketch of the ancient physicalist explanation of the existence of parts of animals such as teeth. They came to be by a combination of necessity and coincidence. The elements out of which they came to be acted necessarily and coincided to yield these particular teeth. The reason why an animal with a particular set of teeth exists, they say, is that its teeth were well-adapted for eating and therefore allowed the animal that possessed them to survive. Other kinds of teeth also came to be, yet because they were not suitable for chewing the animals that possessed them perished.

Coincidence is an important element in the ancient physicalist account of natural things; yet it does in fact appear to make it impossible to speak about the final cause. For if something came to be by coincidence it would seem to have no proper cause at all, whether final or moving. Things which came to be in this way, such as teeth, only appear to be for an end because they indeed are of use and serve the organism. They did not, however, come to be explicitly for that purpose.

The ancient physicalist account, while conceptually similar to the modern explanation of the evolutionary genesis of kinds, does not make it clear how such kinds reproduce themselves once constituted. Aristotle's objection to the physicalist account is thus fully justified in this regard.[26] He obviously takes

[24] See note 8 above for Aristotle's understanding of chance and coincidence. Waterlow explains that "Empedocles and the other *physikoi* are […] portrayed by Aristotle as saying that organisms and their complex organic parts have come about through sets of independent causal processes involving separate material factors which behave and undergo transformation by the necessity of their own natures, and which merely *happen* to occur together, since none occurs because any of the others do, or through the same cause." Waterlow [1982] p. 76–77.

[25] *Physics* II.8 198b29-33.

[26] James Lennox points out that Aristotle's theory of spontaneous generation and the examples he considers might pose a problem for his criticism of the physicalists: "It has been claimed that, un-

the physicalist account to be an attempt to explain the genesis of individuals of an already existing kind. As such, this account is clearly flawed. The nature of coincidence is such that its individual products are irregular and occur rarely. Statistically speaking, viable combinations can, to be sure, come to be in large populations and over large periods of time. Yet the appearance of such stable combinations of more elementary substances is statistically extremely rare. Such coming-to-be is not what Aristotle is considering in the passage in question.[27] The regular reproduction of individuals, such as what in principle occurs whenever sexual activity takes place, is not explicable by means of the coincidental conjunction of elements, but requires an explicit principle internal to the new organism. The only possible reasonable source of such a principle, to Aristotle's empirically oriented mind, are the parent organisms. The general name he gives to this principle is nature. Because the principle is correlative to the fully developed organism that it is responsible for bringing into existence, it is claimed by him to act precisely for the sake of that fully developed organism.

The obvious question that arises here is to what extent Aristotle's presentation of the physicalist view is accurate. It is in fact not entirely clear how broadly the physicalists intended to apply their account, whether it was meant to explain only the original coming-to-be of species or whether it also applied to the generation of each individual.[28] An examination of some of the original textual fragments – of Empedocles, for example – seems to suggest that he is giving a cosmogony and a zoogony, accounts of the original coming to be of the cosmos and of living organisms.[29] If this is the case, then the physicalists' account is limited because it does not explain the more common natural phenomenon of the generation of individuals from parents. Yet there is textual evidence, albeit limited, that the ac-

like his theory of sexual generation, Aristotle's account of spontaneous generation is inconsistent with his metaphysical doctrines of causation and chance." *Cf.* Lennox [1982] p. 220.

[27] Aristotle does not consider the original genesis of kinds, since he appears to have believed in an eternal generation of organisms having the same form, and hence that kinds and species always existed. *Cf.* Lennox [2001] p. 131. However, for Aristotle, a viable, reproducing organism that came to be by a chance combination of elements would in principle have an end, the fully developed individual (together with its reproductive capacity). I would claim that even a hypothetical one--time organism, which came to be by chance and lived on to maturity but failed to reproduce itself, would on Aristotelian principles have an end, a one-time end in this case. The end in each case is the fully developed form of the individual, insofar as this form is the result of an internal efficient-causal mechanism.

[28] Although Aristotle does say that wholes like the man-faced offspring of oxen continue to perish, it is not evident whether he means that this is a regular phenomenon or only an occasional one.

[29] *Cf.* Kirk, Raven, Schofield [1983] p. 299–305.

count is also meant to explain individual coming-to-be.[30] If this, however, was also intended by them, then all coming-to-be, including the propagation of species, is clearly coincidental.

