

Two

Explaining Nature and the Nature of Explanation

2.1 BEGINNING IN WONDER

‘Human beings began to do philosophy’, says Aristotle, ‘even as they do now, because of wonder, at first because they wondered about the strange things right in front of them, and later, advancing little by little, because they came to find greater things puzzling’ (*Meta.* i 2, 982b12). If we reflect at all on the universe of common experience, if we scratch the surface even a little, we find puzzles and peculiarities residing not far below. That we find such puzzles – about space and time, about human freedom and autonomy, about justice and goodness, about the character and reliability of our own faculties – is only to be expected: the universe is a puzzling place. Consequently, while not everyone will be a philosopher or a physicist, as long as we have leisure from labour most of us will wonder about the universe and our place within it. When we wonder, we begin to philosophize.

As Aristotle sees things, we do not need to seek out puzzles. They are, as he says, right in front of us. If we look into the night sky, we readily wonder whether the universe is infinite in space or somehow bounded. Questions about spatial limits readily give way to questions about time and order. Does the universe have a beginning in time, perhaps because it is the handiwork of a surpassingly great being whose intentional actions and purposes explain its order and regularity? Or do the regularities of nature owe simply to brute laws, without there being any further explanation of their necessity? Or, then again, are we already mistaken in presuming that there are regularities in nature? Perhaps the

laws we take ourselves to perceive as given by nature are in fact imposed by us, in a desperate attempt to find meaning and regularity in a world of undifferentiated and purposeless disarray.

For that matter, does it make sense even to suppose that the universe could have a spatial boundary or a beginning in time? What, we are inclined to ask, can be said of the period *before* the universe began or of the area *outside* its outermost boundaries? Upon even a moment's reflection, it is initially hard to fathom that the universe extends infinitely backwards in time. For if that is so, it must also be so that an infinite number of moments have come and gone, and that right now, today, in this instant, it is entirely possible that someone, an angel perhaps, or some other meek and dutiful creature, has been always counting backwards, from infinity, and has just now finished counting ever downwards, having at long last reached zero, the final member in the infinite series of numbers now actually enumerated aloud. If we bristle at the suggestion that such a scenario is coherent, then we seem pushed back in the direction of thinking that the universe cannot extend infinitely backwards in time; but then, again, we wonder: what of the period *before* time began?

These and like questions incited wonder very early in the history of Greek philosophy, and Aristotle found them irresistibly engaging. In his *Physics*, Aristotle treats the nature of time, infinity, boundary, chance, purpose, and change. He typically begins, as we have seen, by recounting the phenomena and recounting the *endoxa*,¹ or reputable opinions, where as often as not these derived from the speculations of the philosophers who preceded him. He does so because he thinks we can learn about our own puzzles by considering how others who have thought hard about them have done so, even if we find it necessary to disagree with them. In fact, Aristotle regularly faults his predecessors, and he does so in a patterned and predictable way: he commonly contends that their explanations are at best only partially correct, first because they rest upon false assumptions but also because the earliest philosophers had not reflected sufficiently upon the character of explanation itself. If we wish to explain some phenomenon completely and accurately, then our explanations had better adhere to some

canon of correctness. It is not enough that we happen to find them convincing.

Aristotle's way forward in philosophy and science is to reflect overtly upon the standards of adequacy in explanation. We make progress, he thinks, only by beginning in wonder and then moving to explanations which satisfy objectively given standards of adequacy. We *do* make progress, Aristotle supposes; when we do, however, we often enough discover newer more difficult problems lurking in our solutions, with the result that we turn directly to them once we have made our way a little and so push ever forward.

Why should we behave this way? Why, as a species, do humans as a matter of fact try so relentlessly to understand the universe and our place within it? As we have seen, Aristotle supposes that we wonder for the simple reason that it is our nature to do so. 'Every human being, by nature, desires to know' (*Meta. i 1 982a23*).² Aristotle thus locates our nature in our *cognitive capacities*, in our natural and indomitable drive to learn and acquire knowledge.

Thus far, then, we might ask Aristotle for a reason to agree with him when he contends that humans have a nature or that we have just the sort of nature he supposes. Judged from a certain remove, Aristotle's first contention may appear rather antiquated and unstable: why suppose that humans have a nature at all, of any kind? After all, along with natures go *essences*, and more recent thinkers have had myriad motivations – some political, others biological, and still others more narrowly metaphysical – for wanting to assail the very existence of essences. If we have natures, then we are essentially a certain way; but we are not essentially any way, these detractors contend. We are free to create ourselves as we wish, to be the architects of our own essences. So, this talk of natures must cease.

Aristotle disagrees with both sorts of critics, and believes that he can show that we have a nature of a definite and discernible sort, one having everything to do with our innate cognitive endowments and little to do with our proclivity towards self-promotion. Since his views are controversial, Aristotle owes us a defence.³ The first inkling of the sort of defence he is inclined to provide has

already made an appearance: human beings, as a matter of simple and undeniable fact, wonder about things. We are information-seeking sorts of beings. We want to know how and why the world works; we want to know, closer to home, how and why our bodies function as they do, how and why our minds and perceptual systems acquire, store, and process data; how and why we must or should act when dealing with others of our kind, whether justice requires conduct of a certain sort or whether justice is itself fashioned to suit the conduct we prefer; and we want to know whether the universe is a purposeful sort of place or a vast cauldron of atoms swirling in an indifferent void.

Many of the things we wish to know have an immediate practical import, as when we want to know whether a given mutated microbe can be controlled with an available antibiotic. Other times, we want to know things with no immediate practical import, and with perhaps no remote practical import either. What is the highest Mersenne prime? What colour skin did the Brontosaurus have? Did Napoleon die of lead poisoning induced by the colour pigment used in the drapery in his room? Why do some people mispronounce the word 'nuclear' in predictable and patterned ways? In these cases, we seek explanations and are satisfied when we have them, though we do not suppose that our doing so holds for us any immediate practical benefit, or indeed even any benefit at all beyond the satisfaction of a curiosity resolved. In short, we human beings seek explanations, and then provide them for ourselves, some good, some bad, some practical, some theoretical, some hopeful, some rather less so. This broad fact is undeniable. Like other facts, contends Aristotle, this fact wants an explanation. Aristotle's first approach at an explanation of our explaining proclivities is simple: we desire explanations because it is our nature to do so. We seek knowledge not just accidentally or haphazardly, but as a result of our essential features – as a result of those very features which make us the kind of beings we are.⁴

This is why, contends Aristotle, we begin in puzzlement and move from wonder to world-view. Philosophers and scientists alike identify patterns they take to be significant, notice anomalies and puzzles in those patterns, and then redouble their efforts to

provide ever deeper and more penetrating explanations. At each stage of development, inferior explanations give way to superior explanations.

2.2 EXPLAINING EXPLAINING: THE FOUR CAUSES

There are two ways of thinking about discarded explanations, corresponding to an important distinction between two conceptions of what explaining consists in. At one stage scientists wondered why malaria spread so rapidly in tropical areas. An explanation was proposed to the effect that warmer water in temperate zones is hospitable to spores carrying the disease. Eventually, that was shown to be false when it was demonstrated that certain sorts of mosquitoes are the primary transmitters. How should we think about the initial proposal regarding spores in the drinking water? We may say either: (i) our initial explanation was supplanted by a superior explanation; or (ii) spores in the drinking water never really explained the spread of malaria at all. The first way of speaking treats explanations as *interest-relative* or as somehow *subjective*, such that something's qualifying as an explanation simply consists in its satisfying a curiosity. On this approach, it is an explanation of Penelope's being a moody person that she was born on the cusp of Pisces, because someone somewhere is satisfied when that reason of her conduct is offered. The second approach to explanation, Aristotle's preferred, treats explanation as *objective*, such that *x* explains *y* just in case (i) *x* and *y* are states of affairs in the world, and (ii) states of affairs of the *x*-type cause states of affairs of the *y*-type.⁵ As he says:

Since the object of our inquiry is knowledge, and we do not think we know a thing until we have grasped *why* (*dia ti*) it is so (where this is to grasp its primary cause), it is clear that we must also find this in the case of coming to be, perishing, and of all natural change, so that when we know the principles of things we can endeavour to refer what we are seeking back to these principles.

(*Phys.* 194b17–23; cf. *Meta.* 983a25)

Something's primary cause is not something whose mention happens to satisfy someone. Rather, a primary cause is what in fact makes it the case that a certain state of affairs obtains.

In thinking of explanations as objective, Aristotle accepts a commitment to there being causes which obtain in the world prior to and independent of our interaction with it. He also consequently distinguishes between *objectively good* explanations and *objectively bad* explanations, in terms of those which do, and those which do not, cite suitable connections between states of affairs obtaining in the world. It is important, then, that we reflect upon what makes a connection between states of affairs suitable to ground an objective explanation. Aristotle contends that genuine connections, the sort cited in objective explanations, are *causal*. Consequently, in order to understand the sorts of objectively obtaining relations required for adequacy in explanation, it is necessary in the first instance to appreciate when causal relations obtain and when they do not. To come to this appreciation in turn, it is first of all necessary to understand what a causal relation is. After all, someone pressed to explain how the signs of the Zodiac influence our moods might simply contend that the configurations of the heavenly bodies *cause* us to feel and behave in certain ways. If we think that is nonsense, then we also think that only some claims to causal connection are genuine, while contending that others are spurious. Which?

In reflecting on this matter, Aristotle offers a response which begins with an intuitive simplicity, but which grows increasingly complex and technical as he presses it into service in the course of his actual explanatory practice. At the root of his approach to causation is a distinction among kinds of causes: Aristotle doubts that all causal explanations are of a single unified sort. Instead, Aristotle distinguishes *four kinds of causes*, four *aitiai*,⁶ all of which, in different ways, provide objectively obtaining grounding relations between the things we want explained and the things which explain them:

One way in which cause is spoken of is that out of which a thing comes to be and which persists, e.g. the bronze of the statue,

the silver of the bowl, and the genera of which the bronze and the silver are species.

In another way cause is spoken of as the form or the pattern, i.e. what is mentioned in the account (*logos*) belonging to the essence and its genera, e.g. the cause of an octave is a ratio of 2:1, or number more generally, as well as the parts mentioned in the account (*logos*).

Further, the primary source of the change and rest is spoken of as a cause, e.g. the man who deliberated is a cause, the father is the cause of the child, and generally the maker is the cause of what is made and what brings about change is a cause of what is changed.

Further, the end (*telos*) is spoken of as a cause. This is that for the sake of which (*hou heneka*) a thing is done, e.g. health is the cause of walking about. 'Why is he walking about?' We say: 'To be healthy' – and, having said that, we think we have indicated the cause.

(*Phys.* 194b23–35)

Aristotle thus, crucially and centrally, identifies the four kinds of causes to be cited in objective explanations.

Because Aristotle's language here is a little alien, and in view of the fact that his four-causal account of explanatory adequacy is absolutely central to very nearly all of his philosophy, we will first reproduce his contention in more familiar and informal terms, and then offer a series of defences for his claims, the first relatively superficial, but eventually becoming more complex and nuanced.

Aristotle's initial thought is relatively uncomplicated, as can be appreciated by reflecting on a simple illustration. Suppose that we are walking deep in the woods in the high mountains one day and we come to notice an object gleaming in the distance. When it catches our eye, our curiosity is piqued; indeed, Aristotle thinks so much is almost involuntary. When we come across an unexplained phenomenon or a novel state of affairs, it is natural – it is due to our nature as human beings – that we wonder and fall immediately into explanation-seeking mode. What we see glistens

as we approach it, and we wish to know what it is. Why do we wish to know this? We simply do: so much is unreflective, even automatic. As we come closer, we ascertain that what is shining is something metal. Upon somewhat closer inspection, from a short distance, we can see that it is bronze. So, now we have our explanation: what we have before us is polished bronze.

Still, if we find a bit of bronze in the high mountains, we are apt to wonder further about what it is – what it is, that is, beyond being so much bronze. We will want to know in addition what it is that is made of bronze. We may conjecture in different ways. Perhaps it is debris from an abandoned mine; or perhaps it is metal left behind by early explorers who had been attempting to transport it over a high pass as material for a machine to be built at their destination; perhaps instead we have before us the remnants of an aeroplane which had crashed in the recent past. No. As we approach still closer, we ascertain that it has a definite shape, the shape of a human being: it is a statue. So now we know what it is: it is a statue, a polished bronze statue.

We also know further, if we know anything about statues at all, that the bronze was at some point in its past deliberately shaped or cast by a sculptor. We infer, that is, though we have not witnessed the event, that the shape was put into the bronze by the conscious agency of a human being. We know this because we know that bronze does not spontaneously collect itself into statues, and we discount the possibility that some discarded metal was perfectly moulded into the shape before us by a random bolt of lightning. So, now we know what it is: a statue, a lump of bronze moulded into a human shape by the activity of a sculptor.

