

Introduction

The reason why an introduction appears first, although it is typically written last, could be as follows: genetic and explanatory orders are reversed in complex creations. In the order of exposition, that which something is for—its end—comes first, and the features necessitated by this condition follow. Accordingly, I will take the opportunity of this introduction to indicate the purpose of this book, which is twofold: (1) to determine how ends are used by Aristotle as explanations in natural philosophy, and (2) to determine what the limits of that kind of explanation are. Ends and limits are concepts that Aristotle himself brings together in several crucial passages that bear on his teleology.¹

A thorough study of Aristotle's teleology can tell us a lot about Aristotle's philosophy, about Greek philosophy generally, and even about contemporary philosophical, scientific, and ethical problems of scientific explanation and causality. As I argue in the conclusion, it can also change the way we view and relate to nature.

How can a study of teleology contribute to our understanding of Aristotle or his place in Greek philosophy? The answer to this question might be thought too obvious. In a recent comprehensive study of cause and explanation in Greek philosophy, covering more than a millennium, teleology is said to be the central issue.² Teleology is thought by many to be the key to Aristotle's thought.³

¹ 'We seek the reason why up to this point, and then we think we know, when it is not the case that this either comes about or is because something else does; for the last term is in this way an end and a limit' (*Post* i 24, 85^B27–30); 'all practical processes of thinking have limits—they all go on for the sake of something else, and all theoretical processes come to a close in the same way that accounts do' (*Anima* i 3, 407^a23–25); 'nature flees from the infinite; for the infinite is imperfect, and nature always seeks an end' (*GA* i 1, 715^B14–16); 'all living things both move and are moved for the sake of something, so that this is the limit of all their movement—that for the sake of which' (*Motu* 6, 700^B15–16); 'the reasonable person, at least, always acts for a purpose; and this is a limit, for the end is a limit' (*Meta* i 11, 994^B16); 'For the end is a limit (τὸ γὰρ τέλος πέρας ἐστίν)' (*Meta* ii 2, 994^B16); 'we apply the term "limit" . . . also to the end of each thing, and of this nature is that towards which the movement and action are' (*Meta* v 17, 1022a4–7), 'there is an end of the things we do, which we desire for its own sake . . . we do not choose everything for the sake of something else, for then the process would go on to infinity, so that our desire would be empty and vain' (*NE* i 1, 1094^a18–21).

² 'Whether . . . nature is such as to be completely describable without remainder in terms of purely mechanical laws of working, or whether rather nature demands to be understood in teleological terms, is the central question of Greek philosophical science' (Hankinson 1998, p. 6).

³ 'If Aristotle is known for anything, it's his teleology' (Gotthelf and Lennox 1987, PIAB, p. 199); 'This most teleological of all thinkers, at least by reputation and upon the basis of many texts in his corpus' (Oates 1963, p. 251); 'Aristotle—the arch teleologist' (Veatch 1992, p. 55); 'much else in Aristotle's thought, from his ethical theory to the theory of substance . . . depends centrally on his natural teleology' (Gotthelf 1997, p. 82); 'The intuitive notion of functions and what they explain is basically Aristotelian' (McLaughlin 2001, p. 211).

Despite near unanimity on the importance of teleology to Aristotle, there is no consensus, but rather widespread disagreement, both about the general character of Aristotle's teleology, and about many specific issues. A comprehensive study of his remarks is needed in order to resolve several persistent interpretative problems and technical difficulties that can no longer be resolved in a piecemeal fashion, since the central issue is how apparently mutually exclusive conceptions of teleological explanation can be reconciled in a coherent interpretative framework. Is teleology about causation or explanation? Does teleology exclude or obviate mechanism, determinism, or materialism? Is teleology focused on the good of individual organisms, or is god or man the ultimate end of all processes and entities? Is teleology restricted to living things, or does teleology apply to the cosmos as a whole? Does teleology identify objectively existent causes in the world, or is it merely a heuristic for our understanding of other causal processes? Even apart from these issues debated with extraordinary depth in the community of Aristotle and Greek philosophy scholars, there are serious popular misconceptions about Aristotelian teleology that must be addressed. For example, Aristotle is often characterized as a naïve or uncritical teleologist. Detractors reject his supposed panglossianism,⁴ mysterious entelechies, magical pneuma,⁵ obscure natures, hidden essences,⁶ backwards causation,⁷ animism,⁸ and anthropomorphism.⁹ Even supporters have sometimes understood his teleology to necessitate such undesirable doctrines as vitalism,¹⁰ creationism,¹¹

⁴ 'Pangloss taught metaphysico-theologo-cosmology. He proved incontestably that there is no effect without a cause . . . "It is proved," he used to say, "that things cannot be otherwise than as they are; for as all things have been created for some purpose, they must necessarily be created for the best purpose. Observe, for instance, the nose is formed for spectacles, therefore we wear spectacles. The legs are visibly designed for stockings, accordingly we wear stockings . . . since pigs were made to be eaten, we eat pork all the year round"' (Voltaire's *Candide, or Optimism* (1758), p. 20, trans. J. Butt).

⁵ Balme complains: 'tradition lapsed into philosophy-fiction, inventing such *dei ex machina* as a hypostasized Nature supervising an overall teleology, or a cosmic control operated by the Unmoved Mover, or a living universe, or mysterious entelechies and magical pneuma within animals' (1980, p. 291).

⁶ Karl Popper says, 'methodological essentialists, for instance Aristotle . . . all agreed with him [Plato] in determining the task of pure knowledge as the discovery of the hidden nature or Form or essence of things' (1945/1966, p. 31).

⁷ 'Aristotelian goal-directed causality . . . appeared to put the cart before the horse—explaining a cause before its effects—and thus to require "backwards causation" (Buller 1999, p. 5); "[teleological explanation] might presuppose either reverse causation or minds' (Nissen 1997, p. vii).

⁸ Gomperz speaks of Aristotle's 'extreme teleological view of nature and the, so to speak, atavistic tendency to assume the animation of all nature' (1909, p. 171); 'Aristotle argued that a falling body accelerated because it grew more jubilant as it found itself nearer home' (Skinner 1971, p. 6).

⁹ 'Modern science arose in opposition to Aristotelian thought . . . and there has since been a pronounced tendency, already noted, to eschew Aristotelian concepts whenever possible. There have not been wanting scientists and philosophers who have insisted that the very concept of a cause is quite worthless, being "anthropomorphic" in origin' (Taylor 1967, p. 57). The charge is leveled earlier by Meyer 1919.

¹⁰ For example, Rist: 'there is some kind of desire inherent in matter' (1965, p. 342).

¹¹ 'Aristotle seems to regard nature as a designing power . . . not merely an immanent force, but a person having reason and foresight' (Allan 1952, p. 33). A recent example: 'Galen did not reject Aristotelianism entirely. His explanation of natural processes such as the transformation of matter depended on Aristotelian concepts, and he was convinced, like Aristotle, that the body had been carefully

and anthropocentrism.¹² I try to show that all of these criticisms and interpretations are misplaced, and that they can be eliminated in the process of addressing the scholarly disputes mentioned earlier.

What can a study of Aristotelian teleology tell us about our own philosophical, scientific, and ethical problems? Because the Aristotelian corpus is a powerful investigative resource and critical tool, Aristotle's theory of teleology, in its application to such diverse disciplines as physics, biology, ethics, and politics, offers an opportunity to survey the uses and abuses of teleological reasoning across a broad spectrum of philosophical interest. It is widely held that the scientific revolution of the sixteenth and seventeenth centuries turned on the rejection of final causes and the establishment of a mechanistic world picture. A possible result of the survey is that we can better understand what renaissance and modern scientists and philosophers were positioning themselves against when they rejected final causes, if that is in fact what they have done. And it can also help evaluate in what respects their arguments were and are right and have proved productive, and in what ways they were wrong, failed to appreciate all the alternatives, and have inhibited a better understanding of what a scientific explanation is.

In part, what I want to do in this study is reopen a line of Aristotelian interpretation that originated in the early twentieth century. The interpretation I have in mind recognized that the most important feature of Aristotelian teleology is that it presents an alternative to the anthropocentric, creationist, and providential schemes of teleology that were favored by Aristotle's predecessors, and were later popular in the commentarial tradition's appropriation of Aristotle, and in the early modern period's natural theology. This point of view is clearly expressed by Zeller,¹³ Gomperz,¹⁴ and Ross.¹⁵ Although the position has also been maintained more recently,¹⁶ it has

designed by a provident and purposeful creator' (Nutton 2002, p. 801). Chroust 1973 has tried to commit Aristotle to such a view with his discovery of a 'teleological proof for the existence of god' in Aristotle's lost work *On Philosophy*.

¹² Examples: David Sedley's affirmative response to the question in the title of his paper, 'Is Aristotle's Teleology Anthropocentric?' (1991); Hughes 1975, pp. 64–5 and 1985, p. 73.

¹³ '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. What Plato effected in the *Timaeus* by the introduction of the world-soul and the Demiurgus is here explained by the assumption of a teleological activity inherent in nature itself' (Zeller 1883/1955, sec. 48).

¹⁴ 'Aristotle's teleological interpretation of the universe outgrew the cramping bounds by which that conception had been confined in the thought of Xenophon, perhaps of Socrates. It is not man and the profit that he draws from the well-ordering of the universe that stands in the foreground of his contemplation. It is rather the well-ordered beauty of the cosmos itself that determines his judgment, wherein he resembles Anaxagoras, Diogenes of Apollonia, and Plato' (Gomperz 1909, p. 132).