Aristotle does not himself make any explicit distinction between the two cases and in his first criticism of the physicalists' position he attributes the second interpretation to them.[31] In fact, this appears to have been the position held by one of the physicalists, Empedocles. He seems to explain all coming-to-be in terms of necessity and coincidence, both the original genesis of living things from the elements and all subsequent generations from previously existing individuals.[32]

Empedocles believed that in the original formation of the world, the parts of living things, limbs, organs, etc., were formed first by the coincidence of the elements. In a later stage these organic parts themselves began to interact and combined to form animals and monsters of various sorts.[33]

He held, moreover – and this is undoubtedly astounding to the modern reader – that something similar takes place in every generation of offspring from parents. The embryo is formed by the union of tiny bodily members drawn from every part of the parents' bodies during sexual union. These combine randomly and again only certain combinations survive and appear. Here too, because it is the result of coincidence, the product cannot be said to be for an end.[34]

The above combination of necessity and coincidence, which in Aristotelian terms amounts to a combination of the material and moving causes, is thus claimed by the ancient physicalists to explain all natural coming-to-be and to render reference to ends and their associated forms superfluous.

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[30] *Cf.*, for example, Empedocles fragment 380. Kirk, Raven, Schofield [1983] p. 304.

[31] "Yet it is impossible for things to come to be in this manner; for the examples cited and all things by nature come to be either always or for the most part, but none of those by luck or chance do so likewise." *Physics* II.8 198b34-36.

[32] According to Balme, Aristotle criticizes Empedocles not for merely maintaining that the fittest survive, but for claiming that they have become fit to survive by chance and the random activity of material causes. *Cf.* Balme [1987] p. 280.

[33] Richard Sorabji gives a sketch of Empedocles' account: "Empedocles suggested that there were four stages in zoogony, the development of animals on the earth. First, individual organs arose out of the earth, heads without necks, arms bereft of shoulders, eyes in want of foreheads. Secondly, the members coalesced into monstrous unions, shambling creatures with countless hands, man--fronted ox-types, ox-headed man-types, part male, part female. Thirdly, in a single long night, primitive creatures sprang out of the earth complete, first trees, then primitive humans." Sorabji [1980] p. 176.

[34] Sorabji explains that "an embryo is formed, in his view, through tiny members being drawn from all over the parents' bodies in the excitement of union, and assembled in the form of seed in the womb of the mother. The embryos are nourished through blood and air being delivered in four tubes. The whole process provides opportunities for monstrosities to be formed once again." Sorabji [1980] p. 176–177.

Difficulties with the physicalist position. The rainfall example

We have seen that in support of their position the physicalists propose the example of rainfall. Let us now consider this example in more detail and identify some of the difficulties that the ancient physicalist account entails when taken at face value.[35] The physicalists, as Aristotle presents them, claim that all natural things come to be after the manner of rain, which takes place with mechanical necessity. However, a comparison of rainfall with examples of natural things such as living organisms reveals significant differences in their characteristics and behavior.

First of all, natural things seem to have within themselves principles of rest and motion: there is something in them, which Aristotle calls "nature", that initiates, directs, and terminates motion. Anything that moves but does not possess such an inner principle cannot be considered to be natural *per se*. The singular – "a principle" – is very important here. Natural things, insofar as they are natural in the strict sense, possess one internal principle of activity. The unity of this principle is made manifest in the unity of the activity for which it is responsible; in each particular instance of a given organism of the same kind, the developmental and vital activities are the same. An example of a natural thing is an acorn. After it has fallen to the ground it will initiate its own growth from within (external conditions may trigger and sustain its inner development, but they do not direct it). After it has sprouted, a principle within the sapling will continue to direct its growth until it reaches maturity. Then the same principle will cause the tree to stop growing. In all of these changes something "within" the organism directs it to use external materials for its own development.

In the case of rain there is no evidence for the existence of such an internal principle. Instead, there is a multiplicity of principles at work, identical in kind. The large-scale behavior of rain is a sum of the activities of the water-parts of which it consists, which act and interact in relative independence. In the rain cycle as a whole, however, the sum of water-parts is driven or directed entirely by factors external to the materials undergoing motion, factors such as heat and cold, altitude, and wind. The ascent of water vapor, for example, while it is indeed natural, is due primarily to the action of heat upon it rather than to an inner source of motion that is somehow distinct from the water-parts themselves.[36] The natural

[35] *Physics* II.8 198b16-23.

