TELEOLOGY IN LIVING THINGS

1. Artefacts and the Four Causes

Aristotle’s doctrine of four causes is central to his study of nature, but both in the order of his thought and in his exposition, it is modelled on the etiology of artefacts. In Physics II 3 and 7, which contain the clearest statement of his doctrine, the examples are, with one exception — “The father is a cause of the child” [194b30-31], “A man generates a man” [198a26-27] — drawn from action and craft. It is, in short, a central heuristic for Aristotle that the explanatory framework for understanding natural things, particularly living things, should be an image of the corresponding schema for artefacts. (He does sometimes say that art imitates nature, and this indicates that the ontological ordering does not necessarily recapitulate the methodological, but this point will not be pursued any further here.)

Let us say that a man wishes to make something, for instance, a house. The man, and at a finer level of detail his actions, originate the process, and are thus efficient causes. The house itself is the end (telos) of his actions or, in other words, their final cause; and it is also that for the sake of which (hou heneka) the man undertakes and plans his actions. How does the man decide what he must do? How, in other words, does he relate the house-as-end to the actions necessary for building it? He has a “model” (paradeigma) in mind, Aristotle says, and this is an “account (logos) of its essence” (194b26-27). The paradeigma or logos is the formal cause of the man’s actions. It guides the man as he manipulates the building materials, the bricks, tiles, and so on. Together, these constitute the material cause of the house.

Interpretive Note

Aristotle uses often uses terms like ‘the sculptor’ or ‘the doctor’ to refer to a cause. Now, one might think that if “the sculptor” is the originator of a series of actions culminating in a statue of Hera, then Polycleitus (who happens to be the said sculptor) is the originator of those actions. But Aristotle does not quite accept this. He says: “Polycleitus is the cause of the statue in a different way than the sculptor; since the being of Polycleitus coincides with the sculptor” (195a33-35). G. E. L. Owen famously used to call statements like these “Aristotle’s Principle of the Discernibility of Identicals” since they apparently differentiate Polycleitus from himself. In reality, it indicates that as far as Aristotle is concerned, “the sculptor” is not identical with “Polycleitus”. In Aristotle's ontology, there are (1) individual substances (Polykleitus is one of them), (2) individual predicables or tropes (the instantiation of the sculptor's art in Polycleitus), and (3) “predicative complexes” (consisting of a trope together with the individual substance to which it belongs – see Matthen 1983). Thus he says: “A predicatively
complex thing (*sumplekomenon*) may be given as cause – *not* Polycleitus, *nor* the sculptor, but Polycleitus-the-sculptor*" (195b10-12). Note that these three things are assumed to be distinct. Aristotle does, however, think that they are "accidentally the same", by which he means that they are all either identical with Polycleitus or resident in him. Aristotle's causes are generally tropes or predicative complexes, not individual substances. Thus, he has a different view from the Stoics, who make bodies the terms of causal relations, and from the "agent-causation" theories recently entertained by some philosophers. Aristotle's view corresponds more closely to the event-causation paradigm that is standard today.

A builder’s mental representation of the model of what he is building must be distinguished from the model itself: he thinks *about* a house; the house is one thing, his thought another. The thought plays a crucial role in the house-builder's deliberations. These deliberations too are efficient causes. (Aristotle says, 194b30, 195a22, that the deliberator is the cause, he says, but he means that the trope [or predicative complex], *deliberating* [*in the man*] is so.) Similarly, the ability to represent the house he will build is an element of the housebuilder's craft (195a5-6, 22), and this craft is an efficient cause. From all of this, we may conclude that the man's representation of the house is an efficient cause. (Cf. *MA* 6, 700b17-19: “The things that move the animal are choice, deliberation, and appetite. All of these come to *mind and desire.*”) The model itself is, as said before, the formal cause of his actions.