¹⁵ 'Aristotle's teleology is, it will be seen, an "immanent" teleology. The end of each species is internal to the species; its end is simply to be that kind of thing, or, more definitely, to grow and reproduce its kind, to have sensation, and to move, as freely and efficiently as the conditions of its existence—its habitat for instance—allow. Only once, perhaps, does Aristotle suggest (and only doubtfully) that a characteristic of one species might be designed for the sake of another' (Ross 1923, p. 129).

¹⁶ Most notably by Balme 1965, Grene 1972, Nussbaum 1978, Berti 1989/90, Lennox 1992, and Wardy 1993.

neither been confirmed through a comprehensive survey of Aristotle's works, nor been brought to bear on more general philosophical issues.

For Aristotle, teleological explanations explain how animal parts and behavior are 'adapted' to their environment, and not how the environment is adapted to the needs of animals or other organisms (including humans). In this way, Aristotle's explanations are more like contemporary biological theories of evolutionary adaptation,¹⁷ and quite different from either 'the teleological proof' or 'design argument' employed by natural theology,¹⁸ or its contemporary cosmological counterpart, 'the anthropic principle'.¹⁹

I also believe strongly that Aristotle's teleology can change the way we view and relate to other natural entities. Aristotle defines nature as an internal principle of change, and as an end. He shows us how ends and goods can and must enter into scientific explanations. Every natural substance is an end, and is identified as the beneficiary of its own parts and motions. Aristotle thus provides us with a way to think about goods as natural phenomena, as objective causes out there in the world, and not merely as products of the human mind. Just as he shows how a thing's nature can be the basis for explaining its parts and behavior without any reference to an intelligent designer, so he shows how the nature of a thing, especially an organism, can be the basis for explaining its end and good without any reference to human interests and ends.

I contend that this presents a challenge to anthropocentrism, pervasive or dominant though it is. Anthropocentrism is the position that human beings are the center—or rather the end—of everything; everything has value or is good only in relation to human beings. Some versions of anthropocentrism are anti-teleological, such as those predicated on the reduction of the explanation of all non-human organisms to 'efficient causes'. Aristotelian arguments that expose the theoretical shortcomings of this view force us to look beyond Cartesian machines and Skinnerian behavior-systems that discount the value of all living things besides humans. Other versions of anthropocentrism are themselves teleological. For example, the Stoics

¹⁷ 'Aristotelian "why" questions are quite legitimate in the study of adaptations, provided one has a realistic conception of natural selection and understands that the individual-as-a-whole is a complex genetic and developmental system' (Mayr 1983, p. 332). Adaptation refers to characteristics that improve the chance of an organism reproducing (whether physiological or behavioral), and so are favored by natural selection (cf. *Unwin-Hyman Dictionary of Biology*, second edition, 1995, s.v. adaptation). Obviously this is on the face of it very different than Aristotle's theory, but my point is that Aristotle's position is not as different from this as it is from teleological arguments in natural theology, or anthropic cosmological principles. See also: Gotthelf 1988; Lennox 1993; Depew 1997.

¹⁸ 'The world exhibits teleological order (design, adaptation); therefore, it was produced by an intelligent designer' (Alston 1967).

¹⁹ 'It is not only that man is adapted to the universe. The universe is adapted to man. Imagine a universe in which one or another of the fundamental dimensionless constants of physics is altered by a few percent one way or the other? Man could never come into being in such a universe. That is the central point of the anthropic principle. According to this principle, a life-giving factor lies at the center of the whole machinery and design of the world' (J. A. Wheeler, 'Forward', in Barrow and Tipler 1986, p. vii).

embraced a cosmic teleology which held that all plants and animals function primarily for the sake of humans. Aristotelian arguments can show that such versions of teleology are theoretically incoherent and scientifically unsound.

Some influential scholars have even maintained that Aristotle's own teleology is anthropocentric. One of my main objectives is to refute that interpretation. It is true that there are passages in which Aristotle discusses the value of natural things like plants and animals to humans, treating such entities as instrumentally valuable. These passages deserve our closest attention because they show a philosopher whose inclinations go the other way grappling with a view virtually unanimously held by his predecessors. But it would be a grave mistake to infer from Aristotle's discussion of the instrumental value of plants and animals that Aristotle therefore holds that such natural substances do not at the same time have intrinsic ends independent of their instrumental value to humans. For Aristotle insists that these ends are in the final analysis more important, even for human success, than the instrumental uses of natural things. While the artificial ends of plants and animals are only instrumentally useful to us, the natural ends of plants and other animals are intrinsically valuable and, as objects of contemplation, have paramount significance for the ultimate end of human life.

Aristotle gives good reasons—scientific and ethical reasons—why we ought to value other natural things more for their own ends than for what we can do with them. Sure enough, humans need to use natural substances, including other organisms, instrumentally. The development of techniques of hunting, agriculture, and animal husbandry is a clear manifestation of that need. But Aristotle argues that these techniques, like all technologies, have a natural limit, the transgression of which is *contrary to nature* and ignoble. That limit is what is necessary for our survival and functioning, in accordance with our own natural needs and functions (which, Aristotle holds, can be objectively determined for humans, just as it can for other animals).

We have overcome the Aristotelian view that the earth is at the center of the spatial universe, but we still need to come over to the Aristotelian view that humans are not at the center of the axiological universe. Thus I think that a study of Aristotelian teleology, in addition to being an intrinsically valuable exercise, can be justified instrumentally on the grounds that it has something to show us about our relationship to nature.

I conclude this introduction with an abstract of the argument that follows. Aristotle holds that natural science is knowledge that comes about through demonstration of the causes of natural kinds. Most important is 'the cause for the sake of which'—the end. The identification of a natural end initiates the process of explanation and constitutes the basis for all objective knowledge about natural kinds—stars, elements, plants, animals, humans, and cities. The determination of the ends of natural kinds also indicates how other causal factors, such as matter and necessity, are to be integrated into an explanatory account of their parts and behavior.

Aristotle is commonly considered the inventor of teleology, although the exact term ‘teleology’ originated in the eighteenth century. If teleology means the use of ends and goals in natural science, then Aristotle should be regarded rather as a critical innovator of teleological explanation. Teleological notions were widespread among his predecessors, but Aristotle rejected their conception of extrinsic causes such as mind or god as the primary causes for natural things. Aristotle’s radical alternative was to assert nature itself as an internal principle of change and an end, and his teleological explanations focus on the internal and intrinsic ends of natural substances—those ends that benefit the natural thing itself. To these he contrasted incidental ends of natural things, such as possible uses of the thing that do not serve its own functions and interests.

Aristotle’s use of ends was subsequently conflated with incompatible ‘teleological’ notions, including proofs for the existence of a providential or designer god, vitalism and animism, opposition to mechanism and non-teleological causation, and anthropocentrism. I aim to correct these misrepresentations through an elaboration of Aristotle’s methodological statements, as well as the explanations actually offered in the scientific works. Although Aristotle’s philosophy sometimes suffers from failed extrapolation of teleological principles, still it succeeds in challenging the anthropocentric conception of nature, and rising above the banausic perspective which views all natural things as instruments for human ends, to a loftier viewpoint from which natures can be observed and appreciated as their own goods.

In the first chapter, I offer a brief overview of the controversial history of the interpretation of Aristotelian teleology. The Greek, Arabic, and Latin commentarial traditions sought to unify Aristotle’s thought with the Platonic demiurge, Islamic faith, and the Christian god, and used his philosophy to develop arguments or proofs for the existence or the qualities of god. In the early modern period, this effort flourished in the discipline of natural theology, which pointed to natural things as evidence of god’s design and providence. The term ‘teleology’ was invented in this context. Philosophers such as Bacon, Descartes, and Spinoza criticized the excesses of teleology and final causes in natural science, and painted a mechanistic world picture that they opposed, rhetorically at least, to the scholastics’ dependence on final causes. Eventually, Kant was compelled to confront the apparent antinomy between teleology and mechanism in the finale to his critical philosophy, *The Critique of Teleological Judgment*. Kant endorsed the heuristic value of teleological explanation, and considered humans the ultimate end of nature. These influences are sources of possible confusion and anachronism in the interpretation of Aristotle. One can get a clearer picture of Aristotle’s own concerns by examining a text written in the milieu of Aristotle’s own school, Theophrastus’ *Metaphysics*. Theophrastus expresses reservations and concerns about the excessive use of teleological principles and slogans, and about the extent to which the universe can be characterized as ordered for the sake of some overall purpose or good. I argue that these are concerns that Aristotle shared with his colleague and successor, and addressed in his own works.

In the second chapter, the way is cleared for a discussion of Aristotle's teleology by introducing in broad terms his conception of cause and explanation. Aristotle says that all causes (including nature, necessity, luck, and so forth) fall under 'four headings'. The causes are crucial to scientific knowledge: demonstration involves a syllogism in which a cause is the middle term. It is necessary to see how this works for three other kinds of cause, before introducing teleological explanations and describing how the cause 'for the sake of which' should work in demonstrations. Aristotle himself raises the most important issues that uniquely pertain to this latter kind of explanation, such as temporal sequence, and integration with material and efficient causation. The chapter ends with a discussion of the crucial distinction between explanatory and non-explanatory causes (or intrinsic and incidental causes), and how these relate to theoretical and practical knowledge.