[36] The structure of the water-parts is distinct from the water-parts themselves, yet the result of this structuring is still water. What happens when liquid water turns into water vapor, i.e. turns into what bears the external appearance of air? The water has in a sense – phenomenally – disappeared and in its place air has appeared.

upward motion of water is brought about directly by the external factors. Only the nature of water is at work, present in each of the water-parts and through them in the water-whole; no new nature of the water-whole is at work. We cannot really say here, as we can in the case of the acorn and of the tree, that external circumstances are merely conditions for the change. Quite the contrary, they are precisely what initiated the motion; the water does not make use of heat for its development into water vapor and then into rain in the way a tree exploits external materials for its growth, or even in the way that it uses solar energy, which propels photosynthesis.

Moreover, although the heated water vapor is acting according to its nature when it rises (in perhaps a less strict sense – for the ancient physicalists would claim that it is the fire – i.e. heat – in it that causes the rising), water would not become vapor nor tend to rise without the action of heat from the outside, whereas a tree does possess an inherent tendency to grow, which can at most be frustrated by the absence of appropriate external factors such as nutrients, light, and heat. Then, when the water vapor has reached a certain altitude it both ceases to rise and begins to condense. Although these two activities are also natural to water, in the sense that water in the form of vapor normally behaves in this way under these conditions and such behavior is part of what it is to be water, they are actually caused or triggered in a direct way by external factors, the altitude of the water vapor and the accompanying absence of heat. Here again it is not the water vapor that initiates the change, but something external.

The above considerations show that the rain cycle is not a natural process strictly speaking because it does not have within itself the source of its own specific motion. It does not have a proper nature and hence cannot be used as a model for things that do.[37]

We have noted one difference between rain and natural things by considering the sources of the motions of each. Another difference is present in the motions themselves. Those of living things insofar as they are alive, and more generally, of natural things insofar as they are natural, are essentially different from those of their constituents. The motions of the elements are simple (fire rises, earth falls,

[37] A physicalist would probably not accept the internal-external distinction. Yet I believe that it is a valid distinction, overlooked by the physicalists and recognized by Aristotle, and very important for him. There is a significant difference between the two processes. Aristotelian substances, and especially organic systems, possess a unity of being and behaving that is not present in non-substantial natural phenomena such as rainfall. The physicalists, however, are proposing the latter as a model for the former.

etc.), while those of the whole organism are complex and articulated.[38] We have only to consider the nutritive and sensitive activities of plants and animals to recognize the difference between them and simple bodies.

In the case of rain the motions of the whole do not differ in kind from those of the constituent material parts. Water evaporates, the vapor rises and condenses as it cools, etc. These motions are the simple sums of the motions of the constituent elements of the rain cycle and are themselves simple. At no point do we find any activity different in kind from those of water or air. It is therefore clear that there is nothing more at work than air and water. Once again, we see that rainfall does not have its own nature. In natural things, however, because there are motions different in kind from those of the constituents, we must conclude that there is something more at work than merely the elements. This extra factor is what Aristotle calls their nature.

The above differences between the internal structure and motions of natural things on the one hand and those of rain on the other show that the latter cannot be adequate as a model for the way in which natural things behave.

Another difficulty is that the physicalist criticism of the claim that natural things act for the sake of something seems to be founded upon a confusion between natural end-directed processes and human action for an end. By introducing characteristics of human activity into the account, they anthropomorphize natural activity.

A distinction can in fact be made between specifically human action for an end (action for a purpose) and natural activity for an end.[39] They are both instances of the more general phenomenon of action for the sake of something, whose

[38] The point here is that an account in terms of the motions of the elements, which is relatively successful in describing phenomena such as rainfall, cannot be used to describe with any accuracy and precision the activities of complex organisms. Rainfall consists only of the motions, and eventually the cyclical transformations, of a single element: water, which turns into air, rises, cools, and then again becomes water and falls. The full description of complex objects and their corresponding activities, even if they materially consist of and come to be from elements, require the use of different, non-elemental terms. The most important of these terms, for example 'oak', makes reference to the fully developed organism that comes to be at the end of a developmental process. Such expressions cannot be adequately reformulated in terms of elemental language.