Aristotle assumes that the house-builder's representation of his end must correspond to what-a-house-is, i.e., that the "correct" account of a house constrains how he thinks of it. This does not seem right. A man may, after all, have a mistaken idea of what-a-house-is: he may entertain a faulty model. But Aristotle assumes that it is pretty much determinate what one is trying to create, so that men of even minimal competence will know what they are aiming at. This shows itself at *Physics* II 8, 199a34-b5, where he recognizes only mistakes of execution – actions wrongly designed or executed for the sake of a correctly conceived end. He does not recognize mistakes of conception. This requirement has a rationale with regard to natural processes, as we shall see in section 6, but it is not clear that it is justified in the case of craft. But were Aristotle to allow that form need not constrain the craftsman's mental representation, it would not be clear what role form plays in craft. In all particular instances of production, the explanatory role of form would be trumped by the mental representation of form.
Aristotle claims that the efficient cause “often” coincides with the formal and the final cause. “These three things often come to the same thing: what a thing is and what it is for are one thing, and that from which the change first originated is the same in form as these” (Phy II 7, 198a24-6). The identity of formal and final cause indicates that he defines artefacts functionally: a house is for shelter, and shelter is therefore a part (or perhaps the whole) of what a house is. Further, the form is represented in the builder’s deliberations and is an efficient cause. In this (somewhat dubious) sense, the efficient cause is same in form as the end. As we shall see in section 6 below, this statement has a very different and a very significant meaning in the realm of natural things.

To summarize, then, we have:

TABLE I here

2. Goals vs. Functions The artefact model outlined above is most straightforwardly applied to temporal sequences of actions, for it is these that have a telos or end: telos normally has a temporal meaning. That is, the telos (for instance, the house) is normally the last event or culmination of a series of events (the building process). Aristotle's framework is naturally suited to explaining what philosophers today call “goal-direction”, the culmination towards which a series of actions is aimed. Accordingly, his examples in the Physics are all goal-directed processes.

In other places, Aristotle extends the framework to the functions of artefacts, such as the house, i.e., to what such artefacts are for, and by analogy to natural functions. He uses what artefacts and natural things are for to explain why they have certain of their properties.

A hatchet, in order to split [wood], must be hard; if it is hard, it must be made of bronze or iron. Similarly, since the body is an instrument – each the parts is for something, and so also the whole – it is necessary that it be such and such and made out of such and such. (PA I 1, 642a10-12; Phy II 9, 200a10-13 makes the same point but with respect to a saw coming to be.)

The notion being introduced here is that of hypothetical necessity: it is necessary that the materials should be this way if the thing is to fulfill this function.
Shelter is what a house is for, its function, but it is a stretch to say that shelter is the telos of the house: the house is not a temporal sequence culminating in shelter. To ameliorate this oddity of usage, Aristotle talks about energeia or actuality. In NE I 1, 1094a4-7, he writes: “A certain difference appears among ends (telē): some are actualities; others are achievements above and beyond (para) the actuality.” The process of building falls into the second category: its telos is the house in which the building process culminates. The house itself falls into the first category: its actuality is at the same time its “end”. We can put it in this way: Being a house – considered as an extended event – has a telos, shelter, that is not above and beyond itself. Shelter is not a culmination but it is causally and temporally related to the being of the house.

There is a degree of discomfort that results from extending to functions a framework primarily constructed for goal-direction. The material cause of the process of building a house is the material that is shaped into a house: bricks, tiles, etc. This material exists independently of the house. And this is theoretically useful, since the intrinsic properties of the building material, i.e., the properties it has independently of its being incorporated into a house, can be used to explain certain features of the process in which that material participates.

Now, what is the material cause of the house itself (as distinct from that of the process of building it)? Aristotle sometimes suggests that the bricks etc. play this role, but what about the functional parts of the house: the door, the roof, the kitchen, etc.? One might expect that as parts or constituents, these too would count as material causes. But there is a difference between such functional parts and bricks and mortar. Since the kitchen etc. are defined in terms of the role they play in the house, and since their playing this role depends on the house itself, they exist only when the house does. That is, they do not exist independently of the house. So their properties independently of the house cannot be used to explain the house. (This is true of letters which Aristotle claims as material causes of syllables [195a16]. How alpha sounds depends on the syllable in which it occurs: it sounds different in ai than in au. There is no independent sound of α that explains the sound of these wholes.)

A similar situation obtains in the domain of living things. The material cause of the generation of an animal is the semen of the father and the menstrual blood (katamênia) of the mother. These, of course, exist independently of the generated animal, and they are crucial in explaining
the process of generation. But what is the material cause of the animal itself? By analogy with bricks and mortar, Aristotle might be tempted to say: flesh, blood, and other such organic materials. These materials are defined functionally and do not exist independently of the whole animal: in this respect, they are more like the kitchen and roof than like bricks and materials. (Of course, flesh is homoeomerous, unlike the kitchen, but this is irrelevant to the present point.) In fact, flesh does not just lose its functional role but physically disintegrates outside the context of a living thing. Thus, the independent properties of flesh and the like cannot be used to explain the properties of the animal. It has no such independent properties.