In the third chapter, we will discuss at length the specific terms and concepts of Aristotle's teleology. Teleological explanations involve what Aristotle consistently calls 'the cause for the sake of which'. This locution is said to have two senses: aim and beneficiary. The distinction has major and underappreciated significance for the interpretation of Aristotle's teleology. But its importance can be seen in connection with other teleological terms and phrases, such as the methodological principle that 'nature does nothing in vain', normative terminology such as 'good' and 'noble', and the family of terms containing the root TELE-, including the noun *telos* ('end'), the adjective *telion* ('complete'), and the verb *teleiousthai* ('to complete').

In the fourth chapter, we discuss Aristotle's dialectical interrogation of his predecessors. Some of the most important discussions of teleological ideas occur in the context of Aristotle's criticisms of his predecessors' accounts of natural things. According to Aristotle, Empedocles tried to account for natural things by the cause of luck, Anaxagoras by intelligence, Plato by form, and Democritus by necessity. Aristotle co-opts what is successful in these strategies, but at the same time criticizes them for failing to account for the regularity with which natural things are generated for the sake of their own ends. By examining these criticisms, one can see how Aristotle could have dealt with other philosophers whom later commentators have considered teleological (such as Diogenes of Apollonia in his use of intelligence and air, and Xenophon's Socrates in his postulation of a providential god designing and arranging everything for the sake of humans). Aristotle considers these causes—luck, intelligence, and god—to be extrinsic causes that cannot on their own present a satisfactory explanation of natural kinds such as plants and animals. His own proposal is that nature is an internal principle of change and an end, and that it is with reference to such a cause that natural phenomena and their regularity must be explained.

Having discussed the history, terms, logic, and available alternatives to Aristotelian teleology, in Part II we examine the actual teleological explanations offered by Aristotle of natural substances. The order in which the examination

will proceed follows the syllabus for the study of nature put forth by Aristotle himself, in the first chapter of the *Meteorology*.

We have previously spoken about [a] the primary causes that are natural (περὶ μὲν οὖν τῶν πρώτων αἰτιῶν τῆς φύσεως) and [b] about all the natural motions, and [c] again about the upper motions of the stars which have been ordered, and [d] about the corporeal elements, how many there are and what they are like, and how they change into others, and [e] about generation and destruction generally. [f] It remains still to theorize about a part of this inquiry (μεθόδου), which all our predecessors called meteorology (338^a20–26) . . . [g] Having discussed these, we can theorize about what way we are able to demonstrate with respect to animals and plants, both generally and separately (καθόλου τε καὶ χωρὶς). For then we would have almost reached the end (τέλος) of everything we wanted to speak about from the beginning (ἐξ ἀρχῆς) (*Meteor* i 1, 339^a5–10; cf. *Sens* 1, 436^a1–17)

This syllabus, as it were, follows a scale of increasing complexity: from general principles and definitions, through elementary motions, to more complex elemental changes, including a vast variety of motions and affections of elements in the region between the earth and the moon, and finally on to the complexities of plant and animal growth, motion, and behavior. We can continue with this train of thought onto the even more complex and difficult stations of human action and political organization.

In Chapter 5, we examine Aristotle's teleological conception of change and motion at the fundamental level of the elements. Aristotle conceives of natural motion and change in general teleologically, as a condition of completion with respect to something's capacities. This is clear on the elemental and every subsequent level of motion and change. The circular motion of celestial bodies (which are composed of the element ether), for example, is the completion of the capacity for perfectly rational motion. Stellar rotation is for Aristotle the paradigm of a teleologically explicable activity, and he supports this claim with evidence from observation, theory, and tradition. Nevertheless, Aristotle's account generates some perplexities, the resolution of which show much about Aristotle's overall methodology. The four terrestrial elements (earth, water, air, and fire) are teleologically explicable because their motion can be completed when they arrive at their natural place in the cosmos, and because through cyclical transmutation they resemble the circular motions of the heavenly bodies. Although Aristotle is clear in his rejection of vitalism or animism, he does hold that the terrestrial elements themselves are the recipients of an extremely attenuated benefit through their existence and everlasting activity. This benefit, not the possible incidental benefits to animals or humans, is crucial to the teleological explanation of rainfall, which is otherwise explained by reference to necessity, moving and material factors alone.

In Chapter 6, we will introduce Aristotle's use of teleological explanations of living things by considering the problems and principles unique to the life sciences. The investigation of living things is, for Aristotle, another aspect of the science of nature, one that studies complex or organic natural bodies (substances), their parts, movements, and behavior. Elements make up homogeneous and heterogeneous

parts or organs. The relationship of these parts to the organisms made up of them is teleological: flesh and hands exist for the sake of the whole organism, specifically the capacities of its soul, which can themselves be ordered serially on a hierarchy of increasing complexity (reproduction, nutrition, perception, locomotion, prudence, knowledge, etc.). Although the more complex parts and capacities come into being after the simpler, the simpler exist for the sake of the more complex. Thus there is an inversion of the genetic and explanatory orders in the case of organisms, although a study of Aristotle's account of explanation generally and animal generation specifically reveals that this inversion does not, as has been argued, require 'backwards causation'. The end of an organism is the basis of all subsequent explanation of its shape, parts, and behavior (form, matter, and movements), and is thus not merely a heuristic for some more basic kind of explanation (like a materialist or mechanistic one).

In Chapter 7, the foregoing account will be fleshed out in an examination of Aristotle's explanations of specific parts and behaviors of living things, especially animals. There are several techniques for explanation of normal cases, and Aristotle has also developed a theory of how to account for non-normal cases, such as freaks and spontaneously generated organisms. With respect to normal cases there are, in addition to the intrinsic ends, incidental ends of organisms, such as the use of plants or animals for food, clothing, transportation, entertainment, labor, and so forth. But these ends are not explanatory of the parts or motions (i.e. behaviors) of the animals in question. They are much like the incidental benefits of rainfall in that this kind of benefit has no role to play in the scientific explanation of the natural substance. Aristotle simply does not give any teleological explanations of organisms, at least not in the biological works, that suppose that a characteristic of one kind of organism can be explained by reference to its benefit to another kind of being, such as another animal, humans, the universe as a whole, or god.

In Chapter 8, I discuss Aristotle's teleology in relation to human beings. This is the most complicated case, not only because humans are the most complex organisms, but also because it is humans that can gain knowledge about their world through teleological explanations, and can use teleology and technology in order to organize and improve their own lives and activities. Humans can use other natural things not in accordance with those things' own ends but, technologically, for human ends. For instance, the elements are also involved in teleological explanations when an agent uses them intentionally in accordance with a craft. An example of this would be the farmer using water to irrigate his crops, or a smith using metals from the earth to make a cup. When we use natural substances for our own purposes, that is, for ends incidental to the substances themselves, we are engaged in goal-directed activity of which we are ourselves the end. This kind of deliberate and intentional human action is, for humans, the clearest and most obvious case of what is teleologically explicable, because we are ourselves conscious of the ends. Aristotle's extensive and careful use of the model of arts in

his discussion of the teleological aspects of natural things is due to the fact that technology is more familiar to humans than other natures, not because he thinks that technology is fundamental to nature. On the contrary, he holds that art imitates nature.

Humans, like elements, stars, plants, and animals, have their own intrinsic motions, functions, and goods. Chief among these Aristotle holds to be contemplation, the activity of theoretical wisdom. Theoretical wisdom differs from practical wisdom in that the latter grasps the means to produce a certain effect for human ends. Theoretical knowledge, on the other hand, is focused on the effects of nature, and grasps their causes, independently of any human needs. The objects of theoretical knowledge include the gods and stars, but the humbler living things as well.

Thus human practical wisdom does not determine all goods, as if all other natural substances exist or function primarily for the sake of human beings. Theoretical wisdom reveals that there are goods that exist independently of human goods. As Aristotle says, 'the good is different for humans and fishes' (*NE* vi 7, 1141^a22–23). It would be slavish to keep asking of things like plants and animals 'what's the use' or 'what's the payoff for us', as one must in practical reasoning, such as that involved in farming, fishing, or animal husbandry. The person who could only see natural things as instruments for human use does not understand the difference between a cause and a joint cause, or between an intrinsic good and an incidental good. This is why when Aristotle specifies how the natural scientist should indicate the cause for the sake of which, he says: 'because it is better this way, not absolutely, but with respect to the substance of the thing concerned' (*Phys* ii 7, 198^b8–9).

Social, political, and rational animals present unique problems, but Aristotle treats them nonetheless as natural bodies and substances, and so explains them by the methods developed in the science of nature in general. The account of human ethics, for example, commences by establishing the function or functions of the human organism in a parallel fashion to the determination of the functions of other natural entities. In a similar way political science is treated as a matter of figuring out the function or functions of cities, and other human organizations. We will examine how Aristotle depends heavily on analogical reasoning in order to apply teleological explanations to ethics and politics. Within humans, certain capacities and functions are subordinated to others, within families certain members are subordinated to others, within environments certain organisms are subordinated to others, and within cities, certain individuals are subordinated to others. The problem with this extension of teleological explanation is that it requires treating individuals as parts ('instruments' or 'organs') of natural groups considered as wholes, so that the part-whole framework can be applied and yield explanatory results, as it did in the teleological explanation of organisms. But since such groups have lesser degrees of unity than organisms, there are serious limitations to the application of such explanatory techniques. The case reveals a

failed extrapolation using methods proper to the explanation of organisms for the explanation of ethical relationships and political institutions. Some of Aristotle's unhappy remarks about the natural justification for slavery, patriarchy, and war result from overstretching teleological explanations to things that are not genuinely substances.