[39] Human end-directed activity can obviously be divided into production, which results in artifacts, and action, which does not result in any material product. In the present paper I am restricting myself for analytic purposes to the former because of its greater resemblance to the natural coming-to-be that the physicalists are attempting to explain. Of course, human practical non-productive activity also has a strictly natural aspect. Aristotle first of all claims that man by nature desires to know (*Metaphysics* I.1) and furthermore he believes that everything that human beings do, including seeking knowledge, is embedded in the general natural human activity of seeking happiness (*Nicomachean Ethics* I). The seeking is naturally necessary for him and is a part of what he is, but the satisfaction of that desire is not.

essential feature, I would claim, is the existence of an ordered temporal sequence of states of affairs leading to a state that has the character of a completion with respect to them, regardless of whether that agent is a human being or a non--human natural object.[40]

While the above feature is common to the two kinds of action for the sake of something, human action for an end differs from natural both in the manner in which the end is present during the process and in the relationship between the final product and the source of its being. In human activity the end, the state of affairs whose physical and empirical instantiation is desired, is present as an idea in the mind of the agent, either in the form of a sensible image in the imaginative faculty or in conceptual form, as a verbally articulated object. Furthermore, this object is freely and explicitly chosen: it is not simply a result of the spontaneous development of the agent and it need not be chosen. And so Socrates' going to the market to purchase groceries or his engaging in the production of sculptures is not a part of his development as a human being, nor does it follow from his being human. The final product is extrinsic to the agent; that is, it is not related to what a human being is as such. Because of these two qualities, being an object of choice and being extrinsic, the end does not always come about; it does so only when it is desired and there are no obstacles to bringing it about. There is no necessity, for example, that Socrates make a statue, for it comes to be as a result of his choice and is not a necessary consequence of his nature in the way that, say, the activities of choosing and judging are.

In natural action for an end, on the other hand, the final state of affairs, the end, is not freely and explicitly chosen by natural things insofar as they are natural, but follows necessarily from their natures, in the sense that it is a part of what it is to be a thing of a given kind. As a result, they take place always or for the most part.[41] The acorn clearly does not choose to become a tree but does so from a sort of inner necessity, if there are no obstacles.[42] The final product of natural activity, however, is intimately related to what the natural thing is as such. It is the perfect or accomplished state of the thing itself and, in some sense, of its seed,

[40] *Cf.* Bradie and Miller for a partial formulation of this interpretation in their discussion of the nature of the final cause. Bradie, Miller [1984] p. 136. John Cooper offers an alternative interpretation of the final cause in terms of the good. For him a goal, whether natural or not, is the good that some other agency produces or makes possible, acting precisely because of that good. Cooper [1982] p. 197.

[41] This is a common thesis of Aristotle. See, for example, *Physics* II.8 198b34-36.

[42] The acorn which is incapable of producing a tree because of a defect is not fully an acorn. It is one in the sense that it is the fruit of an oak, but it fails to be an acorn in the full sense because it does not have within itself a principle that is capable of generating a new oak.

which is the same in kind and perpetuates it. The natural end of the acorn and of the sapling is the mature tree and the acorns produced by it, both of which are identical in kind to the original acorn. Indeed, the entire transtemporal process leading from acorn to oak and back again to acorn constitutes a peculiar unity and is itself an integral super-temporal object. In fact it is in some sense what we understand by the terms 'acorn' or 'oak', which literally and superficially refer only to particular parts of the transtemporal whole.

In the physicalist criticism of the view that nature acts for an end, the peculiar and problematic character of the rainfall example presented above becomes even more obvious. To show that nature and natural things do not act for an end but of necessity, the physicalists propose rain as a counterexample: rain does not fall in order to achieve any end; it does so simply because it must.[43] One is led by this counterexample to suppose that rain was proposed by some as an example of a natural process that is for the sake of something, and the physicalists' objection suggests that this end was the growth of wheat (*hopôs ton siton auxêsê*).[44] According to the physicalists, however, this cannot be the case because rain sometimes causes wheat to spoil; hence they expect the end always to follow the thing whose end it is.

