

Final Cause and Necessity in Nature

When Aristotle presents his theory of causation and the controversial “final cause” (*telos*), he is confronted with a serious objection from Empedocles, a sort of determinist of Aristotle’s time: “Why not suppose that nature acts not for something [a *telos*]...but [only] of necessity?” (198b18). That is, why must we even posit goals and ends as true causes- rather than, say, mere place markers for human reference- if the natural world appears to proceed from necessary conditions (“the hot, the cold, and each element have a certain nature” [198b10]) to necessary final states? Aristotle presents an explanation of rain that is characteristic of this objection:

Zeus’s rain does not fall 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 becomes water comes down, and it is coincidental that this makes the grain grow. Similarly, if someone’s grain is spoiled on the threshing floor, it does not rain in order to spoil the grain, and the spoilage is coincidental.

This example, and the general account of necessity as the sole cause in nature, can be analyzed- and hopefully rebuked- in terms of Aristotle’s theory of causation (194b16). There are four distinct, but not necessarily mutually-exclusive, types of causes: material, formal, efficient, and final. Matter is said to be the material cause of that which it constitutes. In contrast, a form is the formal cause of that which embodies or receives that form, since the form is “the genera of the account of the essence” (194b27) of that object. Aristotle’s efficient cause is the one which most resembles contemporary usage of the term, since it is the “source of the primary principle of change” (194b30) and thus the “initiator of the change” (194b32) in some object. Finally, and most controversially, is the final

cause (*telos*). This is the end towards which something strives, and it is considered to be the cause not only of the original “something” but also “all the intermediate steps that are for the [given] end” (194b36). There is a second class of distinguishing properties of causes: coincidental (*sumbebekos*, lit. falling together) causes, necessary causes, and usual causes. The difference between the second two is often ignored by Aristotle since it is small in comparison with the difference between both term and coincidence: “whereas no result of luck or chance (*sumbebekos*) comes to be **either always or usually**” (198b36). Also, Aristotle acknowledges that even a necessary cause may fail once in a while and “miss the mark” (199b38). In any case, the key distinction for Aristotle is that of coincidental and essential (necessary or usual, non-coincidental) causes.

Aristotle replies to Empedocles objection in a very elegant manner that seems to foresee Darwin’s work on evolution by over a millennium. He argues that if Empedocles considers natural things and processes to be as they are of necessity, “why not suppose, then, that the same is true of the parts of natural organisms” (198b23). For example, Aristotle presents the case of animal teeth, which are sharp in the front (“well adapted for biting” [198b24]) and broad in the back (“useful for chewing food” [298b25]). Aristotle comments that “on [Empedocle’s] view...this (useful) result was coincidental, not what they were for” (199b25). In a final blow to the determinist, Aristotle extends the example to its logical conclusion:

On this view, then, whenever all the parts came about coincidentally as though they were for something, these animals survived, since their constitution, though coming about by chance, made them suitable <for survival>. Other animals, however, were differently constituted and so were destroyed; indeed they are still being destroyed, as Empedocles says of the man-headed calves.

Aristotle has thus shown that the parts of organisms that enable them to survive in their environment cannot be explained away by means of a mere necessary relation, for example, between the constituent elements (“the hot, the cold, and each element” [198b10]) of these parts. By extension to all natural things, we see that “we find, then, among things that come to be and are by nature, **things that are for something**” (199a8). That is, the student of nature must study *ends* in order to account for (at least) some of the observed natural processes, and so final causes are required in a theory of nature.

Continuing on, Aristotle goes on to explain the relationship between natural necessity and final causes. He asserts that necessity is at most a material or efficient cause in nature, since “necessity in natural things belongs to the material cause and to the motions of matter” (200a30). This is significant because final (and formal) causes lie in a relationship of superiority to merely material (and efficient) causes. Just as the game of billiards cannot be completely explicated in terms of the matter (material cause) and movement (efficient cause) of billiard balls, but rather some account of *goal-oriented play* must be involved, Aristotle claims that an account of nature must consider goal-oriented, “for something” causes. The swallow and its nest, the spider and its web, plant leaves and roots, are all evidence of end-oriented behavior for Aristotle, and he equates this type of causation with form; “since the form is the end, and since everything else is for the end [see 194b36 quoted above], the form must be what things are for” (198b33). This account of nature sees natural objects as forms and final causes in themselves, as Aristotle says “when a doctor applies medical treatment to himself-that is what nature is like” (199b33). In short, natural things’ principle of change is one of expressing some end and in doing so enabling further expression of that, or some new, end.

The account above of final causes leaves unclear the issue of whether *all* organisms exhibit *telos*-oriented behavior or only some. This ambiguity is present in the text [see footnote 107, 199a4), and pertains to the scope of final causation. It may be the case that certain (perhaps simple) organisms are not actually moved by final causes, but rather have principles of change- and all *natural* organisms do by 192b13- that are governed solely by necessity. We could imagine these organisms as prisoners of the laws of physics, whose every motion is explainable completely in terms of necessary relations among basic elements- a reductionist dream. This, however, would lead to the paradoxical statement that such natural organisms lacked a form (by 198b33 above), a serious concern for a theory of nature. Given this apparent paradox, it is not clear why Aristotle does not make the stronger claim and instead settles with the weak “we find, then, among things that come to be and are by nature, things that are for something” (199a7).

A similar argument could be put forth for non-organic but natural phenomena like rain and hurricanes, which often don't seem to admit of a “for something” explanation. If Zeus' rain does not fall of necessity but rather for something, is it also true that a fierce tornado which causes death and destruction- “as they do either always or usually” (198b35)- killed its unfortunate victims for something and not by mere coincidence? Empedocles may be right in his objection that Zeus' rain *is* necessary, and the coincidence of grown/ruined grain- or tornado victims- is expected in the same way that a salsa-dancing house builder is coincidentally the efficient cause of a built house for being a salsa dancer. In other words, Aristotle's attempt to assign a **something** for which Zeus' rain falls (ie. the growing of crops) may be like seeing causation where there is only coincidence or luck. This concern can be extended, although admittedly its difficult, to the realm of natural organisms and their parts by

asserting that the forms observed in the natural world are not ends (or the striving for ends) but in reality simply optimal and necessary solutions to problems posed by physical laws and the organism's environment. A piece of contemporary evidence for this might be convergent evolution: when two unrelated and non-interacting organisms independently evolve to possess similar or identical structures like the eye. If one were to attempt to apply Aristotle's theory of causation to this problem, the idea of the form of the eye as a final cause might be denied on the grounds that such organisms could not possibly have displayed the same goal-oriented behavior in vastly differently environments, but rather the necessary laws of optics and the properties of certain materials found in the eye conspired to make this structure in each case. The likeliest case is that part of the explanation of the eye, or any natural organism, will depend upon its material (necessary) characteristics, and another part will depend on form-related final causes.

Despite any apparent ambiguity or equivocation, Aristotle's theory of causation is particularly good at explaining why final causes are an essential ingredient in the vocabulary of nature. And while it is still an open question for the "student of nature" today how much of the natural world is governed by necessity, how much by coincidence/luck and how much by final causes, it is clear that Aristotle's end-oriented mentality has experienced a renewal in modern evolutionary theory. It is easy to see why: as long as reason calls us to investigate, the question of "why?" will always be, at least in part, a teleological one.