In Chapter 9, I discuss the most general application of Aristotelian teleology—to the cosmos as a whole. In Aristotle's ontological and cosmological remarks one finds further confirmation that teleological explanations are supposed to be applied to the study of specific natural substances. Aristotle uses ends to identify and indicate the limits that he believes are necessary to block explanatory regression. On the most general level, this is used to account for the cause of motion and change in general. But the assertion that motion and change in general are end-oriented does not imply an overall or holistic teleology in Aristotle. This is because he does not consider a teleological assertion explanatory until the specifics of the aim and, most importantly, the beneficiary of the motion have been identified, as a careful reading of the dialectical context in which Aristotle carries out his investigation of the cosmological implications of teleology reveals.

Aristotle thinks that the fact that things function well in nature needs a general explanation. But the explanations he offers invariably make reference to specific natural substances. He is wary of attempts to generalize about a generic, overall good, which he holds has little or no explanatory power. Frankly, even if he had wanted to claim that everything relates to some one good, his actual theory of teleological explanations was in no way robust enough to explain everything with reference to such a good. His teleological explanations in the works on nature make reference to the good of specific kinds of things—stars, elements, plants, animals, humans, families, and cities—and not just to human beings, god, or some other overarching cosmic good. The conclusion of his theological treatise, *Metaphysics* xii 10, begins by raising an *aporia* about the overall good, but ends by criticizing various answers offered by others. For his own position, he maintains that nature is a principle of the good for each kind of thing individually.

In the conclusion, we will attempt to arrive at an estimation of the scientific vitality of Aristotle's teleological views. But it will be argued that Aristotle's teleology, whatever its scientific merits, still has promise for axiology—the theory of values—in offering us a naturalistic account of goods. By showing how goods can be conceived independently of human interests, Aristotle shows us a way to rise above the banalistic perspective of anthropocentrism to a theory of value that recognizes the intrinsic good of natural things.

1

Historical Background to the Interpretation of Aristotle's Teleology

This chapter examines the powerful historical circumstances and trends that have influenced the interpretation of Aristotelian teleology.¹ Only once several possible sources of confusion and anachronism have been exposed will it be possible to introduce and evaluate Aristotle's methodology of teleological explanation.

The biggest threats to an accurate interpretation of Aristotle are two mutually exclusive teleological perspectives that have been introduced by commentators and philosophers who were (reasonably enough) less interested in an accurate interpretation of Aristotle than in other theological and scientific concerns. By way of introduction these may be labeled the natural theology perspective, and the heuristic perspective. Briefly, the natural theology perspective employs teleology in the service of creationist theology, specifically proofs for god. The heuristic perspective holds that scientific explanations referring to ends are merely heuristic aids to our understanding of natural phenomena, but are in principle reducible to explanations that refer either to material causes ('materialism'), or to these and 'efficient' causes ('mechanism').

In Chapters 2–10, I will argue that Aristotle explicitly rejected both the natural theology perspective and the heuristic perspective. In the present chapter, I will attempt, as concisely as possible, to describe the process by which the natural theology and heuristic perspectives were insinuated into the interpretation of Aristotle.

The following stand out as decisive historical circumstances bearing on the interpretation of Aristotelian teleology. First is the legacy of the commentarial tradition, which sought to unify Aristotle's thought in several different ways. In the earliest period, Peripatetic commentators such as Alexander of Aphrodisias worked to iron out apparent inconsistencies in Aristotle's writing and develop it into a more or less unified system of thought. Next, Neoplatonic commentators sought to unify Aristotelianism with Platonism. Later, philosophers writing in Arabic, such as Avicenna and Averroes, developed the work of their Greek predecessors in order to unify Aristotelian philosophy with tenets of Islam. Eventually, as more and more

¹ This chapter is neither a comprehensive history of Aristotelian commentary and exegesis (for an overview of which see Minio-Paluello 1970), nor a comprehensive history of all kinds of teleological argument (for which see Barrow and Tipler 1986, chs. 1, 2).

of Aristotle's texts were recovered in the West, Latin commentators, pre-eminently Thomas Aquinas, built on this work in their own effort to join Aristotelian philosophy with the creator god of Christianity. The steady appropriation of Aristotelian philosophy for such theological purposes focused teleological notions onto arguments and eventually proofs for the existence or qualities of god.

Later, in the period of the scientific revolution, these positions would be developed into the discipline of natural theology. This in turn lent itself to the notion of an independent science of ends—'teleology' understood in opposition to 'mechanism'. At the same time, there had been a movement, growing since at least the scholastic period, to restrict final causes and teleological explanations to intentional agents, either humans or god. Teleological explanations in other domains were either eliminated or interpreted as being mere heuristic aids to understanding. This critique of final causes eventually led, in the early modern period, to a general critique of the usefulness of final causes in natural philosophy and science. Natural theology and the critique of final causes obviously did not sit well together, and Kant was compelled to try to rectify the ambivalence of the new science to final causes in the finale of his works of critical philosophy, *The Critique of Teleological Judgment*. The result was a powerful expression of the heuristic perspective on teleology.

All of these movements, then, have influenced the interpretation of Aristotelian teleology, and thus it is worth briefly expanding on the capsule history just provided. After that, we will return to Aristotle's own milieu, and examine some considerations about teleological explanations expressed by Aristotle's colleague and immediate successor. Theophrastus, in a treatise probably composed during Aristotle's lifetime, expresses some concerns about teleological explanation that I argue Aristotle shared. It turns out that Theophrastus' work (which, although increasingly being read in its own right, has not yet been brought to bear on the interpretation of Aristotle), generally casts more light on the nature of Aristotle's teleology than do the commentaries.

1.1 GREEK, ARABIC, AND LATIN COMMENTARY

Commentaries on Aristotle frequently try to iron out apparent inconsistencies of argument within or between texts in the corpus.² But often commentators are

² The first work directly commenting on Aristotle for which we have evidence begins about the middle of the first century BCE (Gottschalk 1990, p. 55). Before then the Aristotelian corpus was not available in the systematized form we now have it. Sometime between 60 and 20 BCE, a man named Andronicus is thought to have completed the edition of Aristotle's works that remains the basis for our own Aristotelian corpus. (For the speculation of an earlier date, see Gottschalk 1990, pp. 62–3. Long 1989, p. 530, represents the standard view; cf. Sorabji 1990a, pp. 1 f. The standard position has been criticized by Barnes 1997.) Andronicus' edition of Aristotle is thought to have profoundly influenced all subsequent generations of Aristotelian commentators, and its effects are still apparent today. Andronicus' arrangement of the texts, and his own biographical and exegetical works on Aristotle,

concerned to make the arguments consistent with more than just Aristotle's own arguments. The attempt to reconcile Aristotle with Plato, and later with Muslim and Christian thought, was more often the aim of the Aristotelian commentators than was the narrow interpretation of the Aristotelian texts.³

For our purposes, this effort begins with the Peripatetic commentators Alexander of Aphrodisias (appointed chair of Aristotelian studies between 198 and 209) and Themistius (fl. c.350–80). Both commentators were concerned to present a unified teleological account of both motion and the soul, which is encouraged by Aristotle's definitions of both of these in terms of 'being in a state of activity' (ἐντελέχεια). In order to do so, they invoked the vague and malleable concept of 'completion' or 'perfection' (τελειότης), transforming it from the modest use to which it was put by Aristotle himself.⁴ Neoplatonic philosophers would later exploit these concepts in their effort to harmonize the philosophy of Aristotle with Plato. Another major issue confronting Alexander as a defender of Aristotelian ideas was the apparent inadequacy of Aristotle's position on providence. Aristotle was interpreted and criticized (probably by Platonists) as holding that divine providence applies to the heavens only and not the sublunary world.⁵ Alexander wrote an independent treatise *On Providence* in which he responded to these criticisms by arguing that Aristotle did hold the sublunary world to be the object of divine providence, but specified as the mechanism for this the souls of celestial bodies which through their continuous rotation perpetuate the living things down here.⁶ An implication of this view, whatever its fidelity to Aristotle, is that the celestial rotations are the primary causes of the changes in the sublunary world, in particular of the generation and destruction of living things. The Platonists to whom Alexander

'presented Aristotle's philosophy as a system like those of the Stoics and Epicureans' (Gottschalk 1990, p. 65). While there are certainly systematizing tendencies apparent in Aristotle's works themselves—for example, extensive cross-referencing, architectonic division of the sciences, programmatic syllabi (e.g. *Meteor i* 1, 338^a20–339^a10 and *Sens* 1, 436^a1–18) and application of general principles to a vast array of subjects—it is nonetheless clear that the ultimate source for our edition was edited and adapted to the demands of the kind of systematic ordering exemplified by the great Hellenistic schools. Whether or not a man named Andronicus was responsible for all this, it is clear that the condition of Aristotelian texts at this time inevitably created the need for a great amount of exegesis, in order to iron out the details of the Aristotelian system and to account for its apparent internal inconsistencies.