The peculiar problem here is that both the example and the counterexample are based upon a weak sense of natural action for an end. Rain, as we have seen, does not have a proper nature, that is, one inner principle of behavior, though it can be said to have a nature in the general sense, insofar as it is a stably occurring and easily identifiable reality, and it can likewise be called natural insofar as it is indeed a natural phenomenon, if this is construed in contradistinction to the products of human agency. Rain, however, is quite different from simple inanimate natural things and even more so from living organisms, such as the oak considered above. It is a relatively homogeneous collection of loosely connected parts, water combined with air. It therefore possesses nothing resembling what may be proposed as the almost trivial end of inanimate natural substances: persistence, simply continuing to be what they are – what persists is the water (liquid or vapor) that underlies it.[45] Rain all the more so does not possess any end analogous to that of the acorn and oak or of other living organisms, i.e. their intrinsic develop-

[43] *Physics* II.8 198b16-19.

[44] *Physics* II.8 198b18.

[45] This is the case because of themselves they are not in the process of becoming anything more; that is, they are not in potency with respect to any further intrinsic actualization.

ment and specific perpetuation, the analogue for them of the trivial continued existence of inanimate substances.[46]

In the case of rain we have at most a weak sense of action for an end, though even here the physicalist objection is misplaced. The rain contributes to something other than itself; hence the rain and the wheat are extrinsically related. Furthermore, they are related not because rain is the natural phenomenon that it is, but ultimately because rain consists of water. Wheat, like every other plant, needs water to live and develop. Yet it does not need water simply, that is, without qualification; it needs the proper amount of water, and this amount is relative to the kind of plant it is and to its current circumstances. Rain does of necessity provide water – because it is water – but it does not of necessity provide the proper amount of water. The amount of water that falls is not fitted to wheat or to anything else it falls upon in the way that the acorn is fitted to the oak that comes to be from it. This is due precisely to the extrinsic relationship between them; in this sense it does not rain in order (in the strong sense) that the wheat may grow. So far the physicalists are right: if we require a direct correlation between an object and its end – and no such correlation exists in this case – rain cannot be said to have an end.

Yet in a weaker sense of being for the sake of something – and such a sense can with justification be applied to rain insofar as it is a weak example of a natural thing – rain can be said to be for the sake of the growth of the wheat. If a natural end is construed, on the interpretation of Aristotle presented here, as any actuality that results from a thing as such, we can indeed say, with the aforementioned qualifications, that the growth of wheat crops is the end of rain, for growth is an actuality that results from rain as such, that is, precisely insofar as it is rain (a significant amount of water falling upon a significant expanse). And here the physicalists are mistaken.

[46] Someone might object that the physicalist does not need to make use of ends, even in a weak sense, in his explanations, and indeed is not even interested in them. He has only to account for regularity, and he believes that such an account can fully well be given in purely mechanical terms, making reference only to the materials and their interactions. Such objections tend to treat ends as competing active factors. Yet Aristotelian ends, I would maintain, are not directing forces. They are just the proper results of the regular activity of such directing forces. Where we can identify one such "force" we have a strong and proper result or end. Where several such active factors are at work in a relatively uncoordinated fashion, as is the case with rainfall, we have a weak result or end. In objects that have substantial unity, we can indeed identify such a force. An example is the complex and unitary biochemical mechanism that is responsible for the development of an oak. Such a mechanism cannot be spoken about without mentioning, and in the first place, the terminus of its activity, the fully developed oak. Properly understood, ends are not in conflict with mechanical causes, but rather serve as their indispensable complements.

The mistake of the physicalists in this case is obvious. First of all, they have chosen to argue against an improper example of nature and natural action for an end. The relationship between the end and the object they have selected is extrinsic and to a certain degree accidental, in the sense that not the water itself, but the amount of water that falls when it rains is incidental to what the wheat needs at the time. Yet most natural things, and in particular living organisms, are quite unlike rain. And so while their objection partially holds in the case of rain, it does not serve as an objection against natural teleology in general.