Still, we may be perplexed. Why is there a statue *here*, high in the mountains where it is so unlikely to be seen? Upon closer inspection, we see that it is a statue of a man wearing fire-fighting gear; and we read, finally, a plaque at its base: 'Placed in honour of the seventeen fire-fighters who lost their lives in the service of their fellows on this spot, in the Red Ridge Blaze of 23 August 1933.' So, now we know what it is: a statue, a lump of bronze moulded into a human shape by the activity of a sculptor, placed to honour the fallen fire-fighters who died in service.

When we know that much, thinks Aristotle, we know enough. We know, that is, each of the four kinds of causes we can know about the statue. Although he does not use just these designators for the four causes, the tradition has come to label them as follows:

Table 2.1 The four causes

Cause	Characterization	Illustration
Material cause	That from which an entity comes to be	Bronze
Formal cause	The shape or structure of an entity	Human shape
Efficient cause	The agent imposing the shape or structure	Sculptor
Final cause	That for the sake of which	To honour the fallen

Aristotle makes two claims about these four causes. First, he suggests that in the vast majority of cases a complete and adequate explanation must cite all four causes.⁷ This is why Aristotle feels justified in his frequent criticisms of his predecessors who, he maintains, confine themselves to a subset of the four causes and thus come up short.⁸ Second, as he contends directly, ‘This, then, is a sufficient determination of the number and of the kinds of cause’ (Phys. 195b29–30; cf. 198a21–24). There are no kinds of causes beyond the four enumerated.

Taken together, these two claims jointly state Aristotle’s four-causal conception of adequacy in objective explanation:

- **E** is an adequate explanation iff **E** correctly cites each of the four causes: the material, the formal, the efficient, and the final.

Note that this formulation states both *necessary* and *sufficient* conditions for adequacy in explanation. The necessity condition: an explanation is adequate *only* if it correctly cites each of the four causes; any account which omits a cause where one is available is incomplete and so inadequate. The sufficiency condition: once an explanation has cited each of the four causes, it has left nothing out, and so is complete and adequate as an objective explanation.

The sufficiency condition may seem immediately objectionable, since it encounters two sorts of challenges straightaway. First, a mere enumeration of four causes by itself does nothing to show that there are not yet other, non-equivalent types of causes still to be recognized. Second, it seems entirely possible to cite all of Aristotle's four causes and yet find oneself in need of additional information. If that is so, then it also seems that one could cite all four causes without producing an adequate explanation.

Aristotle is sensitive to the first worry, and in response he provides only a sort of challenge rather than an argument for closure. In his *Metaphysics*, he refers back to his introduction of the four causes, observing:

We have given sufficient consideration of this matter in the *Physics*. [When applying them] we shall either find another kind of cause, or be more convinced of the correctness of those which we now maintain.

(*Met.* 983a33–b6)

The passage contains an implicit challenge to those who wish to identify some fifth kind of cause beyond the four already attested. If there is another kind of cause not reducible to one or the other of the material, formal, efficient, or final, it needs to be identified by its champion. Aristotle, at any rate, honestly reports that he can find no other. Rightly or wrongly, he now shifts the burden to his detractor. Although necessarily incomplete, this sort of response has at least the merits of forthrightness. Moreover, in any event, it may be observed that many modern thinkers fault Aristotle for countenancing too many kinds of causes rather than too few.

The second objection is more probing. Why suppose that the mere citation of Aristotle's preferred causes should satisfy someone looking for fully explanatory connections between objectively given states of affairs? Suppose, for example, we meet someone wearing a new kind of jacket which repels water while allowing moisture to escape. The material cause of this jacket's success will be a new kind of fabric, using new fluoropolymer fibers interwoven with nylon. If we want to know how the jacket repels rain, it will be

true, but uninformative to say that it is made of fabric. So, someone citing this as the material cause leaves an important feature of the object unexplained.

Aristotle is aware of this sort of worry as well. It illustrates, he thinks, not that another kind of causation is being overlooked, but that each of the individual four causes may be specified more remotely or more narrowly. Recall that when introducing the material cause, he mentioned first the ‘bronze of the statue’ and ‘the silver of the bowl’, but then alluded in addition to ‘the genera of which the bronze and the silver are species’ (Phys. 194b24–26; cf. Phys. 195b4–13). In speaking of *genera* here, Aristotle has in mind the kinds to which bronze and silver belong. At their most general, the bronze statue and the silver bowl have a common material cause, namely metal; but as we become more specific, their material causes diverge, because they are different sorts of metal, one bronze, with all of the properties of that kind of metal, and the other silver, with its peculiar features. From Aristotle’s perspective, we do not cite a new kind of cause when we become more or less specific, but rather we move vertically within a kind of cause. After all, in each case, we specify more or less precise kinds of material. In the case of the waterproof jacket, then, what is wanted is a more refined specification of the material cause, not an altogether new form of cause.

The same distinction applies to the other three causes as well. We specify the efficient cause of a sculpture as the sculptor. We might truly mention something more generic, the artist, or something more specific, the sculptor sculpting. When we cite an efficient cause generically, we say something true, but less informative than we do when we specify the efficient cause in its most specific form. The bare existence of a sculptor is obviously compatible with the non-existence of this statue, this shaped bronze, because the sculptor, considered simply as a sculptor, may not have been busy with just this bronze. This is what Aristotle means when he says additionally that causes may be merely potential or actual: ‘All causes . . . may be spoken of either as potential or actual, e.g. the cause of a house being built is either a house-builder or a house-builder building’ (Phys. 195b3–7).

Significantly, from Aristotle's perspective, actual particular causes are not prior in time to their effects, but are co-temporaneous with them: 'Active, particular causes exist and cease to exist simultaneously with the effects they cause, e.g. this house-building man and that house being built; but this is not always true of potential causes – the house and the house builder do not perish simultaneously' (*Phys.* 195b17–21). It is a hallmark of an efficient cause identified most specifically that the action of the cause is concurrent with the effects being produced. This puts Aristotle at variance with some much later, widespread conceptions of causation deriving from Hume, who states flatly, 'The cause must be prior to the effect.'⁹ According to the Humean view, a cause always precedes its effect in time,¹⁰ and, moreover, 'Any thing may produce any thing.'¹¹ These commitments, however difficult to endorse they may be, put pressure on the oft-advanced contention that the efficient cause is most like 'our' notion of causation – if, that is, we are prepared to allow that our notion is broadly Humean. (Although as a general characterization, it is manifestly false that we are all Humeans these days, this does seem to be what most have in mind when they liken the efficient cause to 'our' notion of cause.)

In any event, the difference between Aristotle and Hume is not merely verbal. Aristotle thinks of causes as processes, rather than as static events. He accordingly assumes that a most proximately specified cause is, so to speak, a *causing* of its effect. When he conceives of causes as processes and not as static events, Aristotle assumes that causes are *activities* which result in changes in the subject on which they operate.¹² The difference here is considerable, since at least some of the kinds of problems arising naturally within a Humean framework have no purchase within Aristotle's framework. It is, for example, difficult to imagine the actual process of a fence's being painted white without the fence's also undergoing the process of being made to be white, whereas Humeans are puzzled by the fact that causation requires one event's necessitating another even though, given the discreteness of the events, it is always possible to imagine the one without the other. Wherein, they wonder, does the necessary connection lie?

It would seem peculiar, or perverse, within an Aristotelian framework of efficient causation to allege that ‘Any thing may produce any thing.’ Although a doctor doctoring a patient might produce healing in a patient, the doctor doctoring will not eventuate in a fence’s being made white; nor will a painter’s painting bring about a beach tree’s shedding its leaves. A properly specified efficient cause, in Aristotle’s terms, carries with it an explanation of why some motion or change was initiated, and does so in such a way as to make perspicuous the connection between the activity in the agent and the alteration in the patient.

In any event, contends Aristotle, we can specify each of the causes more or less generically, and thus more or less informatively. When we do so, however, we do not advert to different kinds of causes beyond the canonical four, but to the four causes themselves, at different levels of specificity. Although we do not establish the sufficiency condition of Aristotle’s four-causal account of explanatory adequacy by appealing to these sorts of distinctions, we do remove one natural and expected sort of objection to it. So far, then, Aristotle may claim that his four-causal theory suffices for adequacy in objective explanation.

The necessity condition requires a fuller and more developed defence. This is especially so since Aristotle regularly upbraids his predecessors, including Plato, for failing to cite causes where they are needed. In our informal motivation of the doctrine of four causes, we saw that we would remain curious about a novel state of affairs, in our case a glimmering hunk of metal high in the forested mountains, until such time as we managed to mention each of the four causes. This may serve as an informal motivation, and may be useful as far as that goes, but it does not go far enough if Aristotle wishes his four-causal account of explanatory adequacy to qualify as an account in the objective sense. So far, as regards the necessity condition, we have mainly noticed a subjective fact about ourselves, namely that in the face of novel phenomena we tend to remain curious until such time as we have cited all of the four causes. If we are lazy, or distracted by hunger, or occupationally obsessed with only one of the four causes, if e.g. we are metallurgists curious only about the tensile strength of

metal, then we may not care about all of the four causes. Once we have ascertained that the shimmering stuff is not, for instance, edible, we may move on. If the only test for adequacy in explanation is the satiation of our curiosity, then we cannot be at all sure that the explanations to which we appeal track the objective relations between interest-independent states of affairs. If objective explanations require objective groundings, then we will have to look elsewhere.

Consequently, if he wishes to ground each of the four causes in an objectively given framework, Aristotle will need to advance some more detailed forms of argumentation. It will not suffice simply to point out that we may tend to be unsatisfied until we have cited all four causes, but then become satisfied once we have. Since he thinks that the four causes are real, objectively existing states of affairs, Aristotle owes some positive argument for this thesis; however natural he (or we) may find the four-causal explanatory framework, Aristotle is not at liberty simply to assume it.

Importantly, he does not. Aristotle argues for each of the four causes. His first and fullest arguments are on behalf of material and formal causation. The primary orientation of these arguments is simple: without matter and form we cannot solve a significant puzzle which we really must solve.

2.3 A PUZZLE ABOUT CHANGE AND GENERATION

Aristotle's predecessors bequeathed him a variety of paradoxes of nature, some rather simple, but others extremely perplexing. One challenging paradox owes to Parmenides, who famously argued that despite what we take ourselves to perceive, *motion is impossible*.¹³ Parmenides' student, Zeno of Elea, developed novel arguments on the same theme, arguments so fiendishly difficult in their seeming simplicity that they have required centuries of mathematics to solve them adequately. Parmenides' original arguments, by contrast, are more complex in their background assumptions and are in consequence initially rather difficult to state. For our purposes, it will suffice to provide a formulation of Parmenides close to the understanding Aristotle himself seems to have had. As Aristotle

reports him, Parmenides claims all being is one: 'Because he supposes that beyond being (to on) there is no non-being (to mē on), he thinks that being is of necessity one and that there is nothing else, (*Meta.* 986b28–30; cf. *Phys.* 185a5–12, 191b36–192a2; *GC* 318b2–7; *Meta.* 984b1–25; 1009b20–25). Although he credits him with having made some progress in difficult terrain, Aristotle believes Parmenides goes seriously awry: not only are his premises false, but even if they were true they would fail to support his conclusion (*Phys.* 185a9–10).

Parmenides begins with the simple insight that, necessarily, whenever anyone thinks of something, there is something of which he thinks. Call that something the *object* of his thought. If one succeeds in thinking of some object or other, then what that person thinks exists. Indeed, every object of thought exists – else it could not be thought. Further, heading in the opposite direction, every object of thought is such that it can in principle be thought. Indeed, in general, everything which exists is such that it can be thought; everything which exists is a possible object of thought. Taken together, these two claims form the basis of Parmenides' otherwise odd-sounding suggestion that what is and what can be thought are the same, or, as I will prefer, that what exists and what can be thought are necessarily co-extensive.¹⁴ If you try to think nothing, you invariably think something or other; if you are not thinking anything, then it is not the case that you have succeeded in thinking nothing. On the contrary, you are not thinking at all. Thinking is in this respect *essentially relational*, as is, for example, marrying someone. If you try to marry someone and they decline your overtures, then you have not succeeded in marrying nothing: you have failed to marry altogether.

Now, infers Parmenides, if what exists and what can be thought are necessarily co-extensive, it follows that we cannot think of what does not exist: we cannot, in Parmenides' way of putting the matter, think of non-being. Nor, indeed, can we even speak intelligibly of non-being; for surely we can speak intelligibly only about what we can think.

Now suppose, as some do, that the universe was generated *ex nihilo*, from nothing at all. Apparently, if Parmenides' principles

are correct, those who make this sort of claim must, upon reflection, be speaking nonsense: they are implicated in talking and thinking about nothing. But this is impossible. So, not only are they mistaken in thinking that the universe is generated *ex nihilo*, but they are also, it seems, mistaken even in thinking that they are thinking such a thing. They seem to be in the position of those who suggest that they can think of a round square, even though round squares cannot possibly exist. The person who reports that she is thinking of a round square is either disingenuous, or, if sincere, seriously confused about the contents of her own thoughts. In either event, she is wrong to suggest that she can think of a round square.