³ In connection with this decisive historical circumstance of Aristotelian interpretation should be mentioned the effect of the commentarial format itself on the interpretation of individual texts. Helen Lang in her study of commentaries on Aristotle's *Physics* (1992) has convincingly described the distorting effects of the format, as utilized by writers from Philoponus (6th cent. CE) through Buridan (14th cent. CE). Aristotelian commentators 'radically restructure Aristotle's arguments, with striking results first for problems and their solutions within physics and finally for physics itself' (Lang 1992, p. 14). Thus when taking into account the value of these interpretations one must consider both the structure of the subject text (the commentarial format) and the restructuring of the object text (the Aristotelian text as constituted in Andronicus' edition and its successors).

⁴ Wisnovsky 2003a, pp. 4–5, 43–59. The following account of the Greek commentators and of philosophers writing in Arabic is deeply indebted to Wisnovsky 2003a and 2003b.

⁵ Sharples 1983, p. 25.

⁶ Sharples 1983, p. 26; Hankinson 1998, p. 356. A discussion of providence survives in Alexander's *On Fate* XVII.

was responding had distinguished between ‘instrumental’ causes and true efficient causes, and Alexander borrowed their distinction in order to distinguish the immediate causes of generation and destruction in the mundane realm, and the true causes of the divine celestial realm.⁷ As we will see, this distinction was to have far-reaching consequences for the Neoplatonic appropriation of Aristotelian teleology mentioned above.

The Neoplatonic project of harmonizing the thought of Plato and Aristotle required adapting Aristotle’s philosophy to the fundamentally Platonic doctrines that the soul is separable from matter, and that god is an efficient (not just final) cause of the motion and order of the world. The second goal involved interpreting Aristotle’s theory of four kinds of cause as having straightforward application in Plato’s cosmology as represented in *Timaeus*. This requires some serious exegetical tweaking, to be sure, since Aristotle himself criticizes Plato for having failed to make use of more than two kinds of cause recognized by Aristotle.⁸ Syrianus (d. c.437) apparently invented a scheme for just this purpose, which was expanded upon by Proclus (c.411–85). Proclus distinguished between transcendent causes, which operate in the eternal superlunary spheres, and immanent causes, which operate in the sublunary spheres of generation and destruction.⁹ Transcendent causes include the final, the efficient, and the paradigmatic causes, which are said to be ‘transcendent of or extrinsic to their effects’; immanent causes include the formal, the material, and the instrumental causes, which are said to be ‘immanent or intrinsic to their effects’.¹⁰ We have already seen that the instrumental cause was considered by Alexander to be an efficient cause operating in the mundane realm (as opposed to a true efficient cause, in the heavenly realm). The paradigmatic cause was, similarly, a Platonic form separate from the mundane world, as opposed to the form immanent in substances in the mundane world.¹¹

The six causes were sometimes associated with specific stations of Neoplatonic cosmology; so the transcendent causes could be identified with the Good (the final cause), the Ideas (the paradigmatic cause), and the Demiurge (the efficient cause).¹² As a matter of Aristotelian interpretation, however, the distinction between transcendent and immanent causes was invoked in order to prioritize the

⁷ Wisnovsky 2003b, p. 56; citing Simplicius, *In Phys* 2 315.12–18, 316.6–14, 317.23–8.

⁸ ‘This then is what Plato’s determined regarding what we are investigating. From this interpretation it is clear that he used two causes only (δυσὶν αἰτίαν μόνον), the “what it is” of something, and the matter relative to it, for the forms are the cause (αἰτία) of what it is to be something for the others, but the one [is the cause of what it is to be] of the forms; and what is the matter—the substratum—of which the forms are predicated for sensible things, he said that it is this dyad, the great and the small. Further, he assigned to each of these elements [the one and the dyad] the cause (αἰτία) of the good and the bad respectively’ (*Meta* i 6, 988^a7–17).

⁹ Wisnovsky 2003b, p. 59. The distinction can, according to Proclus, be traced back to Syrianus’ teacher (and hence Proclus’ scholarly ‘grandfather’), Plutarch of Athens (Proclus, *in Parm* 1058.21–9.19).

¹⁰ Wisnovsky 2003a, pp. 68–9, pp. 93–4.

¹¹ For the paradigmatic and instrumental causes, see Hankinson 1999, pp. 326–7.

¹² Wisnovsky 2003b, p. 60.

final and efficient causes above (literally and figuratively) the formal and material causes, which were considered merely 'conjoint' or 'contributory' causes.¹³ This use of the distinction was subsequently influential, having been adopted by, among others, the Greek commentators Ammonius, Philoponus, Simplicius, and then, as a result, the Muslim philosophers Alfarābī and Avicenna.

The association of the final and efficient causes facilitated the position that god is an efficient cause of the world, in addition to a final cause. The position is definitely attributable to Ammonius (435–517), both through what was preserved of his teaching by Asclepius,¹⁴ and by the testimony of his pupil Simplicius (wrote after 529), who said: 'My teacher Ammonius wrote a whole book offering many proofs that Aristotle thought god was also an efficient cause of the whole cosmos' (Simplicius, *In Phys* 1363, 4–12).¹⁵ Ammonius' motivation was the reconciliation of Plato and Aristotle, specifically the demiurge of *Timaeus* with the unmoved mover of *Metaphysics* xii.¹⁶ Simplicius puts the matter thus: 'That Aristotle says god or the prime mover is a final cause (τελικόν), no one disputes. But that he also says god is an efficient cause (ποιητικόν) is justified, I think, by his calling, in the definition of causes in the second book of the *Physics*, the efficient cause (ποιητικόν αἴτιον) that whence comes the origin of change' (Simplicius, *In Phys* 1361, 11–14). Simplicius adduces several Aristotelian passages in addition to the authority of his teacher Ammonius to support his claim.¹⁷ Another student of Ammonius, Philoponus (c.490–570), also attributes to Aristotle the position that god is both an efficient and final cause of the universe, perhaps more out of a motivation to reconcile Aristotle's god with the Christian god than with Plato's demiurge.¹⁸

The transmission into Arabic philosophy of Aristotelian ideas and terminology¹⁹ was from the beginning mediated by Neoplatonic concerns and innovations.²⁰ These would, in turn, have a decisive influence on the interpretation of the Aristotelian texts in the thirteenth century by philosophers writing in Latin. Avicenna (c.980–1038) used the division of causes into the transcendent (final and efficient) and immanent or internal (matter and form) in several different ways.²¹ First, the distinction was serviceable for the doctrine of the separability of the soul, since the soul's identification with the final cause assures its transcendence of the corruptible world, despite its immanent character as form. As a final

¹³ Wisnovsky 2003b, p. 61.

¹⁴ Verrycken 1990, pp. 205, 205 n. 35.

¹⁵ See Sorabji 1990b, p. 185 f.

¹⁶ Simplicius, *In Phys* 1360, 28–31. See Verrycken 1990, p. 216 n. 137. Cf. Wisnovsky 2003a, p. 61 f.

¹⁷ *Phys* ii 3, 194^b29, *Cael* i 4, 271^a33, i 9, 279^a27, *GC* i 3, 318^a1, *Meta* i 3, 984^b15.

¹⁸ Philoponus repeats the point often that Aristotle's unmoved mover is an efficient cause (*In Phys* 298.6–10, 304.5–10, *In GC* 136.33–137.3, 152.23–153.2, 297.15–24; Verrycken 1990, p. 224). It has been argued that later in his career, as a 'Christian philosopher' as opposed to an 'Alexandrian Platonist', Philoponus changed his position and rejected the view of Aristotle's god as an efficient cause, limiting it to a final cause (Verrycken 1990, pp. 225 f.). See Sorabji 1990b, pp. 185 f.

¹⁹ For a thorough discussion of the translation of Aristotelian teleological concepts from Greek into Arabic, see Wisnovsky 2003a, pp. 99–112.

²⁰ Wisnovsky 2003a, p. 113.

²¹ For the texts and an analysis see Wisnovsky 2003a, pp. 129–33.

cause and efficient cause the soul subsumes formal causality. The subsuming is to some extent facilitated by linguistic conflation of the final cause (an end) and the so-called perfecting cause (a form which as an agent pursues an end). The conflation was a product both of the attempt to square the meaning of *ἐντελέχεια* in the definitions of soul and motion by appealing to a notion of 'perfection' (an effort going back to Alexander) and of choices made in the translation from Greek to Arabic.²² This conflation had the result that 'Arabic philosophers such as Avicenna allowed the final cause an even greater spectrum of causality than the Greek philosophers had' (Wisnovsky 2003a, p. 131). This came at the cost of a model of souls that requires intentional agency, that is, living things deliberately moving or changing things for the sake of something. The model is problematic in its application to plant and animal souls but, on a cosmic level, god can be considered such an agent.