3. The Argument from Non-Coincidence. Aristotle claims that the four causes are to be found in the realm of nature as well as that of craft. This raises some well-known philosophical perplexities. How can the goal, which comes temporally after a sequence of actions, cause or even explain the actions? What does it mean to say that a natural thing is “for the sake of something else”? And even if one could make sense of what this means, how can what-something-is-for explain its properties when there is no intervening mental representation?

Aristotle is well aware of these problems. However, he is convinced that nature does act for an end. Thus, he takes the perplexities of the preceding paragraph as difficulties to be solved, not as proofs of impossibility. In Physics II 8, the problem is stated in this way: “It is a puzzle what prevents one from saying that nature does not act for the sake of anything, nor because it is for the better.” Certain students of nature – call them materialists – say that “Zeus does not rain so that the grain might grow; rather, it rains of necessity.” (“Zeus rains” is apparently a hieratic formula [Sedley 1991]: Aristotle uses it here to allude to the materialists’ assumption that goal-directed processes must be agent-driven.) Why, Aristotle asks, should we not say similarly that the front teeth come to be sharp and the back teeth flat “of necessity”? What compels us to take up the position that they come to be so arranged because it is better that they should be so?

In order to understand Aristotle’s argument, it is important to appreciate his position on efficient causation. It is striking that in Table I, it is this category of causation that has the most diverse instances. Aristotle is full of detail about the origin of motion and about material constitution: these are, for example, the main concern of On the Generation of Animals, and also of the
important short essay, *On the Movement of Animals*. His response to the materialists is certainly not to downplay or neglect these categories of causation – indeed, he appropriates materialist theories, or modifies them to suit his purposes. But he thinks that materialist (i.e., material plus efficient) causation is insufficient in the end.

Why? Is it because in addition to all available materialist causes, a formal or final cause is needed to achieve the result? Some commentators think so, for instance Allan Gotthelf (1976, section VI): “the development of a living organism is not the result of a sum of actualizations of element-potentials”. According to Aristotle, the development of an embryo proceeds by a series of heatings and coolings, pushes and pulls, which effect the transformation of nutriment into the parts of the baby. Gotthelf seems to imply that even if all such “element-potentials” were to be actualized in the right sequence, the result would not come about without the operation of an appropriately matched final cause.

When Aristotle says that a process is “of necessity”, he means that it is wholly driven by the nature of its constituents – “element-potentials” being a limiting case of constituency. Note the contrast with “hypothetical” necessity, the necessity that attaches to material constituents if a certain goal or function is to be achieved. For the sake of clarity, we will call the kind of necessity now being discussed *material necessity*. Suppose you flip a coin. The weight of the material causes the coin to come to rest on the ground. Since this is determined by the constitution of the coin, we say that it happens by material necessity.

On the traditional view of the text under consideration, Aristotle's intention is to argue that well-adapted parts of living bodies cannot come about by material necessity (Nussbaum 1978, 322). Gotthelf takes this to imply that materialist causes are insufficient to create these parts. On the traditional view, these parts are contrasted with inanimate rain: the materialist causes of rain are sufficient to make it fall. Further, a final cause is needed to explain the teeth: they come to be this way because it is better for taking in food. But no final cause is needed for rain: it does not fall in order to make the crops grow.

The traditional interpretation has rain contrasted with the arrangement of teeth; the former occurs by material necessity, the latter for the sake of something. However, David Furley (1985) has pointed out that this is not the contrast we actually find in *Physics* II 8. For Aristotle says: “It
cannot be by luck or by coincidence when it often rains in winter, but only if it does so during the dog days; nor if it is extremely hot in the dog days, but only if so in winter" (198b36-199a2). The contrast drawn here is between rain in *summer* and the ontogenesis of teeth. The rain in winter is on the same side of the contrast as teeth.

Why does the rain in winter not fall by necessity? Aristotle's argument depends on a notion that we have neglected so far: that of coming to be "by coincidence". An outcome involving $X$ is "coincidental" if it is not determined by causes that act on or involve $X$. Suppose that a flipped coin lands heads. This outcome is not compelled (let us say for the sake of argument) by the causes acting on the coin. These causes determine only that the coin will fall to the ground. Coming up heads simply *coincides with* this outcome, Aristotle would say, and has no further cause. It is by coincidence.