So far, then, thinking of absolute generation, generation *ex nihilo*, is impossible. Parmenides pushes his point further by contending that once we agree that we cannot think of generation, or coming into being from what is not, we are similarly precluded from thinking of change at all. After all, whenever we think of change, we implicitly think of what is not. If we suppose that a man learned to play the piano, then evidently we think he did not play the piano before learning. To put the matter in purposely cumbersome terms favourable to Parmenides, let us say that the piano-playing man was *not* before the piano-playing man came into existence – the piano-playing man *did not exist*, was, if you will, a *non-being*, before the piano-playing man was. Therein lies the difficulty: as soon as we think at all seriously about change, we find ourselves implicated in thinking about non-being. Since, however, what exists and what can be thought are co-extensive, we cannot think of non-being; neither, then, it seems, can we think of change. We think we can, but we are deluded, according to Parmenides. We can think of change only if we can think of generation; but we can think of generation only if we can think of non-being. This, however, we cannot do.

Now, Aristotle thinks that Parmenides' argument is a bad argument. He is right about that, since it has a clear flaw. Still, Aristotle is right to suppose that the argument merits careful consideration. At the very least, we will learn something of value by its consideration. Indeed, what we shall learn, suggests Aristotle, is

that there really are matter and form, as objectively existing features of the world, features existing prior to our subjective explanatory exigencies. Moreover, even when we appreciate Aristotle's solution, we shall find a more intractable if less paradoxical problem following in its wake.

To see why, let us follow Aristotle's judicious methodological precept: 'For those who wish to solve problems, it is helpful to state the problems well.'¹⁵ Here, then, is a formulation of Parmenides' argument *Against Change* (**AC**) which lays bare its essential structure:

- 1 Necessarily, what is and what can be thought are co-extensive.
- 2 Hence, it is not possible to think non-being.
- 3 It is possible to think of generation only if it is possible to think of non-being.
- 4 Hence, it is not possible to think of generation.
- 5 It is possible to think of change only if it is possible to think of generation.
- 6 It is not possible to think of generation.
- 7 Hence, it is not possible to think of change.

(**AC-7**) provides a direct statement of Parmenides' challenge. His point is not that we cannot suppose that we think of change, but rather that when we do, we are mistaken. Imagine for a moment that there is no highest prime number. Suppose further that we nonetheless think, wrongly on our supposition, that we have a proof for the existence of such a number. Our proof is complex and ingenious, but flawed – and necessarily flawed, for in fact, we are now allowing, there is no highest prime. Note, however, that if there is no highest prime, then this fact no cannot be merely contingently true. In that circumstance, we would regard ourselves as thinking of the highest prime, but we would be mistaken in regarding ourselves in that way, and necessarily so. Such, if Parmenides is right, is our situation with respect to change. We think we can think of change, because we think that we experience change as actual; but we are wrong to suppose that we think this way, and necessarily so.

2.4 MATTER AND FORM I: ARISTOTLE'S HYLOMORPHISM

Aristotle's response to Parmenides initiates his defence of the existence of matter and form, objectively construed. His response helps us further to appreciate that matter and form are correlative notions, each one relying for its explication and defence upon the other.

The first point is to draw more explicitly a distinction already implicit in Parmenides' argument, but not drawn with sufficient clarity. (AC-5), the claim that we can think of change only if we can think of generation, is really an attempt to reduce one kind of change to another. Let us stipulate that change is any form of alteration whatsoever.¹⁶ Now, we can intuitively recognize that some sorts of change involve the coming into existence of something which had previously not existed, while some other sorts do not. Thus, when a new house is built, after some process of building there exists something where earlier there had been nothing, namely a house. Or, when parents conceive and give birth, a new human being comes into existence where there had been none, namely their child. Call this sort of change *generation*. We suppose that generation occurs not least because each of us believes that there was a time before we were born, before we were conceived, when we did not exist. Contrast generation with a milder form of change, *qualitative change*, which is the sort of change undergone by something already in existence when it somehow alters. Thus, if George Washington goes to the beach for a respite and falls asleep under the bright sun, he comes to be sun-burnt. Later, as the burn fades a bit, he acquires a handsome burnished tan. The right thing to say, evidently, is not that a pale man died, followed by the birth and death of a sun-burnt man, followed in its turn by the birth of a tan man. Rather, George Washington was first pale, and then sun-burnt, and then tanned. He altered, but did not thereby perish. That is, the right thing to say is that generation is not the same as qualitative change. As Aristotle observes, "Things are said to come to be in different ways. In some cases we do not use the expression "come to be", but rather "come to be so-and-so" (Phys. 190a32–33).

Coming to be so-and-so is qualitative change; simple coming to be is generation.

It is important to reflect on the purport of this distinction for Parmenides' argument against change (**AC**). Evidently, it shows (**AC-5**) to be false, inasmuch as that premise conflates two kinds of change, generation and qualitative change. Thinkers of Parmenides' ilk, says Aristotle, went astray because 'they failed to make this distinction . . . and because of this ignorance they lapsed into still greater error: they thought that nothing beyond what is comes to be or exists, and thus they did away with all generation (Phys. 191b10–13). (**AC-5**) is false because it implicitly treats every instance of qualitative change as an episode of generation. Since one may systematically distinguish these, (**AC**) is unsound.

So much, however, does not diagnose the problem which led Parmenides to the conflation. One may state the root problem, implies Aristotle, in a linguistic mode. The problem stems from Parmenides' failure to mark two irreducibly distinct senses of the verb 'to be', corresponding to the two notions of change distinguished. In the case of generation, when we say that something comes to be, we mean that it comes into existence. Call this the existential sense of 'to be'. (We do not use this sense too often in contemporary English, but it is the sense at play in Hamlet's famous soliloquy, 'To be, or not to be . . .').¹⁷ By contrast, when we speak of qualitative change, we mean that something already in existence comes to acquire or lose a trait, that it comes to have some predicate *F* predicated of it. Call this the predicative sense of 'to be'. Armed with this distinction, we can see, even granting (**AC-2**), the claim that it is not possible to think non-being, we are not entitled to infer that we cannot think of something's changing in the predicative sense. If Washington comes to be sun-tanned, then he comes to be so not from what is not *simpliciter*, but rather comes to be *F* from something that is *not-F*, something which though not sun-tanned is nevertheless something else, something pale. Thus, even granting that we cannot think of non-being, we may nonetheless think of something being *not-F*, when it is *G*. Looked at this way, Parmenides' problem lay in his failure to distinguish what is *not-F*, what is not pale, from what is not

simpliciter. What is not *simpliciter* does not exist, while what is *not-F* may nonetheless exist, by being *G*. Hence, even if Parmenides is right that to be and to be an object of thought are co-extensive, what is *not* may nonetheless be available as an object of thought: what is *not-F* may both exist and be an object of thought by being *G*.

Notably, when proceeding with this sort of diagnosis, Aristotle does not find himself in complete disagreement with everything Parmenides had said. On the contrary, he agrees that there is a reasonable point standing behind Parmenides' argument. After diagnosing a problem with the sort of mistake made by Parmenides and other thinkers of his sort, Aristotle observes:

We also affirm [i.e. along with these thinkers] that nothing comes to be without qualification from what is not. Nevertheless, we maintain that a thing may come to be from what is not *in a certain way*, for example, accidentally.

(*Phys.* 191b13–15)

Appreciating this concession is key to understanding Aristotle's defence of matter and form.

Once we have removed the threat of Parmenides' argument, we are free to affirm what seems plain to all, namely that there is change. We do experience change. Still, all change, whether generation or qualitative change, perforce involves *complexity*. Since nothing pops into existence from nothing, all change involves something underlying, something which persists even while there is alteration. In the case of generation, when a statue comes into being, the bronze which is fashioned into the statue exists before the change and continues to underlie the statue once it is in existence. In a case of qualitative change, as when an already existing statue is painted by an artist, the statue itself continues to exist. The complex, involved in both kinds of change, put most generally, is (i) something underlying and persisting; and (ii) something gained or lost. These two factors in the change Aristotle dubs (i) *matter* and (ii) *form*. In their most general frameworks, matter is what persists through change, while form is what is gained or lost in an episode of change. In this sense, Aristotle's introduction of

matter and form – and hence of material and formal causation – depends crucially upon the existence of change, a process the existence of which was denied by Parmenides but vindicated by Aristotle's distinction between qualitative change and generation.

Taken together, then, Aristotle's base argument for matter and form (**MF**) is simple:

- 1 There is change.
- 2 A necessary condition of there being change is the existence of matter and form.
- 3 So, there are matter and form.

Aristotle's rejection of Parmenides, together with his concession to him, explains and justifies (**MF-2**): all change involves a complex of factors, something persisting and something gained or lost, which factors are precisely matter and form.

Note that this argument invokes very general conceptions of matter and form, conceptions which will develop and become increasingly refined as Aristotle begins to deploy the framework they invoke, *hylomorphism*, in a series of ever more complex applications. (The name derives from the Greek words *hylê*, or matter, and *morphê*, or form; thus Aristotle's hylomorphism is equivalently, if more clumsily, *matter-formism*.) Hylomorphism, in its most basic formulation, is, as we have seen, the view that change involves a complex, with the result that all entities susceptible to change are metaphysical *compounds* rather than simples. We can, consequently, introduce base notions of matter and form, and then characterize Aristotle's most basic conception of hylomorphism in terms of them:

- x is matter =_{df} x underlies change in the acquisition or loss of a form.¹⁸
- x is form =_{df} x is a positive attribute gained or lost by matter in the process of change.

Note that so far the notions of matter and form are tied both to one another and to a conception of change whose articulation

they have been invoked to underwrite. So, there is some circularity in the notions of matter, form, and change, though this need not be regarded as immediately problematic. We inter-define other core theoretic notions, including, e.g., the modal concepts of possibility and necessity (x is possible =_{df} not necessarily not- x ; x is necessary =_{df} not possibly not- x) without loss of clarity or explanatory power.¹⁹

However that may be, we may now state Aristotle's basic hylomorphism:

- Hylomorphism =_{df} ordinary physical objects are complexes of matter and form.

The point about 'ordinary physical objects' in this definition is rather vague, but it must be included because in due course Aristotle will come to argue for the existence of a being bereft of matter;²⁰ and he will also allow, in some fashion, the existence of abstractions, including mathematical objects, which are purely formal as well. For now, though, it is easy to think of artefacts and organisms as standard cases of ordinary physical objects. A house comes to be when some matter, some bricks and mortar, are made to realize the form of a house by the activity of a builder. So, the resulting analysis of the constructed house will require that it be a metaphysical complex: we can identify the matter of a house, its bricks and mortar, and, non-equivalently, its form, its shape or structure. Importantly, Aristotle will contend that it is the form which makes the brick and mortar qualify as a house. The same bricks and mortar manifesting a different form would be a different kind of object altogether, for example a pizza oven or a long wall along the border of a Cotswolds estate. A similar account holds in the case of organisms, although the situation now becomes more complex. An organism comes to be when some pre-existing matter comes to realize the form characteristic of that species to which the organism belongs. Thus, so much matter derived from the parents comes to realize the form of humanity, and grows, gaining matter subordinated to the realization of that form, over time. One consequential difference,

according to Aristotle, will be that a living being, unlike an artefact, has its own internal principle of change, its own internal code for development; an artefact, by contrast, is fashioned from without, by the agency of its maker. Still, an organism, no less than an artefact, is a complex, a compound of matter and form.

With that in mind, we can state Aristotle's basic hylomorphism regarding ordinary physical objects, without also worrying about the exact range of physical objects or about the important distinctions Aristotle will eventually draw between the living and the artefactual:

- x is an ordinary physical object =_{df} x is a complex of matter and form such that the presence of the form makes the matter exist as some F .

The form is that whose presence makes the matter what it is; the matter is that which persists through change and underlies the form.

2.5 MATTER AND FORM II: HYLOMORPHISM REFINED AND EXPANDED

The observation that some quantity of matter might now be a house and now be a wall, depending upon what sort of form it manifests, suggests two further fundamental features of Aristotle's hylomorphism. Almost immediately upon introducing the notions of matter and form in the course of his refutation of Parmenides' unsuccessful argument against change, Aristotle observes that another sort of response might equally have served: 'This, then, is one way of solving the difficulty. Another is to observe that the same things can be spoken of in terms of potentiality and actuality' (*Phys.* 191b27–29).²¹ He might have appealed to these notions to the same end of refuting Parmenides because there is another way of pointing out the problem with (AC-5), the claim that it is possible to think of change only if it is possible to think of generation. So far we have proceeded by distinguishing the existential from the predicative senses of the verb 'to be' and have

conceded that even if it is not possible to think of what does not exist, it is nonetheless possible to think of what is not predicatively *F*, since we may think of what is not *F* as what is *G*, for instance of what is not sun-tanned as what is pale. Another way of putting very nearly the same point is this: we may think of what is not actually *F*, because some actually existing *G* is potentially *F*, for example some actually pale man is potentially sun-tanned. That is, even if we are prepared to concede that we cannot think what does not exist, we do not thereby allow that we cannot think of something which is actually *G* but only potentially *F*. Consequently, again, Parmenides is misguided in his attempt to reduce qualitative change to generation.