Thus the distinction between transcendent and immanent causes was also serviceable for Avicenna's proof for the existence of god. Avicenna applied his distinction between existence and essence to the Neoplatonic distinction between transcendent and immanent causes, holding that the formal and final causes were the cause of essence, while the efficient and material causes were the cause of existence. Avicenna distinguished between what is 'contingent in itself but necessary through another' and 'necessary through itself'. Composites of matter and form are in themselves contingent things—why a thing is this and not that is a contingent fact—and so the necessity of their existence can only be due to something extrinsic and transcendent that is their efficient and final cause. This cause, necessary through itself barring a regress of contingent causes, is god. It follows from the fact that god is necessary to bring contingent beings into existence, that god exists. In this way, Avicenna subsumes all causes by the final cause. For example, he says, 'the end is the cause of all the causes . . . so when there is an end, it is the cause of all the causes' (*Philosophy for Ala-ad-Dawla*, 54, 9–10 and 55, 2)²³ and 'something may be caused with reference to its essence and its inner reality, and it may be caused in terms of its existence . . . the final . . . is the efficient cause of the efficient cause' (*Pointers and Reminders*, 139, 14–20).²⁴ The mechanism of this causality is, in accordance with the Neoplatonic cosmology of procession and recession, god's superabundance acting first as an efficient cause of generation, and then moving things as a final cause or end. God's superabundance was confirmed on the basis of his 'perfection'—an Aristotelian term that we have seen had been transformed through Neoplatonic commentary into a device permitting the construction of a theologically correct cosmology.

Averroes (c.1126–98) criticized Avicenna's proof for its excessive Neoplatonic aspects. He argued that Avicenna's conception of something that was 'contingent in itself but necessary through another' was incoherent on Aristotelian grounds;

²² Wisnovsky 2003a, pp. 131–3.

²³ Wisnovsky 2003a, L38, p. 168. I have used the translations of Avicenna's titles in Gutas 1988.

²⁴ Wisnovsky 2003a, L40, p. 169. See also the texts translated by Wisnovsky at pp. 161–3 (L36), 163 (L37), 149 (L40, 41).

that which is necessary is eternal and hence contrary to the contingent. Averroes reverted to the proof for god's existence as a necessary first mover that he found in the final book of the *Physics*, claiming that this is 'the best method to follow . . . and the nearest to strict truth' (*Incoherence of the Incoherence*, trans. Van der Bergh, p. 393). He also countenanced arguments from design of a more popular character²⁵ in his work on natural theology, *The Exposition of the Methods of Proof*, in which he elaborated what is often called a 'teleological' argument or proof for the existence of God.²⁶ In it, he appealed to arguments both from natural motion and from design in order to prove god's existence and providence and, what is more, he attributed such arguments to Aristotle.²⁷

Robert Wisnovsky has called the attempt by Neoplatonists to harmonize the philosophies of Plato and Aristotle the 'Ammonian synthesis', and he has traced the influence of the parties to this synthesis on Avicenna and his predecessors. His discussion of Avicenna's attempt to harmonize the Neoplatonized Arabic Aristotelianism with tenets of the Muslim faith suggests the label 'Avicennian synthesis'. Despite their disagreements on points of detail, Averroes was influential on this synthesis, and then subsequently on what we might call the 'Thomistic synthesis', meaning the attempt to harmonize Neoplatonized Aristotelianism with Christian theology.

²⁵ Such arguments had already been advanced by Ghazali on the basis of passages from the Quran (e.g. 2:164), and indeed by several earlier philosophers and theologians. Davidson (1987, pp. 213f.) has argued that the source of these arguments can be traced back to Cicero's *On the Nature of the Gods*. Cicero's work influenced patristic literature, especially the fifth-century Theodoret's treatise *On Providence*, which was transmitted into an Arabic treatise, extant under the title *The Book of Proofs and Reflection regarding Creation and Divine Governance*. This treatise was widely influential on Arabic and Hebrew literature; the treatise *The Wisdom in God's Creatures*, attributed to Ghazali, contains extensive excerpts of it.

²⁶ Averroes, Al-Kashf 'an Manahij Al-Adilla (*The Exposition of the Methods of Proof*), trans. Najjar (2001). Davidson has argued that Averroes' encouragement of such a proof is 'not scientific and philosophic' (1987, p. 229), since such design arguments tend to depend on anthropocentrism (strictly the view that all goods exist for the sake of humans), which Averroes was determined to reject on the grounds that the superior cannot exist for the sake of the inferior (Davidson 1987, pp. 230–1). Davidson concludes, 'the sole proof of the existence of God which meets the standards of serious philosophers would be Aristotle's proof from motion' (1987, p. 231). But the passage that Davidson cites as evidence that Averroes considered the proof from motion the only 'serious philosophical' one (*Incoherence*, pp. 393–4) simply says that the proof is the 'the best . . . nearest the truth . . . [and] in my opinion sufficient'. Kukkonen (2002) has argued against Davidson that Averroes is most serious about the proof, even if he must assign it an inferior status as an inductive argument.

²⁷ A strong piece of evidence in favor of Kukkonen's argument against Davidson (see previous note) is the following comment of Averroes on Aristotle's *Metaphysics* xii: 'It must be known to you that this is Aristotle's view concerning providence, and that the problems arising about providence are solved by <his view>; for there are people who say that there is nothing for which god does not care, because they claim that the Wise must not leave anything without providence and must not do evil, and that all his actions are just. Other people refuted this theory through the fact that many things happen that are evil, and the Wise should not produce them; so these people went to the opposite extreme and said that therefore there is no providence at all. The truth in this is that providence exists, and that what happens contrary to providence is due to the necessity of matter, not to the shortcomings of the creator, so that some people carried on their reflection on this to the point that they said that there are two gods, a god who created evil and a god who created good' (Averroes, *Commentary on Aristotle's Metaphysics Book Lambda* [ad 1075a], 3:1715.1–11, tr. Genequand).

It is through the translation of Averroes into Latin that the argument about god as both moving and final cause became known to and adopted by thirteenth-century scholars, including Thomas Aquinas (1225–74).²⁸ Aquinas offered a number of proofs for the existence of god, in several different works. In the relatively early *On Truth*, which prefigures the famous fifth argument in the *Summary of Theology*, a ‘teleological’ proof is couched in terms of a response to what he characterizes as two Greek views, one recognizing the existence of material causes only, the other recognizing only efficient and material causes. Still other Greek philosophers, he points out, have shown that such causes cannot account for the existence of goodness, except by chance. But chance cannot account for the regularity of the good. So far the argument follows Aristotle closely enough (e.g. *Metaphysics* i 3–4 and also *Physics* ii 8). But Aquinas further argues that it follows from the fact that there are goods regularly attained by beings lacking intellect that the world must be ordered by an intellect that makes such ends attainable in nature. This shows the existence of a providential being, which is as far as the argument goes in *On Truth*, but it is offered as a proof for the existence of god in the *Summary of Theology*.²⁹ In the *Summary against the Gentiles*, he offered a different argument from the harmonious order of the universe, which he attributes to John Damascene.³⁰ The greater part of the argument there, however, is devoted to the proof from the first cause of motion borrowed from Aristotle’s *Physics* viii.

In his commentary on the *Physics*, Aquinas argued against Averroes’ view and against the view that the creation is eternal and that things were not created after having not existed (Aristotle, *Cael* i 12). But he agreed with Averroes and the tradition that god is moving and final cause.³¹ In arguing that god is both an efficient and final cause, Averroes held that efficient and final causes are, ultimately, identical. This is also a conclusion of Aquinas’ commentary on Aristotle’s *Physics*.

A problem for such a view is to explain how the efficient cause can be the final cause. The solution, as anticipated by Avicenna, is to use a model of conscious agency, since agents are efficient causes that act for the sake of ends. In this way, Aquinas justifies an expansion of god’s causal power from final to efficient causality through an appeal to the Avicennian position that the final cause is the cause of the other causes:

another meaning of cause is found in other causes, i.e. insofar as the end or the good has the nature of a cause. And this species of cause is the most powerful of all the causes, for the

²⁸ Sorabji 1990b, pp. 193–4.

²⁹ *De Veritate*, q.5, a.2; *Summa Theologiae* I, q.2, a.3. For a thoroughgoing summary, see Wippel 2000, pp. 410–13, 480–5.

³⁰ *Summa Contra Gentiles* I.13.
³¹ He says: ‘even Averroes admits in *De Substantia Orbis* that god causes the heavens not only in respect to its motion, but also in respect to its substance. This could not be unless it had its existence from him. But it only has eternal existence from him. Therefore it has its eternity from another. And Aristotle’s words are also in agreement with this when he says in *Metaphysics* v [1015^b9–10] and above at the beginning of Book VIII that there are certain necessary things which have a cause of their necessity’ (Aquinas, *In Phys* viii 1154, cf. 1152).

final cause is the cause of the other causes. It is clear that the agent acts for the sake of the end. And likewise it was shown above in regard to artificial things that the form is ordered to use as to an end, and matter is ordered to form as an end. And to this extent the end is called the cause of causes. (In *Phys* ii 186³²)

What is striking about this passage and its cognates is the emphasis on a determination of the final cause as the antecedent necessary and sufficient condition for an effect, as opposed to a determination of the final cause as an explanation for a given event. The question for Aquinas is not: How do final causes explain? But rather: How do final causes prove the existence of god? Aquinas evidently conceived of physics as a study that culminates in the proof of god's existence, not a scientific explanation of the motion of natural things.³³

Although it is easy to attribute the persistence of the position that god is both a final and efficient cause to Neoplatonic, Muslim, or Christian ideology, there can be no doubt that those who entered into the dispute, from Ammonius to Aquinas, presented themselves as if they were offering the correct interpretation of Aristotle. Aquinas, for example, warns against misinterpreting Aristotle for the sake of reconciling him with Christian teachings (*Commentary on the Physics* viii, 986), but clearly does not think that the case of god as moving and final cause fits into that category. Even where the view would seem to run up against the fact of Aristotle's belief in the eternity of the world, Aquinas is careful to make the relevant distinctions, while at the same time maintaining his role as Aristotelian exegete.³⁴

In the sequel we will see how the emphasis on the efficient nature of final causality in late medieval philosophy leads to the charge that final causes lack explanatory force. After all, they do not seem to provide any explanation beyond that of the efficient cause itself. On the one hand, such a charge is somewhat misplaced, since in the contexts we have been examining final causes are not being utilized as generators of explanations in natural science, but as a component of a theological proof. On the other hand, such criticisms proved highly productive since scholastic and renaissance Aristotelians were obliged to criticize this concept of final causes and, in so doing, once again reoriented the interpretation of Aristotelian teleology.