Secondly, even the partial truth of their objection is not to their credit, because the reason why rain does not have a natural end in the strong sense, given above, is not contained in their argument against teleology. The argument that they offer is in fact false. They presuppose a symmetry between growth and spoilage, as if these two resulting states of affairs were equivalent. According to them, because rain sometimes causes crops to spoil, we might just as well argue that it rains for the sake of spoilage.[47] Yet clearly, they continue, we do not. And so, because both states of the wheat, its growth and its spoilage, follow upon the falling of rain in what they presuppose to be equivalent ways, and in the second case we do not maintain the existence of any action for the sake of something, we ought not to maintain it in the first case either. Both states just follow, without there being anything in the rain that directs it to one or the other.

Yet growth and spoilage are clearly and eminently not symmetric or equivalent states, just as being and non-being are not. One is a coming-to-be of something, the other is a ceasing-to-be. One is the acquisition of actuality and reality, the other is its loss. For Aristotle a natural end, as interpreted above, is always the actuality, i.e. the being, that results from a thing as such. The end in the sense of the *telos* is never a destruction. Furthermore, while an intelligent agent can indeed purposely destroy something, yet even in such a case it can be argued that this is done for the sake of a positive end that is seen as achievable through such a destruction. This is not the case with mere spoilage.

Next, as indicated above, the physicalist interpretation of teleology appears to be anthropomorphic. That is, the physicalists seem to take human goal-directed activity as the paradigm of action for an end in general. In this context, their objection takes on a new light and indeed seems to be justified. The original Greek that introduces the physicalists' argument is *all' hôsper huei ho Zeus*.[48] In English versions of this passage *ho Zeus* is either not translated at all (Apostle's translation:

[47] *Physics* II.8 198b21-23.

[48] *Physics* II.8 198b17-18.

"as in the case of rain, which does not fall")[49] or it is rendered as "sky" (the Oxford Translation: "but just as the sky rains")[50], which is indeed one of the possible figurative translations. Yet literally it refers to the deity. In either case the sky or Zeus is taken to be the agency responsible for rain. If this agency, in the physicalist understanding, did indeed act for the sake of the growth of the wheat when it produced rain, having the good of the wheat in mind, so to speak, then like a good gardener, it would produce rain in accordance with the needs of the wheat. Because it does not produce rain in this manner, there is no such agency. And if the activity of such an agency is identified with action for an end, then there is no action for an end in nature.[51]

For Aristotle, however, teleology involves an intrinsic relationship between a thing and its end, as we have in the case of an acorn and an oak, and even, in a weaker sense, in the case of water in general and the growth of plants in general (since it is not by accident that water contributes to the growth of plants). Such an intrinsic relationship exists both in natural coming-to-be when a true nature is at work and in intelligence-directed coming-to-be where the desire for the final product or state of affairs is intrinsically related to what in fact is coming to be.

The example that the physicalists propose as paradigmatic combines incompatible features, one that is typical of non-intentional natural activity for an end and one that is characteristic of intentional human action for an end. First of all, they expect necessity of ends: the product in natural processes that would qualify as teleological would have to follow always or necessarily, which is an attribute of non-intentional natural activity for an end. In order for rain to satisfy this requirement, it would have to cause wheat always to grow and never to spoil, i.e. to be an end in the strong sense. However, they propose a situation that could never even hope to satisfy this requirement. The final product, the growth of wheat, is independent of the nature of rain and could therefore at most be an end in the weak sense. Having an end that is independent of the nature or essence of the substance that is acting is typical of intentional action for an end and is an end in the weak sense. Thus, if nature were indeed to be something that acted for an end, they would expect rainfall (1) to produce wheat always, in the same way

[49] Apostle [1980].

[50] Barnes [1991].

[51] While Aristotle does argue for the existence of a prime mover of the universe, he does not attribute to this mover any direct role in producing changes in the sublunar domain. *Cf.* Balme [1987] p. 277. Cooper maintains that "Aristotle, unlike other teleologists of nature (Plato, the medievals, Leibniz), finds goal-directedness in natural processes without feeling any need at all to find intentions (whether God's or, somehow or other, nature itself's) lying behind and explaining it." Cooper [1982] p. 221.

that an acorn always produces an oak or a human being always gives birth to another human being and (2) to produce something that intrinsically has nothing to do with what it is, in the same way that a human being produces first a table and then a stool. Their example is therefore *a priori* flawed. It could never hope to be teleological in the strict sense.