Structuring his rejection of Parmenides by relying on the notions of actuality and potentiality permits Aristotle to introduce two further concepts fundamental to his hylomorphism. That these concepts might equally have sufficed for this purpose in place of matter and form already suggests the closeness of the connection Aristotle envisages between the two pairs: (i) matter and form, and (ii) potentiality and actuality. This is a connection he makes explicit in his *Metaphysics*, when he says: ‘Matter exists in potentiality, because it may move into a form; and to be sure, when it exists actually, it is in its form’ (*Meta.* 1050a15–16). In fact, instead of relying on the notion of change for definitional purposes, we might equally have said:

- x is matter =_{df} x exists in potentiality.
- x is form =_{df} x makes what exists in potentiality exist in actuality.

There are two advantages to proceeding this way. If we accept potentiality and actuality as our primitive notions, then we may define matter and form in terms of them, and subsequently define change in terms of matter and form. That is, we can argue for the existence of matter and form by showing their indispensable role in change, and then in turn show how they may be defined in terms of two other primitive notions, for which we do not argue, namely actuality and potentiality.

Note that proceeding in this way is partly only a matter of expository convenience, but does have the advantage of taking as primitive two further notions, themselves interdefined, which are relatively easy to illustrate. If Cora is not now in love, she is nevertheless potentially so. When she comes to love someone, she has changed somehow and has become actually in love. It is important to note in this connection that Aristotle's concept of *potentiality* is not equivalent to the related notion of *possibility*. When we say that Cora is potentially in love, we mean more than that it is possible for her to fall in love. Rather, she has the real capacity, given the kind of being she is, for loving. Her potentiality thus says more about her than some bare possibility. We may have a dream in which the refrigerator talks to us by flapping its door open and shut, entreating us, 'Come along now, why not have a lovely cheese sandwich? There is also some nice wine in the cupboard.' When we look to the cupboard, it follows suit, but says, 'Don't look at me like that. I cannot talk; I am a cupboard. Fool.' This dream represents what is possible, at least in the sense that it shows us something conceivable; it is precisely the sort of thing that an imaginative cartoonist might represent as actual. Still, in fact, refrigerators and cupboards lack the capacity to speak, and so lack the capacity to tell us that they cannot speak. If we dream of our mother offering us a cheese sandwich, then we dream of someone, our mother, of whom it is true to say that she potentially speaks, and not as a bare possibility. She has this potentiality in virtue of her being a rational being, with a mind, and a mouth and vocal cords – all features wanting in a refrigerator. Potentialities are grounded in real facts and in the actual features of the entities which manifest them.

For this reason, when Aristotle claims that he may equally have appealed to the notions of potentiality and actuality in his refutation of Parmenides, he suggests that his hylomorphism has at its conceptual foundation two further interdefinable concepts, contentful concepts upon which his explanatory edifice rests. He does not propose to reduce these concepts to anything more fundamental. Still, to the extent that they are made clear by illustrations, actuality and potentiality may serve the purposes he foresees for them.

At the same time, the notions of potentiality and actuality introduce a refinement into Aristotle's hylomorphism, one showing a further way in which his concerns about change, even when allayed, can yield surprising consequences. When he confronted Parmenides with his hylomorphic analysis of change, Aristotle conceded something significant, namely that there is no generation *ex nihilo*, that nothing simply pops into existence from nothing at all. Chairs are made from pre-existing wood, statues from bronze, and so forth. Nonetheless, when distinguishing the two kinds of change he accused Parmenides of conflating, namely generation and qualitative change, Aristotle committed himself to two irreducibly distinct kinds of change. In fact, though, given his concession, one might well wonder why he is entitled to do so. If we think that all change, of whatever kind, involves the acquisition or loss of some form by some matter, then how is there real generation? Why, that is, are we precluded from representing the production of a statue or a human being as an instance of qualitative change rather than as a case of *bona fide* generation? If we say that a fence continues to exist when it is painted from grey to white, and thus suffers qualitative change but not generation, then we may equally say that a quantity of bronze alters when it loses its blob shape and acquires its fire-fighter shape. There seems to be no more need to hypothesize real generation in the case of a statue than there was in the case of a fence. In each instance, we have some underlying stuff which persists, the matter – the fence and the bronze. What persists loses one form and acquires another. The fence loses greyness in favour of whiteness, while bronze loses its blob shape when acquiring its fire-fighter shape.

Aristotle's response is to take the first in a series of steps intended to refine and augment his conception of form by making it ever more metaphysically robust. So far, we have thought of forms in the broadest possible terms, as positive traits and as nothing more. This, indeed, is how Aristotle himself first introduced the notion in the context of analysing change. Then we followed him in refining the notion of form slightly, by regarding it in some cases not merely as a positive attribute, but as a positive attribute of a particular kind: as a shape. A shape is a complex

configurational feature, something, we have suggested, whose presence is capable of making a statue what it is. When, and only when, the lump of bronze manifests the shape of a fire-fighter does it constitute a statue of a fire-fighter; when it is molten and recast as a railing, the lump is no longer a statue but a railing. In so speaking, we have implicitly gone part of the way towards Aristotle's first and most important development in his approach to forms.

When confronted with the worry that all cases of generation might be reduced to qualitative change, Aristotle's response is to distinguish two kinds of forms, corresponding to two ways some parcel of matter may be said to be made actual. Aristotle contends:

Only substances (*ousia*) are said to come to be without qualification. Now in all cases other than substance, it is plain that there is necessarily something underlying, namely the thing which comes to be [a certain way] . . . But that substances, things said to be without qualification, also come to be from some underlying thing, will be clear to one examining the matter. For there is *always* something which underlies what comes to be, from which what comes to be comes, for instance, animals and plants come from seed.

(*Phys.* 190a32-b5)

Some forms are such that they make a parcel of underlying matter *beings without qualification*, whereas in other cases this does not occur.

A being without qualification is a substance, an *ousia* in Aristotle's language. An *ousia*, literally, 'a being',²² is the only sort of thing which comes into being, or is generated. Aristotle regards the sorts of forms at play in this sort of change as distinct from the sorts of forms involved in qualitative change. Thus, we may further distinguish:

- x is a substantial form = $_{df}$ x is what makes what exists potentially exist unqualifiedly.
- x is an accidental form = $_{df}$ x is what makes what is potentially F , where F is not a substantial form, actually F .

This formulation takes as basic the notion of existing unqualifiedly, and then defines accidental forms negatively in terms of their not being substantial. Although the idea will receive much fuller treatment,²³ for now it will suffice to say that a being which exists unqualifiedly, a substance, is the sort of thing which does not rely upon anything else for its existence, in the sense that an account of what it is need make no reference to anything beyond the thing in question. A substance is not ontologically parasitic upon any other kind of being. To appreciate what Aristotle has in mind, we might agree, provisionally, that a quantity is not a substance because a quantity is necessarily a quantity of something; a quality is not a substance, because a quality is always a quality belonging to something; less straightforwardly, a musical man is not a substance, since a musical man depends upon the existence of a man for its existence, and not the other way around.²⁴

As another first approximation, developing our intuitive thoughts about statues, we may think of a substantial form as the kind of feature whose presence makes a being what it is, and which, when lost, results in that being's ceasing to exist. Accidental forms, by contrast, may come and go without threatening the existence of the beings whose forms they are. To approach Aristotle's distinction between substantial and accidental forms, think first about yourself. Plainly, you could continue to exist if you had one less hair upon your head. Thus, let us say, you at present have an even number of hairs upon your head; if you pluck one, in the interest of solidifying your understanding of the substantial/accidental form distinction, you will find that you still exist, though you have changed inconsequentially. You are now a person having an odd number of hairs upon your head. So, the form, having an even number of hairs upon your head, is an accidental form of yours. By contrast, there are other forms for which this seems not to be true, for example, *being human*. Without arguing for the distinction in the current context, it suffices to note that being human, unlike having an even number of hairs upon your head, qualifies as a substantial form of yours.²⁵ Without being human, you would cease to exist. In any event, if

you had your molecules scattered throughout the solar system by a fiendish scientist involved in a grotesque experiment, the reasonable thing to conclude would be that you had perished, not that you were now simply spread out. Or, less dramatically, if a glass of wine is poured into the Pacific Ocean, at some point the wine ceases to be wine; the Pacific Ocean does not merely become an unusually diluted glass of pinot noir. In your case, it is reasonable to say that you had perished because the quantity of matter which had realized your human form has ceased to do so. A human form, unlike an accidental form, is the sort of form whose presence makes something existing in potentiality exist unqualifiedly. So, being human is a substantial form, the kind of form which suffices for generation, rather than mere qualitative change.

For these reasons, Aristotle's hylomorphism is simultaneously complicated and enhanced by the notions of potentiality and actuality. When these notions are deployed as ranging over distinct kinds of forms, the substantial and the accidental, we can come to appreciate that substantial forms make matter into something which exists in a basic, non-derivative, independent and unqualified way, whereas the acquisition of an accidental form makes what already exists unqualifiedly change qualitatively without taking anything into or out of existence. If there are substantial forms, then their actual presence explains how generation is possible, even though everything comes to be from some pre-existing matter, as potential.

2.6 THE EFFICIENT CAUSE

Thus far we have been given reason to suppose that matter and form are features of objective explanations: they are the factors in the world explaining change, whether substantial or qualitative. For this reason, we have reason to accept them as objectively existing.

The efficient cause, it is often suggested, needs no such defence. Aristotle identifies a kind of cause which is responsible, as an active feature, for the bringing about of some change. He variously characterizes this cause as the moving cause (*to kinoun*), where

his language clearly indicates that intends the kind of cause which initiates motion, as the *source of change* (*archê tês kinêseôs*), or simply *what, primarily, moved something* (*ti prôton ekinêse*) (Phys. 194b29–32; GC 324b13–18; APo. 94b233). It is often said that the efficient cause is most like our notion of cause: it is that which brings about visible motion and alteration in the world. We see one billiard ball collide with another and bring about the motion of the second. We can explain the trajectory, speed, and spin of the ball put into motion in terms of the trajectory, speed, and spin of the ball putting it into motion. Aristotle's efficient cause seems precisely this. (Note that Aristotle does not in fact use any Greek term corresponding directly to 'the efficient cause'. The entrenched practice of using this phrase in English arises out of medieval developments of Aristotle's doctrine. Because the developments are themselves unobjectionable, the continuing use of the common English name is warranted.)

The tendency to align Aristotle's efficient cause with our notion of cause may be fine as far as so much suggests, but unless caution is exercised here this practice can be nonetheless doubly misleading. Looking first towards 'our notion of cause', it seems plain that we do not have a notion of cause. On the contrary, accounts of causation in contemporary philosophy vary widely, ranging from those which suppose causes to be sufficient conditions, or necessary conditions, or necessary and sufficient conditions, to approaches which treat causes probabilistically, as events which raise the probability of the occurrence of other events to above .5, to contingently related events falling under necessarily related universals, to non-co-incidental events.²⁶ Philosophers further dispute about whether causation is extensional or intensional;²⁷ whether it is inherently explanatory or not; whether only events may serve as the *relata* in cases of causation, or whether agents can be causally efficacious; and whether instances of singular causation are possible. In all these ways, our notion of causation is volatile. Accordingly, it is difficult to suppose that there is some common core to all of these accounts, a core which qualifies as our notion of cause, as a sort of standard with reference to which Aristotle's efficient cause may be comfortably compared. Moreover,

we have already seen one feature of Aristotelian causation putting him at variance with a widespread if rarely defended assumption in many contemporary approaches to causation, according to which causes are temporally prior to their effects. Aristotle, in contrast to this presumption, treats efficient causes as processes co-temporaneous with their effects.

Looking in the other direction, it will turn out that some of Aristotle's efficient causes can be causes of motion without being themselves in motion. Evidently, for Aristotle, something may serve as a cause of motion without imparting its own motion to its effects, precisely because the cause in question is not in motion. Perhaps this is something we can accommodate in a contemporary framework, though this has been doubted.²⁸ In any event, this is at least one way in which there is a potential mismatch between Aristotle's conception of efficient causation and some more readily familiar contemporary understandings.

Bearing those provisos in mind, we can allow that those who identify Aristotle's efficient causation as a recognizably causal notion in the way, e.g., that material or formal causes are not, or are not immediately, do have a point. Some paradigmatic cases of efficient causation will equally count as paradigmatic for several widely endorsed contemporary approaches to causation.

One further point of contact is this: Aristotle does not think it is especially worth his while to argue that there are efficient causes. In this way, he is like the vast majority of contemporary philosophers who wrangle about the correct analysis of causation without stopping to argue that *there are in fact causes operative in the world*; they agree that there are causes, but then disagree about how those causes are best to be understood. In Aristotle's case, any suggestion to the effect that there are no efficient causes is tantamount to the claim that there is no motion. Hence, in effect, any claim in this direction is a challenge to the first premise in Aristotle's argument for the existence of matter and form, (MF-1), the simple claim that there is change.