Appealing to coincidence in this way would be unsatisfying if the coin *always* landed heads. Things that happen regularly do not occur by mere coincidence. If a coin always landed heads, we would look for some cause of its landing heads. Supposing that this cause cannot be found in the material constituents of the coin, we would have to conclude that the coin does not land heads by material necessity. For instance, we might conclude that it does so because of its shape, not its material constitution. Similarly for the rain in winter and for the arrangement of teeth: they are *regular* occurrences – they happen "always or for the most part". They cannot be consigned to coincidence. (There is a lacuna in Aristotle's argument. Regular relative to what? Aristotle does not see the need to elaborate. It may be a regular occurrence that rain falls in summer *after a long spell of muggy days*. Thus, it is not clear that rain in summer is freakish *tout court*. We shall ignore this here.)

Now, Aristotle believes that it rains when water is drawn up by the heat of the sun, cools in the upper atmosphere, and returns in liquid form (*Mete* I 6). This cycle of material/efficient causes is in play whenever it rains, in winter just as much as in summer. Notice, though, that is no materialist cause that is capable of bringing it about that the sequence occurs in the right order. (Materialist causes include elements going to their proper places, heat being transferred, pushes and pulls, etc. None of these is sequence-compelling.) As far as the infrequent rain in
the summer, this is no problem. The requisite sequence occurs infrequently and by coincidence. But this explanation will not suffice for regular winter rain, which implies a further cause.

Let us distinguish between two kinds of question.

**Sufficiency** Does a particular series of materialist causes $E$ suffice to bring about a particular result?

**Regularity** Does a particular series of materialist causes $E$ suffice to bring about a particular result “always or for the most part”?

Aristotle's theory concerning rain implies a positive answer to the question of **Sufficiency**. In the dog days, $E$ does bring about rain without any additional cause. If $E$ is sufficient in the dog days, then it is so in winter. Here, at least, Gotthelf must be mistaken: this outcome is the result of a sum of actualizations of element-potentials. If the rain can occur in this way by the coincidental occurrence of material causes, why not the sprouting of teeth?

Aristotle's argument implies, however, a negative answer to the second question. When $E$ occurs only infrequently, it need not be ascribed to any cause – it may have occurred just “by coincidence”. But when $E$ occurs regularly, we need to invoke a cause to explain it (cf. Matthen 1988, 178-79). This is especially so when $E$ is a complex sequence. Perhaps very simple sequences can occur regularly by coincidence, but with complex occurrences this is very unlikely. There is in these cases an overarching cause of $E$, a cause that is responsible for the occurrence, order, and timing of a complex sequence.

Aristotle's claim is that when an event $O$, brought about by a complex sequence of constituent events occurs regularly, there must be an overarching cause $C$ responsible for the material/efficient causes of $O$. $C$ is responsible for $O$ occurring regularly because it ensures that the materialist causes sufficient for $O$ occur regularly. The materialist explanation that cites only $E$ is deficient, then, not because it gives causally insufficient conditions, but because it does not specify all the causes of $O$. In *Physics* II 8, Aristotle is accusing his materialist opponents of incompletely specifying the causes of the rain in winter – non-coincidentally occurring rain, and of the ontogenesis of teeth. These opponents miss the overarching cause of these events.
4. Craft, Form, and Spontaneity How does Aristotle's argument from non-coincidence translate into a full-blown four-cause scheme for natural things? The case for materialist causation is straightforward: these are the causes acknowledged by his opponents. It has just been argued that Aristotle thinks that an overarching cause is needed regularly to bring these causes into play in the proper way. How does such an overarching translate into the formal and final causes that we have seen at work in artefacts?