Whatever might be the status of their theoretical position, it is evident that at least the example they have chosen is not suitable to illustrate it. Indeed, it compromises their position, since presumably it was chosen precisely to support that position and refute the competing position. Not only does the example not satisfy their criteria for being something that acts for an end in the strict or strong sense, but in fact it could not satisfy anyone's criteria. The reason is that rain is not a natural thing in the strict sense and therefore does not have a proper natural end. Yet, even more importantly, because their criteria demand that natural things have both human and non-human qualities, very few things, if any at all, could possibly satisfy them, and certainly not most of the things that we would accept as natural.[52]

Conclusion

In the ancient physicalist account, then, as Aristotle presents it, invoking a final cause seems absurd and unnecessary. If everything comes to be through the interaction of the material elements and these act necessarily and interact randomly, then it would seem that reference to a final cause is superfluous. The rainfall example is intended to show this. Rain falls when it does because it must and the results, positive (growth) or negative (spoilage), just follow. Likewise teeth, and by extension all other parts of animals and the whole animals themselves, come to be because they must; the results, survival due to the positive contribution of the teeth and other such parts, or extinction due to the failure to produce a viable organism, just follow, without there being any *a priori* activity for the sake of one or the other result. Moreover, the above is perhaps surprisingly maintained by the physicalists to be the case both in the original coming-to-be of the first member of a given species and in all future comings-to-be of individual members of the species.

[52] The argument here is clearly external to the physicalist position. They obviously cannot be expected to propose as an example something that has a nature, since they do not believe that there are natures apart from those of the elements. My point here is that, unbeknownst to them, what they in fact propose as a model for natural processes is missing essential features of basic natural things such as living organisms. Natural organisms are wholes in a way that the phenomenon of rainfall simply is not, and this is something that they could have seen.

However, the rainfall example fails to accomplish the task for which it was selected, that is, to show the plausibility of a physicalist account of natural coming-to-be. First of all, it is not an adequate example of a natural thing. It is one at most in a weakened sense. Natural things have internal principles of rest and motion, which Aristotle calls "nature" in the strict sense; in the case of rain we find no one such internal principle.[53] It contains a multiplicity of principles. Furthermore, natural things have motions that are qualitatively different from those of their constituents; this is not the case with rain.

Next, there is the problem of action for an end. The physicalists' position seems to be founded on a confusion between natural action and human action for an end. In the latter case the purpose is explicitly chosen and extrinsic to the agent, as a result of which it does not always come about. In the former case, however, the end is intrinsically related to the object and necessarily follows if there are no external obstacles. In the rainfall example, the suggested end, the growth of wheat, is extrinsic to the rain in the strict sense, yet it is expected to take place always. The reason for this difficulty, I suggest, is the fact that rain does not have a proper nature and therefore does not have an end in the strict sense. In this the physicalists are partially right, though not for the reason they offer. Yet because rainfall is not a proper natural thing, it cannot be used in an argument against the existence of natural activity for an end.

We can, however, attribute to rain a nature in a weak sense, and hence action for an end in a weak sense. In this sense rain can be said to be for the sake of the growth of wheat crops, since it does indeed contribute something to the crops in virtue of what it is. Yet this does not help us either, because of the fundamental flaw in the example: it is not a natural thing in the proper and strict sense.

But even if the proponents of natural teleology were to propose rain as a genuine example of being for an end, the physicalist counterargument is still of no avail to them. They presuppose a symmetry or equivalence between the two possible states of affairs that result from rainfall: the growth of wheat and its spoilage. Growth and spoilage are, however, clearly not symmetric or equivalent; one involves coming-to-be, the other ceasing-to-be.

[53] It is clear, of course, that the physicalist does not have to accept Aristotle's terms of discourse: nature, end, substance, essence, actuality. Yet I would claim that he must accept the experimental distinctions that underlie these terms. A process such as the rainfall cycle can, up to a certain point, be successfully described and accounted for in mechanical and material terms. However, someone who, in explaining rain, says nothing about the contribution of rain to the growth of plant life has failed to give an adequate account of the reality of rain. This contribution is at least one of its ends, though in a weak sense, because rain and the plants it contributes to are distinct substances.

Finally, the physicalists' understanding of activity for an end seems to be notably anthropomorphic. They appear to take human goal-directed activity as the paradigm of action for an end in general. Only in this context, which is nonetheless fundamentally mistaken, does their objection make some sense.

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