1.2 SCHOLASTICISM AND THE SCIENTIFIC REVOLUTION

The received intellectual tradition has it that, in the sixteenth and seventeenth centuries, revolutionary philosophers and scientists began to curtail and reject the

³² Also, 'but the end is prior to the efficient cause insofar as it is bringing something about in a substance and its complement since the action of the efficient cause is completed only on account of the end' (*De principiis naturae* IV, 25).

³³ Lang 1992, pp. 164–8. For an account of Aquinas' view on nature that discusses his attempt to accommodate the Platonic technomorphic model in an Aristotelian framework suitable for creationist theology, see Honnefelder 2000, pp. 76–83.

³⁴ See, for example, *In Phys* viii 974.

teleology of the medieval and scholastic Aristotelians, abandoning final causes in favor of a purely mechanistic model of the universe. The perspective is well represented by the words of Alexandre Koyré:

The disappearance—or destruction—of the cosmos means that the world of science, the real world, is no more seen, or conceived, as a finite and hierarchically ordered, therefore qualitatively and ontologically differentiated, whole, but as an open, indefinite, and even infinite universe, united not by its immanent structure but only by the identity of its fundamental contents and laws . . . This, in turn, implies the disappearance—or the violent expulsion—from scientific thought of all considerations based on value, perfection, harmony, meaning, and aim, because these concepts, from now on *merely subjective*, cannot have a place in the new ontology. Or, to put it in different words: all formal and final causes as modes of explanation disappear from—or are rejected by—the new science and are replaced by efficient and even material ones. Only these latter have right of way and are admitted to existence in the new universe of hypostatized geometry. (1950/1965, pp. 7–8, emphasis in original)

Indeed, Bacon (1561–1623),³⁵ Descartes (1596–1650),³⁶ and later Spinoza (1632–77)³⁷ appear to have renounced the final causes of the scholastic Aristotelians and to have advocated the elimination of final causes from scientific explanation (at least in cases that do not involve intentional agency). Their revolution is supposed to have paved the way for a scientific notion of cause and the triumph of the mechanistic world picture. Modern science, which on this view operates almost exclusively with their notion of cause, has thoroughly expurgated the final vestiges of teleology.³⁸

³⁵ '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 . . . All which are properly alleged in metaphysics; but in physics are impertinent, and as remoras to the ship, that hinder the sciences from holding on their course of improvement, and in introducing a neglect of searching after physical causes' (*Advancement of Learning*, iii.4, p. 141; Cf. *New Organon* I.48, 65).

³⁶ 'That we must not inquire into the final, but only the efficient causes of created things. Finally we shall not seek for the reason of natural things from the end which god or nature has set before him in the creation . . . But regarding him as the efficient cause of all things, we shall merely try to discover by the light of nature that he has placed in us, applied to those attributes of which he has been willing we should have some knowledge, what must be concluded regarding the effects that we perceive by the senses' (*Principles of Philosophy* I.28; Cf. *Meditations* IV; *Replies to Objections* IV; Letter of August 1641 to 'Hyperaspistes' in AT iii, pp. 422 f.). See also Des Chene 2001, pp. 117–19.

³⁷ Appendix to *Ethics* I.

³⁸ 'The concepts of material and formal causes are archaic . . . final causes have likewise long since been expurgated from physics . . . Partly because of the rise of physical science and the accompanying demise of Aristotelian modes of thought, the concept of cause is now generally that of an efficient cause' (Taylor 1967). 'The scientific revolution began with the denial of final causes' (Clark 1995, para. 13). 'Aristotle invoked final causes throughout his scientific works, including many cases that appear not to involve genuine purpose (as when webbed feet are said to be for swimming). An emphasis on teleological explanation (shared by Plato) characterizes most subsequent Western philosophy of science until the seventeenth century' (Mackie 1995). 'With the rise of modern science in the 16th and 17th centuries, interest was directed to mechanistic explanations of natural phenomena, which appeal only to efficient causes; if teleological explanations were used, they took the form not of saying

If this were true, then it would be desirable to have a cogent account of what exactly it was that the revolutionaries all agreed to reject. Perhaps this book can be useful on this score for some readers. I suspect, however, that the picture needs to be qualified by the following considerations. First, the major philosophical figures associated with the scientific revolution, even Spinoza,³⁹ did not without qualification reject final causes. Second, later prominent scientific revolutionaries, such as Gassendi (1592–1655),⁴⁰ Boyle (1627–91), Newton (1642–1727),⁴¹ and Leibniz (1646–1716)⁴² actively countenanced final causes, even in the context of natural science. This is seen nowhere more clearly than in Boyle's fascinating *Disquisition about the Final Causes of Natural Things, wherein it is Inquir'd, Whether, And (if at all) With what cautions, a Naturalist should admit Them?* (1688).⁴³ Now these final

(as in Aristotelian teleology) that things develop toward the realization of ends internal to their own natures but of viewing even biological organisms as machines ingeniously devised by an intelligent being' (*Encyclopaedia Britannica* 2002, s.v. teleology). Cf. Burtt 1954, pp. 98–9; Dijksterhuis 1961; Barbour 1971, p. 50; Grene 1972, p. 397; Wright 1976, p. 2; Woodfield 1976, p. 8; Schmitt 1983, p. 5; Osler 1996, pp. 388–9; Asma 1996, pp. 27 f.; Nissen 1997, p. vii; Kullmann 1998, pp. 29–34; Garrett 1999, pp. 311–12; Dusek 2001, pp. 81–5; McLaughlin 2001, pp. 20 f.

³⁹ Don Garrett has challenged the standard view in an insightful and probing article. He argues that, 'although Spinoza maintains a certain rhetorical distance from the Aristotelian vocabulary of final causes, he fully and consistently accepts the legitimacy of many teleological explanations . . . it is not Leibniz but Spinoza who holds the position on teleology and teleological explanation nearest to that of Aristotle' (1999, pp. 311–12). The basis of his argument is the distinction between 'final causes' assumed as intrinsic to nature, and 'final causes' in accordance with an intelligent designer. As we will see, this is a crucial distinction to grasp in order to understand Aristotle's teleology, and how it is different from his successors.

⁴⁰ Gassendi's creationist theology involved god in everything from the creation of the atoms and the ordering of the cosmos to meteorological events. He also argued that god created animals. He actively countenanced final causes in the explanation of organisms, *against* the Greek atomists' account, invoking Aristotelian arguments to this end in section III, book III of the *Syntagma Philosophiae* (see the third chapter on 'Of the use of the parts of animals', *Op.* vol. ii, pp. 226–37). See Johnson 2003, pp. 340–3.

⁴¹ 'We know him [sc. God] only by his most wise and excellent contrivances of things, and final causes . . . a god without dominion, providence, and final causes is nothing else but Fate and Nature. Blind metaphysical nature could produce no variety of things. All that diversity of natural things which we find suited to different times and places could arise from nothing but the ideas and will of a Being necessarily existing . . . God, to discourse of whom from the appearance of things, does certainly belong to natural philosophy' (*Philosophiae Naturalis Principia Mathematica*, 3rd edn., Book III, General Scholium). See also the correspondence with Richard Bentley.

⁴² Leibniz defended the use of final causes in natural philosophy: *A Specimin of Dynamics* (AG 126); *On Nature Itself*, sec. 4; *Monadology*, sec. 79–90; *Against Barbaric Physics* (AG 319). He even translates and quotes with approval the Platonic Socrates demand for research into final causes in *Discourse on Metaphysics*, sec. 19–22, *Two Sects of Naturalists* (AG 281–4); cf. *Letter to Molanus* (AG 242).

⁴³ See Lennox 1983. Boyle concludes, 'all consideration of Final Causes is not to be banish'd from Natural Philosophy: but that 'tis rather Allowable, and in some cases Commendable, to Observe and Argue from the Manifest Uses of Things, that the Author of Nature Pre-ordain'd those Ends and Uses' (1688, p. 151). The disquisition is too rich and multifarious to summarize. But we can get an idea of just how far Boyle was willing to go by considering something he says about Aristotle. Apparently Aristotelians do not recommend the study of Final Causes enough for Boyle, for even if they give them, they do not in addition give thanks to the creator who created it all: 'I think this reflection may justly serve to Recommend the Doctrine about Final Causes that we embrace, to Philosophers that are truly pious . . . And therefore the Ancient Aristotelians, who look'd upon the World as Eternal and Self-existent in a Condition like its present System; did not use to Thank God for the benefits they

causes are all defended from the perspective of natural theology, but the point is that the major scientific revolutionaries did not absolutely reject final causes, as they are so frequently said to have done. Third, the scientific revolutionaries were hardly the first philosophers to critique the abuse of final causes: prominent scholastics had already undertaken to do just that. (As we will see later, that tradition goes back to Aristotle himself). This last point has not been appreciated until very recently. Dennis Des Chene contends, 'Descartes and those who subscribed to his polemics exaggerated the sins of their opponents, ascribing to the Aristotelians views that Aristotelians would have repudiated' (1996, p. 169). The evaluation is based on the fact that the major criticisms of Aristotelian final causes at the time—that they are animistic, and superfluous given adequate efficient causes—cannot really be said to apply to the Aristotelians (such as Scotus, Ockham, Buridan, and Suárez) whose works were read in the milieu of those who leveled the criticism.