There are two lines of thought to be considered here. First, according to Aristotle, a process (kinēsis) leading to an outcome $O$ is the product of two potentialities (dunameis) matched to one another and in contact: a passive potentiality resident in the material in which the process takes place, and an active potentiality resident in the agent that works on that material ( Phy III 1-2). For example, the process of building that culminates in a house is (standardly) brought about in bricks etc. that possess the passive potentiality of becoming a house. Similarly, the house is brought about by the actualization of an active potentiality to build a house. This resides in the builder. In cases where the outcome is not merely by coincidence, i.e., where they are properly caused, these potentialities are matched not only to one another, but also to the outcome. Now, the overarching causes spoken of earlier are potentialities matched to the outcome in this way. The overarching cause of the rain in winter is (as we shall see later) is the obliquity of the Sun's orbit. This obliquity is precisely the Sun's potentiality to make it rain in winter. In living things too there is an overarching cause of well-adapted processes. Aristotle characterizes calls this the nature of a living thing. At the heart of the craft analogy is a comparison between the nature of a thing and a craftsman. Like a craftsman, the nature of a living thing brings about outcomes that are good for that living thing by acting upon the materials of that thing. Nature is an impersonal potentiality, to be sure, but it has the same relationship to matter as a craftsman. Just as a craftsman sequences his actions appropriately to his end, so too does nature; just as a craftsman sometimes makes errors of execution, so also does nature. In embryonic development there is an interplay between an active potentiality resident in the semen and a passive potential in the katamēnia or menstrual blood. This interplay is sequenced and controlled by the form of the baby present in the semen. This form acts much as the skill of the builder does, fashioning the material present in the mother into a baby.
In addition to this rather technical argument, Aristotle also observes a number of other analogies between nature and craft. Processes under the control of nature are for the good. The winter rain is for the growth of plants (or perhaps specifically for the growth of crops planted by humans). Teeth grow into an arrangement that enables animals first to tear and then to chew. Just as the builder builds for some good, so also does nature.

Where no such good generally comes to pass, Aristotle is not inclined to posit an overarching cause. When it rains in summer, the grain on the threshing floor might spoil. And it might be that this happens regularly: every summer, some farmer gets caught in a thunderstorm. But spoiling does not demand that water falls artfully on grain; no elaborate sequence of events is needed. Similarly death, destruction, and decay, though regular events, do not require any particular sequence. Natural organs and organisms decay with time under the influence of materialist causes. By contrast with the embryonic processes by which these are built, decay happens randomly. In development, the heart has to be fashioned first, to prepare for other developments; in decay, it makes no difference whether the heart goes first or last. Decay is not a sequence of events; it is merely an accumulation of events under materialist causation. As such, it does not need an overarching cause.

The four causes responsible for the ontogenesis of a baby are given in Table II.

Table II here.

Though natural outcomes are standardly explained in this fashion, Aristotle recognizes a category of spontaneous events (ta automata) which are not caused by matched potentialities (Phy II 4-6). As we have seen, sometimes a potentiality for \( O \) will be at work, but bring about a distinct outcome \( O' \) because \( O' \) "coincides with" \( O \). Aristotle's example is a man who goes to the market to buy groceries and there encounters somebody he wanted to meet, but did not expect to find (196a1-3). The potentiality at work here resided in the man's deliberation, which took him to the market. These deliberations did not foresee that the man was going to be there, and were hence not directed at meeting him. His trip to the market, however, coincides with finding the man: the two events are (accidentally) one on this occasion, though usually events of this type are not. Thus, meeting the man is on this occasion is caused not by the potentiality to bring about \textit{this} result, but by another potentiality. This is what makes it a spontaneous event.
In similar fashion, some lower animals come-to-be spontaneously. These organisms presumably come to be from relatively simple sequences of events; like the rain in summer, they can appear without the need for form as an overarching cause.

5. **Non-Bodily Causes** In *Physics* II 9, Aristotle gives us an example of a wall with heavy stones forming the foundation and light things like wood on top. The fact that the stones are able to bear the weight of what is constructed on top of them is due to material necessity emanating from the nature of the stones. These stones are there by hypothetical necessity: that is, they are there because they are necessary for the function of the wall. Aristotle also makes a point about how the wall came to be. The stones did not get to the bottom by virtue of their weight. As far as the genesis of the wall is concerned, the natures of the constituents had nothing to do with it. The stones are at the bottom because they were put there by the builders.

In the discussion of generative processes in the biological works, Aristotle often seems to assign the building role to non-bodily entities. From one point of view, this is entirely explicable. Aristotle's materialist opponents think that natural organic processes are driven by element potentials. Aristotle thinks that form and final cause play a role as well. He cannot locate these non-materialist causes in body: to do so would be tantamount to accepting a completely materialist account.