Aristotle displays a bit of impatience with those who adopt such postures, partly because he accepts the existence of change as a datum to be explained and not as a conjecture to be contested:

‘To maintain that all things are at rest, and then to seek an account of this by disregarding sense perception would indicate feebleness of mind’ (Phys. 253a322–24). Still, he does not refrain from addressing the critic in question by means of a potent counter-argument. We will all agree that it *seems*, according to sense perception, that there is change. Surely, in any event, it seems undeniable that we seem to experience change. If you pick up this book and toss it in the rubbish bin, then you will see it move through the air, thus changing its location; if you leave the book unread on the desk before you, but blink while looking at it, then you experience change in your visual field; indeed, even if you see it before you without blinking, and consider reading it but then decide against, you have just been the subject of a series of mental changes. If someone denies resolutely that we *seem* to experience change, then although we cannot refute her directly, we would do well to cease chatting with her, setting her aside as someone who is obstinate for the sake of obstinacy. After all, even Parmenides agreed that there seems to be change; this is why he felt the need to advance so uncompromising an argument for his surprising denial of the existence of change.

Now, suggests Aristotle, if someone agrees that we seem to experience change, but believes that she has an overpowering argument to the contrary, then she is enjoining us to imagine that the world is not at all as it seems, and thus, overcome by the crushing power of her argument, to amend our beliefs accordingly. In such an eventuality, queries Aristotle, are not mental alterations, including episodes of imagination and belief formation, themselves changes? Aristotle contends they are (Phys. 253a32-b6, 254a23–31). So, if the detractor of change enjoins us to change our belief about what seems to be the case, viz. that there is change, then she enjoins us to do what she says cannot be done, namely *change* our minds. Hence, her request is self-undermining and incoherent. If the critic retorts that she is not enjoining us to do any such thing, then, of course, we have no reason to respond to her: she, having said nothing, merits nothing in response. Taking all that together, if the critic denies that there seems to be change, there is nothing further to say. If she agrees

that there seems to be change, but supposes that any belief to this effect is systematically mistaken, then she exhorts us to do what she denies we can do, namely *change* our thinking. In that case, however, she advances an immediately self-enfeebling claim.²⁹

Consequently, we remain perfectly justified in asserting what we know to be true, that there is change. If there is change, however, then there seem to be causes of change. The alternative, certainly a logically possible one, is to suppose that changes occur uninitiated. If we are disinclined to accept that expedient, then we are prepared also to agree that there are efficient causes, as mind- and language-independent features of the world, features which, consequently, require recognition in any account of explanatory adequacy.

2.7 THE FINAL CAUSE I: PROBLEMS WITH ARISTOTLE'S COMMITMENT TO TELEOLOGY

We habitually ascribe final causes to actions, events, and artefacts, even if we do not do so self-consciously or by that name. Why did she stop at the organic food store? She did so *in order* to buy organic milk. Why was there a large rally and protest march in London? People marched *so that* they could make their opposition to the murderous and unnecessary war known. To revert to our earlier example, why is there a statue high in the mountains? It was placed there *in honour* of the fire-fighters who fell while trying to combat a raging inferno.

Do we say, though, that the inferno was itself *for* anything? Here opinions divide. In some instances, we may say that we have a complete explanation without any appeal to final causation, as when we discover that the fire was caused by some careless scouts who neglected to douse their campfire before breaking camp. Sometimes, though, we think otherwise, as when, for instance, we learn that the fire was deliberately set by an out of work fire-fighter hoping for gainful employment. In this case, we may say that the fire was intended to serve some purpose, namely that of creating economic opportunity. Sometimes, more tendentiously, one reads ecologists asserting that forest fires have been only

wrongly suppressed by natural park managers, because nature regulates the health of the forests via a cycle of growth, destruction, and rebirth. Forest fires, they say, are *for the sake of* healthy forests, where health needs to be considered in time frames outstripping the interests of blinkered humans and their local preoccupations.

When we appeal to final causes, we may, as in appeals to other kinds of causes, be right or wrong, justified or unjustified. If we say that the woman stopped at the store in order to buy organic milk when she in fact went there in order to meet a double agent posing as an organic shopkeeper, then we are wrong, because we have cited the wrong final cause. There is a strong tendency, however, to suppose that there is another sort of problem, a deeper, more distressing mistake associated with Aristotle's notion of final cause: would it not be preferable to avoid speaking in terms of objectively existing states of affairs as explanatorily efficacious final causes by referring instead to an agent's beliefs and desires as efficient causes? Why, that is, refer to some end-state as a cause, when we can equally, and preferably, refer to a subject's antecedent beliefs and desires as the causes of her action? Indeed, suppose in the case imagined that there is no double agent, that the woman is delusional. Should we cite a non-existent meeting with a non-existent double agent as the final cause of a woman's going to the organic shop? There seems to be nothing available to cite. Aristotle's explanations were supposed to be objective, but here there is no object in view.

In fact, there are two distinct forms of complaints lodged against Aristotle's notion of final causation, no matter how innocuous and prevalent our practice in appealing to them may be. Firstly, it is thought, final causes are merely convenient fictions and as such are dispensable because reducible to other more routine kinds of causation.³⁰ Secondly, and more strongly, it is urged that such talk must be dispensed with, because the notion of final causation is worse than explanatorily vacuous: it is positively incoherent.

In view of these sorts of charges, Aristotle owes a defence of teleological causation, especially given his contention that for a

broad range of cases, an objective explanation is incomplete without an appeal to a final cause. Interestingly, although it is often suggested that the rise of quantitative science doomed teleological causation, Aristotle was already faced with an analogous objection in his own day.

There is a puzzle in this: what precludes nature's acting not for the sake of something, nor because something is better, but of necessity – rather, just as Zeus's rain falls, not in order to make the grain grow, but of necessity? For it is necessary that what has been drawn up is cooled, and that what has been cooled and has become water comes down; and it is co-incidental that this makes the grain grow. Similarly, if someone's grain is spoiled on the threshing floor, it is not the case that it rains in order for the grain to spoil. Rather, this occurs co-incidentally.

(Phys. 198b16–23)

Aristotle envisages an objection to final causation, given in terms of natural necessity. Why not speak simply and exclusively in terms of the natural material necessities and nothing more? If every explanation can in principle be given in terms of natural necessity, then perhaps it will be simply superfluous to appeal to final causes. In the face of this concern, Aristotle sees the need to advance a defence of teleological causation.

To appreciate Aristotle's defence, let us begin with an example sympathetic to his approach. Suppose while walking on a remote beach we come upon what appears to be an artefact, but of what sort we cannot say. It has a white, conical shape, with wires and silicon chips within, all connected to a central component board of some sort. While we acknowledge that it might be something created spontaneously, by a freakish natural event, we are nevertheless perfectly justified in thinking of it as an artefact. We know, in Aristotle's terms, its material cause, because we have analysed it. It is so much copper, silicon, and plastic. Suppose, moreover, now somewhat incredibly, that walking further along the beach we come upon a factory full of large robotic devices producing artefacts of the kind we have already found, though we can find

no-one to explain to us what the artefact is. No-one is attending the robotic machines, which simply mould, assemble, finish, and package the items in question. Now we are completely sure that we have an artefact before us, and we have uncovered its efficient cause. Further, in the most general and thin notion of formal cause, we have appreciated its form, its structure or shape. Still, we do not know what it is. The only thing lacking in our understanding seems to be some other kind explanatory factor. This factor Aristotle calls the final cause.

When at long last we discover an instruction manual in the bottom of one of the packages into which the item is robotically placed, we learn that the artefact is an AirPort Extreme wireless transmitter, used to broadcast the internet to computers with appropriate WiFi cards installed. Now, and arguably only now, do we have an explanation of the artefact: only when we ascertain its function, only when we know what it is for, only, that is, when we have grasped its final cause, do we have the explanation we were seeking.

So far, perhaps, no-one should disagree. After all, we know how the transmitter came to have the final cause it has: we gave it its function, and this function is what it is for. Finding ourselves with some need or desire, we developed a tool, a sophisticated tool, made of just the right suitably sophisticated stuff, and pressed it into our service. In general, there can be no interesting question about whether artefacts have final causes in Aristotle's sense. Note, however, that he has a much broader role for his final causes to play: he wants to show that final causes are operative 'in nature', where the natural contrasts with the realm of the artefactual. Thus, he claims:

As things are in action, so they are in nature; and as they are in nature, so they are in action, so long as nothing interferes. But action is for the sake of an end. So, natural things are also for the sake of something. For example, if a house were to come to be by nature, it would come to be as it in fact now comes to be by craft. And if things which come to be by nature came to be not only by nature but also by craft, then they would come to be just

as they do by nature – one thing would come to be an account of another . . . If, then, things coming to be in accordance with a craft are for something, clearly so too are things coming to be in accordance with nature. For later stages are related to earlier among things coming to be in accordance with nature just as they are among things coming to be in accordance with a craft

(*Phys.* 199a9–20)

In this passage, Aristotle asserts that we have the same reason to ascribe ends to items in nature that we have in the case of artefacts: we see certain things fitted to tasks of various sorts, such that those tasks explain their structures. We see eyes fitted to animals for the purpose of navigating, which involves their using light and colour detectors, which in turn explains the internal structures of their eyeballs. In such cases, it seems plausible to Aristotle that we should want to appeal to function to explain structure. Still, importantly, in the realm of nature, there is no designer available. Consequently, he wants to argue that some entities have final causes even though they were not given those causes by the activities of conscious designing agents to whose interests the functions in question owe their existence. Paradigm instances of designerless function-laden entities are the parts of animals. Moreover, whole animals, indeed all living beings, according to Aristotle, have final causes. This, of course, includes us. We have final causes, though no-one has given them to us.³¹

In order to understand how Aristotle builds to this conclusion, it is imperative to see first that he contends that it makes perfect sense to speak of at least some entities as sporting final causes even though they have not been designed by any conscious agent. He claims, for example:

It is odd for some to suppose that things do not come to be for the sake of something unless they see an agent deliberating. After all, art does not deliberate. If the ship-building art resided in wood, it would produce its same results by nature. Consequently, if that for the sake of which is present in art, it is also present in nature. This is made most clear when a doctor doctors himself:

nature is like that. It is plain, then, that nature is a cause, and indeed cause of this sort: a cause for the sake of something.

(*Phys.* 199b26–33)

So far, his defence is limited, removing only one fairly inconsequential impediment to supposing that final causes are operative in nature. We see civic planners and engineers deliberating about how to design the items in their spheres, but we never see nature pausing to wonder whether kidneys are optimally suited for filtering blood. Aristotle's response is that we can very often observe actions done for the sake of some end even though no deliberation has preceded them. That what he means when he speaks of a doctor doctoring himself: being an expert in his craft, and knowing his own symptoms from the inside, he can, in some cases does, move immediately to the cure without having first to consider various options available to him. Still, he acts for the sake of curing himself. Similarly, musicians do not stop to deliberate in the middle of a performance about which violin string to press. Arguably, their doing so would ruin their performance. When they play, they deliberately press the G-string in order to produce a sound, one component of a melody, which is their ultimate objective. Here too deliberation is not a necessary condition of their acting for the sake of some end. Accordingly, infers Aristotle, a lack of deliberation is compatible with the presence of teleological causation. Hence, lack of deliberation is compatible teleology. Consequently, it is no bar to the existence of final causes in nature that nature never deliberates.

That may seem fair enough, as far as it goes, but it hardly goes far enough. Presumably, someone who doubts that final causes are present in nature is impressed by more than the fact that nature does not deliberate. Doctors and violinists act for ends without deliberating, but they, unlike nature, do have minds. Moreover, doctors and violinists act without deliberation because of their long practice and habituation, all of which involves a great deal of deliberation. Nature is thus in a salient way unlike a doctor doctoring himself or a violinist performing a sonata. Nature, unlike these kinds of agents, is not minded at all; nature is

not a being with intentional states. There is an obvious reason why computers have the functions they have: they were designed to have them by creatures with intentionality. No such creature designed our teeth. The reason doctors do not deliberate at some times before acting is because they have earlier deliberated well and have developed entrenched habits of informed acting. If nature acts without deliberation, this is not because it acts from a well-established pattern of spontaneous action given rise by protracted deliberate intentional attention at an earlier time.

Aristotle's response is two-fold. Initially he offers an argument which should strike us as unconvincing. Subsequently, though, he appeals to some deeper and more engaging sorts of considerations.

To appreciate his first argument, it is useful to see that he may be understood – and seems to have understood himself – as positioned between two extremes: those who see no purpose in nature whatsoever and those who see purpose only where there is design. Let us call the first sort of theorists *teleological eliminativists* and the second sort *teleological intentionalists*. Teleological eliminativists simply deny that purposes are present anywhere in nature: if we think that our kidneys are for filtering blood, or that bees dance in order to warn their swarm-mates of the presence of predators, or that fancy plumage serves the end of reproductive fitness, then we are sorely mistaken. Such eliminativists were known to Aristotle in the figures of Empedocles, Democritus, and Leucippus. Teleological intentionalists, by contrast, might or might not find purpose in nature; it is just that they will find it there if and only if there is a designer of the universe who has given nature or its parts purpose. A teleological intentionalist may well, then, find nature acting for the sake of some end, may think that our eyes are for detecting light, but only because we have been marvelously outfitted by the providential God who created the universe. Although the parallel should not be pressed too far, one figure known to Aristotle, Anaxagoras, tended in the direction of teleological intentionalism.

Aristotle seeks a middle course between teleological eliminativists and teleological intentionalists. As he sees the matter, teleological eliminativists deny purpose where it exists, whereas

teleological intentionalists restrict purposiveness unduly by finding it only in relation to designing intelligence. He contends that eliminativists can offer only impoverished and incomplete explanations, whereas intentionalists import more than is required for adequacy in explanation. He argues most stridently against the teleological eliminativists, giving less thought to the intentionalists. Still, it is worth appreciating that if his argument against the eliminativists is persuasive, then the alternatives remaining seem to be either intentionalism or his own preferred, non-intentional, non-eliminative realism about teleological causation in nature.

Against the eliminativists, Aristotle considers the hypothesis that perhaps everything in nature happens by necessity. We say that puddles in the street evaporate due to the dryness of the air, that when enough moisture collects in the atmosphere, water condenses, clouds form, and rain falls. If the rain falls on our holiday parade, thereby spoiling all of our fun, we would be foolish to insist that the rain fell *in order to* ruin our day. The cycle of rain, evaporation, condensation, and rain happens of necessity, and not for the sake of anything. Perhaps we should view all of nature this way: everything happens by material necessity, with the result that appeals to final causation have no purchase. In response to this sort of posture, Aristotle begins by noting something obvious, that we do not begin the day supposing that there is no purpose anywhere in nature. On the contrary, in some corners of nature, we unreflectively speak as if purpose were present. Consider the organs of human beings. We think hearts are for pumping blood, that teeth are for tearing and chewing, that kidneys are for filtering blood, and that, by contrast, the appendix may have lost its function is merely vestigial. When considering those who simply deny purpose in any of these connections, Aristotle claims, stridently, 'It is not possible that things should really be this way' (*Phys.* 198b33). Unfortunately, as suggested, his initial argument for this conclusion does not provide him the support he requires. He claims:

For these [viz. teeth and all other parts of natural beings] and all other natural things come about as they do either always or for

the most part, whereas nothing which comes about due to chance or spontaneity comes about always or for the most part. . . . If, then, these are either the result of co-incidence or for the sake of something, and they cannot be the result of co-incidence or spontaneity, it follows that they must be for the sake of something. Moreover, even those making these sorts of claims [viz. that everything comes to be by necessity] will agree that such things are natural. Therefore, *that for the sake of which* is present among things which come to be and exist by nature.

(*Phys.* 198b32–199a8)

In saying that even those insisting that everything occurs by material necessity will allow that the items in question – teeth and various other naturally occurring phenomena – come about by nature, Aristotle signals that he is concentrating on teleological eliminativists, and setting aside for the present teleological intentionalists. Against the eliminativists, he suggests that it is simply implausible to suppose that features which provide benefits over and over again occur by chance. Should we think that it is simply happenstance that our kidneys show up by chance over and over again, generation after generation, ever suited to filter blood? That seems problematic: if a man meets a woman after work for 150 days running, sometimes in the café, sometimes in the grocery shop, sometimes in a pub, and sometimes in a motel lobby, we should be hard pressed to accept that suggestion that they have just chanced to meet, by accident, 150 times in a row. Rather, their meetings are for the sake of something: their meetings have a final cause.

The argument may have a superficial plausibility, but when it is examined more closely, it is seen to be unacceptable. Aristotle's first argument for teleological causation (**ATC**), in schematic form is:

- 1 Natural phenomena exhibit regularity, occurring 'always or for the most part'.
- 2 Things happen either by chance or for the sake of something.
- 3 What happens by chance does not exhibit regularity; chance events do not occur 'always or for the most part'.
- 4 So, natural phenomena occur for the sake of something.

Hence, (ATC) concludes, if the eliminativists reject final causes on the grounds that they are inoperative in nature, their explanations are incomplete.

The most obvious problem arises with respect to (ATC-2), which is evidently intended to be an exclusive and exhaustive disjunction. In any event, if it is not so construed, then the argument is formally invalid. If this is correct, however, then (ATC-2) leaves no room for regularities which are neither accidental nor purposeful. Unfortunately, there are such, with the result that (ATC-2), thus interpreted, is false. For instance, as my heart pumps blood, it also thumps. This is a clear regularity, but it is neither purposeful nor accidental. On the contrary, though there is a nomological, or law-governed, connection between muscle contraction and noise, my heart does not beat in order to make a thumping noise. When we fly in aeroplanes, we predictably, because regularly, engage in an activity which pollutes the atmosphere. This too is nomological and not accidental. Still, no-one flies in order to pollute the atmosphere.

These sorts of examples are readily multiplied. They are instances of regularities which are not susceptible of teleological explanations. They show, therefore, that (ATC-2), interpreted as an exclusive and exhaustive disjunction, is false. Yet if it is not taken this way, the entire argument is formally invalid. Hence, taking all that together, either (ATC-2) is false and the argument is unsound or (ATC) is formally invalid. In either case, then, (ATC) is unsound.

That said, it is surprising that Aristotle should assent to (ATC-2), as he undeniably seems to do. For in his biological writings, he is himself keen to point to countless instances of non-purposive regularity (PA 676b16–677b10, GA 778a29–b6). So, it would be unfair to allow the matter to rest there. Perhaps, then, he is assuming that in cases where we have non-teleological regularities, this is due to there being underlying teleological causes. Thus, for example, if a heart is for pumping blood, and its pumping nomologically necessitates its making noise, then its noise-making is epiphenomenal upon its pumping.³² In that case, (ATC-2) could be re-written as:

(**ATC-2***): Unless epiphenomenal, things happen either by chance or for the sake of something.

Such a restructuring, however, seems problematic. So far, at any rate, the eliminativists will rightly be unimpressed with an appeal to epiphenomenalism; for the features in question seem to be epiphenomenal only on the final causes whose existence is currently in dispute. Minimally, it would be dialectically awkward to proceed along these lines. That is, we are in the process of wondering whether various features are for the sake of something. To insist that *circulating oxygen for the sake of the organism* is not an epiphenomenal regularity of a heart's beating, while its making a thumping noise is, seems already to presuppose that some regularities are indeed for the sake of something. That, however, is just what the eliminativist doubts. Moreover, such a response seems only to postpone the problem, since there also seems to be non-epiphenomenal, not-accidental regularities, which are nonetheless not for the sake of anything. For instance, a man who leads a meticulously scheduled life might walk his dog in Reading at 5.20 in the morning at the exact instant the Oxford to London morning train pulls into the Reading station. Perhaps he is so punctual that those who commute to London on the train come to rely on his presence to indicate whether they are on time as they arrive at the station. The events in question are not epiphenomenal, but also non-accidental, since each, in its own sphere, is so perfectly regular. If that is so, however, then an eliminativist still need not be impressed with this argument, since (**ATC-2***) fairs no better than the original (**ATC-2**). Consequently, (**ATC**) is not immediately promising as directed against the eliminativists.

2.8 THE FINAL CAUSE II: TELEOLOGY EXPLORED AND GROUNDED

It would be a shame if the matter were to rest there. First, as becomes clear from studying his work, Aristotle adverts repeatedly to the final cause as an explanatorily fundamental principle. In subsequent chapters we shall find appeals to teleology cropping

up in his physics, his metaphysics, and his psychology, as well as his ethical theory, politics, and theory of rhetoric; indeed, his theory of tragedy is routinely misunderstood by those who fail to grasp its teleological moorings. If the entire edifice of Aristotle's philosophy rests upon an unmotivated and indefensible commitment to teleological explanation, then our interest in his thought could be at best antiquarian. Second, and more immediately, Aristotle's defence of teleology is in fact not encapsulated in this single passage of the *Physics*, which has captured a disproportionate amount of scholarly interest. In fact, he provides additional support in other passages, some of it much more complex and metaphysical in character than we have encountered so far, but also much less problematic. For these reasons, Aristotle's defence of teleology merits further consideration.

Towards this end, it is important to begin by noting that whether or not any variety of Aristotelian teleology remains viable today in any sphere, many of his detractors are alarmingly wide of the mark in the target of their criticisms. The fact is that Aristotle simply did not subscribe to most of the views ridiculed in his name. To take but one typical example, the American behaviourist psychologist B. F. Skinner reports, bewilderingly, 'Aristotle argued that a falling body accelerated because it grew more jubilant as it found itself nearer its home.'³³ As Skinner would have it, Aristotle held to the belief that a rock rolls down a hill because it rejoices in moving downwards and grows ever more animated as it approaches its destination. Aristotle's rocks, according to Skinner, have feelings and thoughts about their proper place in the cosmos – attitudes sufficiently sophisticated that they manifest complex propositional attitudes which bring them joy and spur them to act in ways determined to secure their ends. Perhaps the silliness of this perversion would not be worth recounting if it were merely aberrant. Unfortunately it is not.³⁴

Other criticisms are not so obviously wide of their mark; and it is incontestably true that some of those at the forefront of the rise of modern quantitative science saw themselves as superseding a version, however attenuated, of Aristotelian teleology. Boyle, for instance, contends: 'The treating of final causes in physics has

driven out the inquiry of physical ones, and made men rest in specious and shadowy causes, without ever searching in earnest after such as are real and truly physical. And this was done not only by Plato, who constantly anchors upon this shore, but by Aristotle, Galen, and others.’³⁵ Interestingly, many of the figures of the early modern era critical of blind teleology of nature at the same time embraced a kind of intentionalist teleology, according to which the natural universe should be understood to be an orderly manifestation of God’s plans. Thus, Newton maintains: ‘We know [God] by his most wise and excellent contrivances of things, and final causes . . . Blind metaphysical nature could produce no variety of things. All that diversity of natural things which we find suited to different times and place could arise from nothing but the ideas and will of a Being necessarily existing.’³⁶ Even now, when it is easy read Newton’s appeals to final causation achingly pre-Darwinian, it bears emphasizing that many contemporary critics of Aristotelian teleology rely upon precisely his intentionalist presuppositions.

The point of recounting some of these authors is not to gain some *ex autoritate* credence for Aristotle’s teleology. On the contrary, that we find serious thinkers disagreeing about the character and value of Aristotelian teleology only commends a closer look at Aristotle’s own position on the matter. Some have rejected Aristotle for treating inanimate nature as intentional; others have faulted him for supposing that if nature itself is not intrinsically intentional, it must – given the presence of final causes in nature – be ordained by a providential god; and still others have found fault with his countenancing final causes of any kind, in any domain. Minimally, Aristotle could hardly be guilty of so many sins simultaneously.

In fact, as we have already seen, Aristotle himself wants to find a middle way between teleological eliminativists, who reject all appeal to teleology, and intentionalists, who find teleology only where it is the result of conscious design. Looked at from even a distant remove, Aristotle is right to observe that eliminativists seem extreme. Surely we recognize *some* instances of teleology operative in the world. Presumably, when Aristotle seeks to illustrate

the teleology of nature in terms of a doctor doctoring himself, it is because he takes it for granted that human actions are for the sake of something. As he asserts without argument at the beginning of the *Nicomachean Ethics*, 'Every craft and every inquiry, and similarly every action and choice, is thought to aim at something good' (EN 1094a1). Plainly, when builders move lumber around on a building site, cutting it, fixing it, and shaping it in determinate ways, it is for the sake of building a building. The craft of house-building aims at building houses; and when builders act they have in view some end, namely a complete house. So much seems almost too obvious to state. Yet humans are parts of nature; so parts of nature exhibit final causes.

Further, if crafts and actions have ends, then we explain those crafts and actions in part by appealing to those ends. What explains a builder affixing a large beam across two others is that the house needs support if it is to stand. Now, the eliminativist, who austerey rejects all appeal to teleological causation, needs to deny that such appeals have any role to play in the explanation of the activity we observe. That much does seem extreme, and needs some sort of powerful argument if it is to be taken seriously, an argument showing that any appeal to goal-directedness is incoherent, or that all purposive explanation is as such somehow outmoded or incomprehensible.³⁷ Without this, it seems reasonable, supposes Aristotle, to proceed in our normal ways of understanding human action. Looked at in this light, Aristotle's initial appeals to teleological explanation receive no argument from him, because he thinks they need no argument. All we really need is ostension, or simple demonstration: we may simply point to the forms of explanation we habitually give of human actions and note that they are patently teleological in character.