Consider the following passage:

As semen is a residue, and as it is endowed with the same movement as that in virtue of which the body grows through the distribution of the ultimate nourishment, when the semen has entered the uterus it "sets" the residue produced by the produced by the female and imparts to it the same movement with which it is itself endowed. The female's contribution, of course, is a residue too, just as the male's is, and contains all the parts of the body potentially, though none in actuality; and 'all' includes those parts which distinguish the two sexes. Just as it sometimes happens that deformed offspring are produced by deformed parents, and sometimes not, so the offspring produced by a female are sometimes female, and sometimes not, but male. The reason is that the female is a deformed male . . . (*GA* II 3, 737a18-29, trans. Peck)
Consider Aristotle's account of the sequence of events that takes place after the semen has entered the uterus. If the materialists are right, this sequence is driven by element potentials. In other words, the materialist line is that the mixture of semen and the "female residue" has properties that neither has on its own, properties that drive the mixture on its embryological path by material necessity. Aristotle denies this. He thinks that the semen imparts its own movement to the female residue. It cannot do this simply by materially acting on the katamēnia. For as noted in section 3 above, no material has the power to bring about sequences of events. Significantly, Aristotle says above that sometimes the semen fails, and when it does, the female movement keeps going in its path of material necessity, thus failing to produce a penis. The deficiency here is ultimately a failure of form over matter. The deformed parent produces deformed offspring because the overarching cause fails to control.

There is one other reason why Aristotle is an immaterialist. He believes that reason or noûs is not a bodily activity. Accordingly, he argues that this activity requires something other than bodily causes: it enters from "outside" and it alone is divine (GA II 3, 736b28-30). This non-bodily part is apparently carried with the semen and imparted to the fetus. The bodily part of the semen then disappears, leaving the ensouled fetus behind.

6. Global Teleology The question must now be addressed: how is it that nature is organized in accordance with the craft analogy? The most obvious answer, and the one adopted by Plato, is that the world was constructed this way by a creator. Organisms are best constructed the way we find them, and in order to explain why the world and its creatures are so well-constructed, Plato appealed to the intentions of a superior being. This answer has the additional advantage of explaining why natural functions seem to be, as Aristotle says in Physics II 8, “for the better”, since it could additionally assumed that this creator created the world in accordance with its apprehension of the Good.

Aristotle disagrees with this whole approach. First, he does not believe that the world had a beginning in time (DC I 10-12), and for this reason he rejects the notion that the world is created. Secondly, he does not believe in a pre-existing and independent Good which things in the world measure up to. Rather, he believes in immanent goods. The good-for-humans is the ideal
execution of human ways of acting in the world (NE I 7). The ways of acting come first as parts of human nature; the good-for-humans derives from them as their being performed well. So also for the Universe itself: its good is what it does. (The interpretation offered in the present section is taken largely from Cooper 1987.)

Now, one of the things that the Universe “does” is to be stable forever. It imitates the Prime Mover (Aristotle's God), who lives a perfectly homogeneous life, eternally contemplating itself. Many of the other activities of the Universe and many of its characteristics are teleologically subordinated to this one activity. Consider, for example, the sublunary sphere – the part of the Universe under the Moon – of which fire, air, water, and earth are the elements. Aristotle observes in De Generatione et Corruptione II 10 that these elements move in straight lines, either toward or away from the centre of the Universe. Left to themselves, they would separate out “in infinite time”. Consequently, the Sun is placed on a displaced orbit which leads it on its annual path, first to the northern and then to the southern hemisphere. This movement causes the rain cycle, displacing the elements that would otherwise that would otherwise simply settle in their natural places. The rain in winter is caused by the obliquity of the Sun's orbit, which is in this way for the sake of the stability of the Universe. “That is why . . . the simple bodies, imitate circular motion,” Aristotle says. “It is by imitating circular motion that rectilinear motion too is continuous” (336b31-37a7). In this way, the world is so structured as to imitate the homogenous eternal activity of the Prime Mover. This homogeneity is its good. (Incidentally, Aristotle attributes this structure to God in this text, but this is evidently not meant to imply that God created the Universe.)

Now, one might ask: why should the world be made this way? Could it not have been eternal by omitting the sub-lunary elements altogether and making do with the circularly moving starry element by itself? This is precisely the kind of question that Aristotle's immanent Good is supposed to circumvent. The question assumes that there is an external reason why the Universe should be the way it is, some independent good that it would instantiate by being so. Aristotle denies any such transcendentalist notion of the Good. The good of the Universe is the ideal performance of the parts and functions it actually possesses. (Since the form of the Universe is
eternal, it necessarily possesses those parts and functions it actually possesses. But this does not imply that another kind of Universe is inconceivable.)