If it puts pressure on the eliminativist, ostension of this sort is perfectly agreeable to the teleological intentionalist. She has no problem with teleological explanation as such, but rather with appeals tending to move it beyond the realm of intentionality;³⁸ from her perspective, teleological explanation is unobjectionable, so long as intentional agency is in play. As an historical matter, neither the intentionalist nor the eliminativist has captured Aristotle's

actual position, which was well stated already in the nineteenth century by the German scholar Zeller: 'The most important feature of the Aristotelian teleology is the fact that it is neither anthropocentric, nor is it due to the actions of a creator existing outside the world or even of a mere arranger of the world, but is always thought of as immanent in nature.'³⁹

As a philosophical matter, it remains to discover how, and how well, Aristotle seeks to ground his pervasive teleology. So far, we have seen that one of his central arguments has come up short.⁴⁰ As we shall see, however, this argument hardly exhausts Aristotle's defence of this form of causation. In order to see how he proceeds, and given the range of views voiced regarding teleology's role in explanation across a variety of domains, it is instructive to construct a ladder of teleology, built with the sorts of examples Aristotle deploys, in order to determine how high one might wish to climb. Aristotle climbs to the top, but does so without the aid of the intentionalism or animism so often ascribed to him. The ladder begins with two paradigm cases, human-designed tools and human agency, which all but the austere eliminativist will accept without hesitation:

- i Tools are *for the sake of something*, namely the functions they were given by deliberative agents.
- ii Deliberative actions are *for the sake of something*, namely the goods sought by the agent.
- iii Non-deliberative actions, whether of humans or non-human animals, are *for the sake of something*, namely the good pursued by the actor.
- iv The parts of living systems, e.g. the eye or the kidney, are *for the sake of something*, namely the function they play in the organic systems of which they are parts.
- v Organic systems, e.g. animals and plants, are *for the sake of something*, namely their own intrinsic goods.

By the time we reach (v), which is an appeal to a non-derived free-standing teleological explanation, the intentionalist is clearly no longer on board. Where, though, does she stop climbing?

Presumably, (iv), which involves an appeal to a systemically derived teleology not grounded in intentional action, is already discomfiting to the intentionalist. Still, if it can be shown that (v) is defensible, then (iv) should likewise be unobjectionable. This is Aristotle's tactic.

Looking further down the ladder, it seems safe to assume that the intentionalist has no difficulty with (i) or (ii). The next step may seem in one way innocuous, but once one appreciates the sorts of examples Aristotle has in view, then the step from (ii) to (iii) may prove more objectionable than first appears. Two sorts of cases strike him. Just after noting that in nature no less than in craft we seem to have ends ordered in hierarchies, he observes:

This is most obvious in the case of animals other than man: they make things using neither craft nor on the basis of inquiry nor by deliberation. This is in fact a source of puzzlement for those who wonder whether it is by reason or by some other faculty that these creatures work – spiders, ants and the like. Advancing bit by bit in this same direction it becomes apparent that even in plants features conducive to an end occur – leaves, for example, grow in order to provide shade for the fruit. If then it is both by nature and for an end that the swallow makes its nest and the spider its web, and plants grow leaves for the sake of the fruit and send their roots down rather than up for the sake of nourishment, it is plain that this kind of cause is operative in things which come to be and are by nature. And since nature is twofold, as matter and as form, the form is the end, and since all other things are for sake of the end, the form must be the cause in the sense of that for the sake of which.

(*Phys.* 199a20–32)

We say that the swallow builds its nest in order to breed its young; in the same vein, we say that spiders spin their webs in order to trap their prey. In neither case do we find deliberation; nor are ants or spiders conscious in any robust sense of the term. From there, suggests Aristotle, it is a small step to think that plants put their roots downward for the sake of nourishment. This is the

sense in which botanists make free use of intentional vocabulary in speaking, for example, of xyrophytes and phreatophytes and other desert plants as ‘ingenious’ and ‘innovative’ in the way they send their roots out to acquire water. These botanists are impressed by such plants, describing them as engaging in end-directed strategies, though of course without ascribing to them the sorts of internal mental representations required for the deployment of a literal strategic plan. Just so, thinks Aristotle: they engage in end-directed behaviour though they are neither deliberative nor conscious agents. In the case of such plants, we appeal without apology to their engaging in non-intentional teleological behaviour. If we have crossed that gulf, we have moved from (ii) to (iii), with the result that any move from (iii) to (iv) should now prove relatively unproblematic, at least for the (former) intentionalist.

Still, even if we were to grant that much, we might yet doubt (v), whereby self-contained intentional systems are held to have *non-derived* or *native* ends. Thus far, at any rate, it has been possible in each case to think of final causes as in one way or another *derivative*, if not from intentional design then at least from a functional role played in an overarching system. Still, if the kidneys serve the ends of the whole organism by purifying blood, then the whole organism has its end either as derived or intrinsically. If the organism has an end, then it is either from a system larger than itself, to which it plays some subordinate role, or by the agency of a conscious external designer, perhaps some creative god – so that organisms turn out to be surprisingly artefactual after all. The other alternative, Aristotle’s, has it that organisms have their ends neither by subordination to any larger system nor by the agency of a conscious designer, but rather intrinsically, in a non-derivative way. Indeed, Aristotle resists the suggestion that organisms derive their ends from the larger environment in which they find themselves. This is understandable, since we would have in that event mainly a strategy of postponement. Eventually, if we are non-intentionalists, then there must be some ground for final causation which is neither intention-dependent nor system-derived. Aristotle suggests that the level of the organism is the right place to stop.

What can be said on behalf of this suggestion? First, it is imperative to appreciate that Aristotle's dominant examples of systems of non-derived teleology are organisms – that is, living systems. Every living system, he supposes, is essentially living – is such, that is, that it ceases to exist when it ceases to live (DA 415b13).⁴¹ To the extent that it makes sense to ask of every living system whether it is *flourishing*, it also makes sense to begin thinking of it as having a non-derived end, precisely insofar as it is living. Thus, a healthy heart is one which discharges its function relative to the animal whose heart it is; but the animal's being healthy seems to involve no further appeal, since it is not healthy relative to anything else, but rather in itself.

Finally, in what is his most complex and metaphysically intricate defence of teleological causation at the level of the whole organism, Aristotle appeals to some facts about the metaphysics of growth. To appreciate the sort of point he has in mind, suppose that you and I are soldiers in a platoon, and as punishment for being slackers our sergeant orders us to dig two holes, one each, no less than four-feet deep. When we finish, he then orders us to get rid of the two piles of dirt we have created, saying that he does not want to see either pile anywhere within fifty metres of the perimeter of our camp. Now, when you take a coffee break, I simply shovel my pile onto your pile, claiming when you return that my pile is now gone, whereas yours has got a lot bigger. Since mine is now gone, and nothing can be made to begin to exist twice, there is nothing you can do to restore my pile to me. You take issue, and call me a sophist. You deny that your pile has got any bigger, claiming that it is in fact impossible for anything ever to get bigger. You support this improbable claim by contending that your pile – like every other material being – is nothing more than an aggregate of molecules of earth, and it is what it ever was, just that aggregate. All I have succeeded in doing was moving my aggregate very much closer to yours.

Our argument seems to be about the identity conditions of material objects, whether at a time or through time; and the problem we are having stems from the fact that there are no clear identity conditions for piles of dirt. Now transfer the case to

organisms. Suppose that after we resolve our difficulties about the dirt we go out to dinner. After we begin eating, you head to the bar to order a drink. When you do, I take your mound of potatoes off your plate and eat it, having already finished my own. When you return and complain, I try to use your own argument against you. I say that I have not eaten your mound of potatoes, that it in any case still exists, that if I had eaten it, I would have got bigger, but, as you say, nothing ever gets any bigger. It is true that I have moved your mound of potatoes closer to my mound by putting it into my stomach next to mine; but it exists as it ever did, even now. If you back-pedal from your earlier point and now insist that things do in fact get bigger, I will perhaps agree, and respond that it is your mound of potatoes which has got bigger, a lot bigger, while the person who took the mound off your plate has gone out of existence. Since I am consequently certainly not that person, it is unfair of you to chastise me for something I did not do. Indeed, since I am now not a person at all, it would be positively absurd of you to find fault with me. Surely you do not wish to scold a potato-appendage.

In all of this there is, suggests Aristotle, a serious philosophical point: it is a non-conventional fact that organisms get bigger, by growing, which they do by accretion, subordinating ambient matter, food, to their own ends. Note, however, the appeal to *ends*. You and I have been talking about piles and organisms as if they were on a par, treating organisms as if they were mere aggregates, and conventionally determined at that, as if it were somehow up to us to determine which of two things gets bigger when material bodies interact. This is not so in the case of growth:

One might raise a further difficulty. What is that which grows? Is it that to which something is added? If, e.g., a man grows in his shin, is it the shin which grows, but not that whereby he grows, not, that is, the food? Then why have both not grown? For when A is added to B, both A and B are greater, as when you mix wine with water, for each ingredient is alike increased in volume. The explanation, in all probability, is that the substance

(the *ousia*) of the one remains unchanged, but the substance
(the *ousia*) of the other does not.

(GC 321a30)

In the abstract, we have four choices when we think about eating: (i) the eater gets bigger (= grows); (ii) the eaten gets bigger; (iii) both get bigger; or (iv) nothing gets bigger, everything staying as it ever was, though perhaps eaters and the eaten enter into intimate proximity with one another in the course of a meal.

We think that (i) is the obvious answer, too obvious perhaps even to state. Aristotle agrees, but now wants to press a point with respect to our natural and unreflective choice: the first alternative is to be preferred because the *ousia* of the one persists, namely the organism, while the other ceases to exist altogether. Crucially, these points about persistence are not conventionally determined. It is, Aristotle assumes, not up to us to stipulate that it is the burrito which has got bigger. For if it were, we could easily change the facts, by changing our conventions, and come to suppose that burritos grow when eaten, by appending human bodies to themselves. What makes this way of thinking indefensible is that the persistence conditions of organisms are non-conventional. Further, we are right to say that the man eats the burrito and not the other way around, because the man subordinates the matter of the burrito to his own ends, breaking it down in his metabolism and discarding what is useless to him. All such talk of subordination, however, is already ineliminably teleological in character.

Here, then, is Aristotle's metaphysical defence of teleological causation, which proceeds at the level of the entire organism (**TO**):

- 1 Organisms are non-conventionally existing diachronic continuants, bounded in space and time, capable of growing to maturity.
- 2 The only, or best, explanation of these facts is that organisms have non-conventional, non-derived intrinsic ends.
- 3 Hence, organisms have non-conventional, non-derived intrinsic ends.

(**TO-1**) is supposed to be the purport of our allowing that some entities get bigger by *growing*, which they do, in general, by eating. (**TO-2**) contends that this fact is best or uniquely explained by accepting the existence of final causes for organisms. We have not seen an argument for this conclusion as yet, though Aristotle has hinted at one by suggesting that a living system is more than a mere aggregate and that it makes ready sense to think about material replenishment in the case of organisms by speaking in terms of the appropriation and subordination of matter for the organism's own purposes, or towards its own end.

Looked at this way, the argument for (**TO-2**) may be regarded as abductive, in the sense that it accepts as given some phenomenon – namely that living systems are unified entities capable of growing by replenishing their matter – and postulates an explanatory factor, an intrinsic end, as required for an adequate explanation. Another, more deflationary way to approach (**TO-2**) is simply to regard it as an implicit challenge. Unless we are to go the way of the eliminativists, who deny (**TO-1**), suggesting perhaps that it is a matter of convention or indifference whether we think the eater or the eaten gets bigger, then we will need to account for the facts of unity and growth. We have already seen that we should not be looking towards mere aggregation as an appropriate explanation. One can imagine, of course, other sorts of possible explanations, which cannot be ruled out a priori, if at all, until canvassed and considered. Until they are considered, on this second less ambitious understanding of (**TO-2**), Aristotle's appeal to non-derived intrinsic ends for organisms will be his best hypothesis of how to account for phenomena we surely wish to acknowledge, namely that some beings grow by eating, where their doing so is a non-conventional fact, something to be explained and not merely ignored.

Aristotle does consider one sort of alternative hypothesis, one that sounds perfectly natural at first. Perhaps we need not appeal to final causes in this domain, but should think that what explains the fact that the organism persists while the food does not is the simple fact that the one body remains intact, while the other does not. In Aristotle's terms, this sort of proposal is implicitly an

appeal to the material cause: the idea is that we can explain persistence solely in virtue of the persistence of matter. Aristotle doubts this. For this sort of response merely postpones the issue: the body of an organism remains one and the same, sustaining material replenishment through time. It is, as such, bounded in space and time. If we restrict ourselves to appeals to matter alone, we deprive ourselves of the ability to account for these facts. What makes it the case that the matter of a chair upon which a woman sits while reading is not part of her body? There are, after all, chemical interactions between her skin and objects in contact with her skin. If we were thinking of her body as *structured* matter, then we have made an implicit appeal to form; but an appeal to form already implicates us in hylomorphism and all that entails. One thing it entails, Aristotle contends, is an appeal to the sorts of forms operative at the level of the type, namely substantial forms. Such an appeal, in its turn, will require a further reference to function and thus to final causation. Any simple appeal to material causation will prove insufficient; and an appeal to formal causation will be incomplete until forms are construed robustly, at the level of kind membership.⁴² Thus, attempts to account for the facts of (TO-1) in such terms will fail, pushing us back again in the direction of (TO-2).

When he thinks about the facts of life and persistence, Aristotle supposes that we will ultimately find ourselves appealing to non-derived final causes, as required for explanatory adequacy. This is one of the reasons teleological explanation runs very deep for him: it runs as deep as the division between the living and the non-living. As we have seen, appeals to the intrinsic goods of living systems already implicate Aristotle in supposing that living systems are essentially alive, and that, consequently, what it is to exist at all for a living system is for it to have a function. We have already also seen that he has the machinery to distinguish those features of an entity which are essential from those which are not, in the apparatus of substantial and accidental forms,⁴³ together with the allied thought that forms are those entities whose presence makes something potentially *F* actually *F*. In the case of organisms, this amounts to the view that actual living systems

exist when matter of an appropriate kind is enformed by a substantial form whose presence makes it both living and the kind of living thing it is, which makes some animals both living and an animal of a discernible kind, a jaguar rather than a poodle.

For these sorts of reasons, Aristotle is unhappy with opposing views he regards as equally extreme: teleological eliminativism and teleological intentionalism. To the eliminativists, he has wanted to insist that at least some events permit of – or, more strongly, require – teleological explanations, namely human actions and crafts, which are explained fully only by reference to the ends they seek. To the intentionalists, who have agreed with this much, he has wanted to contend that teleological explanation need not – indeed, should not – be restricted to the domain of intentional agency. We need not apologize or regard ourselves as speaking loosely when we appeal to the functions of spider webs, nests, body parts or indeed whole organisms. Things may be as they seem without the invocation of an intentional designer.

2.9 RELATIONS AMONG THE CAUSES

In ascribing non-derived, non-intentional ends to organisms, Aristotle has committed himself to a close connection between the formal and final causes of living systems. A substantial form of a living being is essential to the organism whose form it is and so is appropriately appealed to when questions about its good arise. This closeness helps explain an otherwise puzzling remark we have already encountered in Aristotle's bid to press teleological explanation beyond the intentional. He concluded his suggestion in that connection by contending: 'Since nature is twofold, as matter and as form, the form is the end, and since all other things are for sake of the end, the form must be the cause in the sense of that for the sake of which' (*Phys.* 199a30–32). In the case of organisms he identifies the formal and final cause. The form of a squirrel is its final cause.

If that is so, we may wonder whether organisms have not four causes, but three: the efficient, the material, and the formal/final. Indeed, matters are still worse because Aristotle is prepared to take

a further step by identifying the efficient cause with the formal and final. He claims, for example:

Now, the causes being four, it falls to the natural scientist to know them all, and he provides an account in the manner of a natural scientist by leading the quest of why something obtains back to them all – the matter, the form, the mover, that for the sake of which. The last three often co-incide: for what something is and that for the sake of which it is are one, while the primary source of motion is the same in species as these: for man generates man.

(*Phys.* 198a22–27)

Thus, perhaps, we should be thinking, then, not of a four- but of a two-causal explanatory schema. If the formal, final, and efficient causes are one, and the matter another, then really, one might conclude, there are but two causes, one of which enjoys several names.

That would be a mistake. In identifying three of the four causes in the case of living beings, Aristotle does not intend to suggest that what it is to be a final cause in the case of organisms is the same as what is to be a formal cause. Rather, he is thinking of these causes as co-extensive. That is, in some frameworks, final, formal, and efficient causal explanations will designate the same feature of the world. Just as it may be true to say that the President of the United States of America is the most powerful white male in the world, in the sense that (let us stipulate) one and the same figure has always been both the most powerful white male in the world and the President of the United States of America, it does not follow that what it is to be the most powerful white male in the world is the same as (means the same as, if you prefer) what it is to be the President of the United States of America. Perhaps soon the most powerful white male will be the Prime Minister of France, or the President of the United States will be a woman and so trivially not the most powerful male in the world. Though co-referential, these expressions diverge in what they are expressing with respect to their shared referent. So too with formal and final causes: the form of an organism may be both what the organism

is *for*, its final cause, and *what it is*, its substantial form. This is the sense in which Aristotle has wanted to contend that the formal cause is, in the case of organisms, the final cause.

This is fortunate, because Aristotle also wants to contend something crucial about the four causes which is directly incompatible with their being the same in any sense stronger than extensional equivalence. For he contends that there are priority relations between the four causes, such that some cut deeper in explanation than others. In particular, Aristotle argues that the final cause is prior to the other causes when it comes to determining the essence or nature of things. Thus, he contends that the function of things determines what they are:

All things are defined by their function: for in those cases where things are able to perform their function, each truly is an F, e.g. an eye, when it can see. But when something cannot perform its function, it is homonymously F, like a dead eye or one made of stone, just as a wooden saw is no more a saw than one in a picture.

(*Met.* 390a10–15; cf. *GA* 734b24–21; *PA* 640b18–23; *Met.* 1029b23–1030a17; *EN* 1098a7–8; *Pol.* 1225a19–25)

In this passage, Aristotle states a foundational principle of his to which he will appeal implicitly and explicitly over and over again in his writings. In its simplest formulation, it is his *functional determination thesis*:

FD: An individual *x* will belong to a kind *F* iff *x* can perform the function of that kind.

(**FD**) makes two claims: (i) something belongs to a kind *F* if it can do what *F*s do; and (ii) if something cannot do what *F*s do, it does not belong to the kind *F*. So, for example, something is a light just in case it can illuminate. That is, something qualifies as a light irrespective of whether it is incandescent or fluorescent or halogen or LED or burning gas. Nothing stitches these disparate kinds together in terms of their matter or form, construed, at any rate, superficially, in terms of shape. Only function seems up to the job

of individuating this kind. Heading in the other direction, if I have a defunct irreparable flashlight, Aristotle will suggest it is no longer in fact a light – except, to use his preferred terminology, homonymously, by which he means that we may yet *call* it a flashlight, though it is not a real one, no more than a decoy duck is a real duck.⁴⁴ For this reason, Aristotle relies upon **(FD)** as a principle of kind individuation.

Also for this reason, he tends to treat the final cause as prior to the other causes, as ‘the cause of causes’ in the apt expression of a later Aristotelian.⁴⁵ The final cause is prior to the other forms of causes insofar as it sets constraints on them. If we accept **(FD)**, then we think that what something is fundamentally or essentially is given by its function. A function, however, can express itself only via various forms, and ultimately, in suitable kinds of matter. A hammer has the function of pounding nails; so, it requires a structure suited to that end. Nothing shaped like a nimbus cloud will be a hammer, because nothing with that form can drive nails. Having the right shape, however, is not yet sufficient. Something shaped like a hammer but made out of chocolate will not really be a hammer at all. If we call it a hammer, then we are speaking, as Aristotle says, homonymously – we apply the name ‘hammer’ to it, but we do not do so intending to treat the item as an actual hammer. Hammers are realizable only in functionally suitable matters, and chocolate is not suited to the task to driving nails. Note, however, that talk of functional suitability is already to constrain the material cause by some prior appeal to function, and so to the final cause. It is in this sense that the final cause is prior: it sets constraints on the suitability of form and matter for the expression of some end.

We see, then, that far from challenging one another, Aristotle’s two contentions about the relations between causes complement one another. When he is thinking of forms in a metaphysically robust sense, Aristotle will assert directly that the ‘essence of a thing, its form’ is its ‘nature’, which is ‘the end or that for the sake of which’ (*Phys.* 198b4–5). So, ‘end’ and ‘form’ pick out the same explanatory factor, though under different guises. Still, the form, thus construed, is already thought of as conforming to the functional constraints laid down by **(FD)**, the functional determination thesis.

We do not end up with a contradiction in thinking that one and the same thing, the form which is the end, is both prior to itself (as the final cause) and posterior to itself (as the formal cause), even while being one and the same. On the contrary, though in a complete explanation the formal and final cause will designate the same feature of the world, the feature of its being a final cause is prior to its being a formal cause. If that sounds complex, we may come back to a simple illustration of Aristotle's: what explains an eye's having the structure it has is its function, namely the detection of colour and light; but an eye's structure just is its having light and colour detectors. Or, to revert to an illustration involving an artefact, what explains a can-opener's having the form it has is its being designed to perform the task of opening cans, and in this sense its final cause is prior to its formal cause. Its function delimits the kinds of form and matter it may have. Still, when we explain its function, we appeal to its form, as realized in some functionally suitable matter, and in this sense, we appeal to one and the same structure when we explain what it is (its form, it is a can-opener) and what it is for (its function, it is for opening cans).

That said, it should be noted that we have so far restricted ourselves to cases favourable to **(FD)**, because we have appealed to kinds which are intuitively functional kinds. In fact, Aristotle thinks the clearest cases where form and final cause co-incidence arise not among artefacts, but in the realm of nature, among living beings (*Phys.* 198a25–27). If we feel reluctant to join him in treating **(FD)** as so completely general, this is most likely due to our reluctance to find in nature final causes which are non-intention dependent. If Aristotle has made a reasonable case for his contention that we should be neither eliminativists nor intentionalists about final causes in nature,⁴⁶ then at least this aspect of our reluctance is misguided.

2.10 CONCLUSIONS

Like most people, Aristotle wants the answers to the questions he asks to be more than merely satisfying: he wants them to be genuinely explanatory. He wants his explanations, that is, to be

objectively correct. He thus expects his explanations to adhere to the canons of rational adequacy. His desire leads him – as it has led other philosophers and scientists since his time – to reflect on the properties good explanations must as such exhibit. His answer, for a broad range of cases, is his *four-causal explanatory schema*. The four-causal schema, he urges, is adequate precisely because it is *causal*: full and correct explanations are those which cite objectively obtaining causes. So far, many will agree with Aristotle, supposing that when people have been satisfied by (alleged) explanations which in fact fail to reflect the causal structure of the world, they have only failed themselves by resting content with illusions rather than realities. Still, even among those who embrace Aristotle's commitment to causally anchored objective explanations, there may be yet many who resist his further insistence that adequate explanations need to appeal to all four causes. Indeed, it is a hallmark of modern philosophy to reject the notion of final causation, and to a lesser but still appreciable extent, the notion of formal causation.

Aristotle's response to his detractors comes in two waves. First, he argues directly for the real existence of matter, form, and function. There must be matter and form, he argues, if there is to be change; and there is, no doubt, change. Further, we ascribe functions together with end-directed behaviour in the realm of nature no less than in art and craft. We suppose that agents do things for the sake of their ends; and we think organisms are outfitted with parts suited to discharge functions relative to the survival and flourishing of the organisms whose parts they are. Given our easy and reasonable propensities in these directions, Aristotle finds it appropriate to urge a middle way between what he sees as two mistaken extremes: the absolute denial of all final causation, eliminativism, and the restriction of function to the realm of conscious design, intentionalism. His arguments here are initially less compelling than his arguments for form and matter. In any event, the primary argument of *Physics* ii 8, (ATC), his brief argument for teleological causation, seems plainly unacceptable as it stands. Still, he has additional arguments not so easily set aside, because they rely on deeper metaphysical principles pertaining to the normativity of life and the impossibility of explaining such fundamental

facts as the diachronic unity of living beings in the absence of unifying final causes.

Because these arguments tend to be both foundational and abstract, they are unlikely to win converts among the sceptical without protracted engagement. Fortunately, although such argument is necessarily abstract and highly general, a consideration of the merits of Aristotle's four causal explanatory schema may also proceed via a second, less abstract but more indirect approach. The second wave of defence unfolds in Aristotle's actual deployment of his the four-causal explanatory schema. That is, it seems in some measure fair to judge Aristotle's four-causal schema by its success or failure in its applications; if we find him deploying the four-causal schema to good effect in metaphysics, psychology, ethics, politics, and art, then we have some reason to credit him with a success in adumbrating and articulating a defensible explanatory framework. By the same token, if the explanations this schema provides prove persistently spurious, then we have reason to question the framework in terms of which his explanations have been cast. In this sense, our ultimate judgment regarding the four-casual schema awaits an assessment of its deployment across the range of inquiries Aristotle engages.

Be that as it may, it will prove imperative as propaedeutic to any adequate understanding of Aristotle's philosophy that his four-causal explanatory schema be grasped in at least the level of detail in which it has been presented here; for it forms the skeletal structure of the explanations he advances in nearly every area of his inquiry. He wonders, as we all wonder, about questions of abiding interest; and he structures his theorizing in answer to his wondering within the framework of his four-causal explanatory schema. In its terms alone, he contends, can we move forwards, from wonder to world-view.

FURTHER READING (* = ESPECIALLY SUITED TO BEGINNERS, IN TERMS OF CLARITY OR ACCESSIBILITY)

Primary Sources

Aristotle, *Physics* i–ii; *De Generatione et Corruptione* i 1, 3–5, ii 2–5; *De Partibus Animalium* i 1

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