It is part of the way the world is that it contains certain species. These species too aspire to the eternally homogeneous activity of the Universe and its Prime Mover. But it is impossible for individual things of this sort to be eternal. So they are eternal in the only way open to them: eternity as a kind. This they achieve by producing offspring (GA II 1, 731b32-35). Obviously, their ontogenetic activities would not achieve this end if they did not produce creatures of the same kind as themselves. This is why animals reproduce: to preserve their kind. This is the best they can do by way of achieving eternity. This makes sense of Aristotle's claim that even "monsters" (terata) result from "erroneous" processes that are, nevertheless, for the sake of reproduction (Phy II 8, 199b3-4). The process of creating offspring makes no sense to him if it is not for the sake of producing something of the same kind. This is the reason why in nature the formal cause and the efficient cause are one: man generates man.

This looks at reproductive activity from the point of view of the species themselves. But one could also look at things from the point of view of the Universe, as it were. As noted before, the Universe is itself stable. If its species were to perish, that stability would be undermined. Just as it would contradict the stability of the whole if the sub-lunar elements were to separate out in time, so also it would contradict the eternity of the whole if the species were to perish. Thus, animal reproduction does not only subserve the local good of each species; it also subserves the global activity of the Universe.

It is significant that the "starry element" plays a role in reproduction. Aristotle "proves" this by noting that various stages in ontogenesis are brought about by heat carried by the pneuma present in the semen (GA II 2, 736a1-2). However, mere heat will not do, he says: fire will not produce a baby. He concludes that the pneuma that gives the semen its fertility carries a special sort of heat; it is "analogous to the starry element". This reaffirms the role of the starry element as an instrument for preserving the stability of the whole. Elsewhere, Aristotle insists that the heavens and the planets serve as divine instruments for maintaining "the cycle" in the sublunar world; they are described in Physics VIII 10 (267a21-b9) and Metaphysics XII 7 (1072a20-25)
as intermediate between God (or the Prime Mover) and sublunary entities. Here too this element is given a similar role.

All of this suggests that the teleology of living things is part of a grander scheme by which the Universe itself maintains its stability. Such a suggestion undermines, as David Sedley (1991) has said, the school of thought that reads Aristotle as “refusing to extend the workings of . . . finality in nature beyond the internal structure and functioning of individual organisms.” Sedley himself argues for a “broader interactive teleology”, a “global teleology” which sees the Universe as a single large structure and the nature of living organisms as part of this larger structure (see also Matthen 2001).

Sedley argues that this structure is, as he puts it “anthropocentric”, in that much of the world does not merely subserve the imitation of eternity, but specifically serves the interests of human beings. In support of this interpretation, he adduces three important passages. The first is from Politics I 8 (1256b10-22), where Aristotle claims that “plants exist for the sake of animals, and the other animals for the sake of men.” The second piece of evidence is the rainfall passage from the Physics, which has been dealt with in detail above. Finally, there is a passage from Metaphysics XII 10 (1075a11-25) where Aristotle suggests that the nature of the Universe aspires to the goodness of the Prime Mover and in so doing forms a joint-arrangement in which all creatures participate, each in their own way. Sedley’s hypothesis is controversial, to say the least (see Wardy 1993), but it now seems uncontroversial that Aristotle's teleology of the living world is not fragmented and species-bound in the way it was only recently thought to be. The final causes of each species connects in some way to the excellent activity of the whole Universe.

Mohan Matthen
References and Further Reading


### TABLE I

<table>
<thead>
<tr>
<th>Efficient Cause (whence the action originates)</th>
<th>The man, the craft, the mental representation of the house</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Cause (what the builder’s actions modify or shape)</td>
<td>Building materials</td>
</tr>
<tr>
<td>Formal Cause (what the product is; this constrains the mental representation)</td>
<td>Essence of house (note difference from mental representation)</td>
</tr>
<tr>
<td>Final Cause (product)</td>
<td>A particular house</td>
</tr>
</tbody>
</table>

### TABLE II

<table>
<thead>
<tr>
<th>Efficient cause</th>
<th>Potential matched to outcome: form instantiated in semen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material cause</td>
<td>Material that is shaped by the efficient cause: <em>katamenia</em> in female, which waits for activation by semen</td>
</tr>
<tr>
<td>Formal cause</td>
<td>Essence of man, soul</td>
</tr>
<tr>
<td>Final cause</td>
<td>Baby</td>
</tr>
</tbody>
</table>