On the other hand, Avicenna's and then Aquinas' generation of the efficient (and all other) causes from the final, a position that had great influence, called for a response. Aquinas' position on the nature and priority of final causality was related to his position on the ultimate identity of moving and final causality in god, itself a position with a long history, going back at least to the Greek commentators, as we saw. The position is more or less maintained by Duns Scotus (c.1265–1308), albeit in a somewhat altered and certainly more complicated form, in his influential proof of the existence of god (*Opus Oxoniense*, I, dist II, q. i; 1987, pp. 35–52). The main thrust of that proof is that there has to be a first (efficient) mover, and there has to be a first reason to move, and that these in turn must be identical; the entity in which they are identical is god. Notice that there can be here no charge of animism in this use of final causality, since the final cause is itself an intelligent agent. Scotus accepted the Avicennian views that the end is the cause of causes, and the old Neoplatonic distinction, transmitted by Avicenna, between immanent and transcendent causes.⁴⁴ Furthermore, he held with Aquinas the view that if natural agents (such as brutes) act for the sake of an end then this must be due to the intelligent voluntary agency of god acting as an efficient cause; 'final causes in nature depend on some other intelligent voluntary agent ordering them to an end'.⁴⁵ These positions are effective means to a proof for god, but are problematic in the context of the scientific explanation of natural agents; clearly Scotus was concerned more with the former than the latter.

William of Ockham (1285–c.1347), on the other hand, was greatly concerned with the method of explanation and the scientific status of final causality. Ockham in effect pre-empts the charge of animism by explicitly restricting the application of final causes to the actions of intentional agents, and thus suggesting efficient

receiv'd from things Corporeal: Tho' some of them thought themselves Oblig'd to thank *Nature*; which they look'd upon as acting with Design, and proposing to her Self for Ends, the Welfare of the Universe, and of Men' (pp. 118).

⁴⁴ Adams 2000, pp. 157–8.

⁴⁵ Adams 2000, p. 170, citing *De Primo Principio* IV, sec. 4.13; see also Adams 2000, p. 162.

causality as the basis for the explanation of natural things. This is a very important move in the history of Aristotelian interpretation, and it seems to have won acceptance by many of Ockham's contemporaries and successors, and so it is worth briefly elaborating his position.

Ockham clearly distinguishes final from efficient causes,⁴⁶ and argues that sometimes one belongs to a thing, sometimes the other does, and sometimes both do (*Quodlibidal Questions* iv 1, p. 294). His point is that, *contra* Aquinas and Scotus, it is possible for final or efficient causes to belong to a thing without the other also belonging to it. Ockham does agree that god is both a final and efficient cause (*Quodlibidal Questions*, p. 295), but he also argues that, 'it cannot be sufficiently proved that every effect has a final cause' (*Quodlibidal Questions*, p. 295). Ockham has in mind all effects not caused by intentional agents. He says: 'the existence of the end is not required in order for the effect to be produced. Nonetheless, in intentional agents it is required that the end be loved and desired efficaciously' (*Quodlibidal Questions*, pp. 298–9). Ockham also makes it clear that he is advancing an interpretation of Aristotle:

the philosopher's arguments all apply just to an agent that is able to fail and fall short without any change at all in the concurring agent or the patient or the other dispositions. The only sort of agent like this is a free agent . . . the arguments in question do not establish that other agents have a final cause . . . the question 'For what reason?' is inappropriate in the case of natural actions . . . it is no real question to ask for what reason a fire is generated, this question is appropriate only in the case of voluntary actions. And so it is right to ask for what reason they are fighting, since they are fighting voluntarily in order that they might dominate. And it can be proved evidently through experience (and in no other way) that a free agent acts because of an end. And in such actions the effect sometimes has a final cause that is distinct from its efficient cause and sometimes has an end that is not distinct from its efficient cause. (*Quodlibidal Questions* iv 1, p. 299 trans. Freddoso and Kelley)

What is really interesting about this position is that its acknowledgement ought to complicate the popular perception of a radical break in the seventeenth century from scholastic Aristotelianism and a turn away from final causes. The fourteenth-century Ockham more strictly limits the scope of final causality than even Bacon. For Bacon thought that final causes were appropriate with respect to all kinds of non-intentional entities or modes (such as the existence of eyelids or the toughness of animal hides), provided the context is what he calls 'metaphysical'—as opposed to 'physical'.⁴⁷ Even Descartes did not absolutely deny the existence of

⁴⁶ He defines a final cause as 'being loved and desired efficaciously by an agent, such that an effect is brought about', and an efficient cause as 'that which is such that something else follows upon its existence or presence' (*QQ* iv 1, p. 294).

⁴⁷ He says: 'these final causes, however, are not false, or unworthy of inquiry in metaphysics, but their excursion into the limits of physical causes hath made a great devastation of that province; otherwise, when contained in their own bounds, they are not repugnant to physical causes . . . these two kinds of cause agreeing excellently together; the one expressing the intention, and the other the consequence only' (*Advancement of Learning* iii 4, pp. 142–3).

finality,⁴⁸ certainly not with respect to voluntary actions and intentional agents. Rather he restricted them to that, just as Aristotelians like Ockham had. For this reason Des Chene concludes: 'Descartes' views here are rather the culmination of a trend rather than a radical departure' (1996, p. 394).⁴⁹

It is true, however, that most Aristotelians, especially those of the Renaissance period, generally made less restrictive use of final causes than Ockham, and it is probably they that critics of final causality, such as Bacon and Descartes, had in mind. For example, the Coimbrans (late sixteenth- and early seventeenth-century Jesuit philosophy professors at the University of Coimbra in Portugal who wrote influential commentaries on Aristotle's works)⁵⁰ seem to have embraced global creationist teleology.

Nothing superfluous or without an end has been brought about by God, although to the ignorant it may at first glance seem so, just as someone might judge the tools in some craftsman's workshop to have been multiplied beyond necessity, because he is ignorant of their uses. (Coimbra, *In Phys* 2c9q1a3, 1:326; trans. Des Chene 1996, p. 176)

The Coimbrans explain the existence of minute animals, for example, in terms of their beauty and interaction with other beings, and even animals hostile to humans 'should at least be praised for reminding us to esteem that other better life, in which there is the greatest security . . . it was useful to man that he should encounter some beneficial things, and some harmful, so that in avoiding one and striving after the other he should exercise his power of reason' (Coimbra, *In Phys*, 2c9q1a3, 1:327 trans. Des Chene 1996, p. 177). Such so-called explanations show the anthropocentric orientation of the Coimbrans' use of final causes, which is also integrated into a comprehensive hierarchy, as:

It is established by the law of nature that things of inferior grade are rendered to the more excellent, especially if they can sometimes make use of them . . . the form of an element, the most contemptible of all, is ordained to [the use of] the form of a mixed body; the form of a mixed body to the vegetative; the vegetative is possessed by the sensible; and this again by the rational soul, which embraces all ranks and perfection of forms . . . man, by the inborn right of his nobility, and the prerogative of the more eminent form, summons the whole body of nature, and claims it for himself. (*In Phys* 2c9q2a1; 1:328, trans. Des Chene 1996, p. 183)

⁴⁸ Descartes believes that god makes use of both final and efficient causes, but that we can only know the latter. That should not be taken as a blanket denial of the existence of final causes. He also uses ends in the account of the senses at the end of the sixth meditation, and in the physiological descriptions of *L'Homme* (Des Chene 2001, pp. 119–22).

⁴⁹ In what follows I am deeply indebted to Des Chene's studies, 1996, 2000, 2001.

⁵⁰ I am quoting from their commentary on Aristotle's *Physics* (*In Phys.*), which was published in 1594. About their commentaries in general: 'These commentaries had a wide distribution and broad influence throughout the seventeenth century in Europe, North and South America, Africa, India, and the Far East, including both Japan and China' (Doyle 2001, p. 15). C. S. Peirce called them 'commentators than whom no authority is higher' (Doyle 2001, p. 21). For a fascinating discussion of a Coimbra commentary on *Categories* translated into Chinese in the seventeenth century, see Wardy 2000.

The problem with this gradation of finality is that the lower grades ('natural agents' and animals) will have to be thought of either as ends only in a secondary sense, or else in connection with the ends of the highest grades ('rational agents', i.e. humans). The Coimbrans clearly related ends of all lower beings to humans. Suárez (1548–1617) simply argued that they do not have ends in the strict sense; for lower beings,

there is no final causality, properly speaking, but only a tendency to a certain end ... the adequate principle of these actions is not just the proximate natural agent, unless perhaps *secundum quid* [i.e. with respect to the order of efficient causes] ... but absolutely the chief [principle] is the first cause, and so an adequate principle of such actions includes an intellectual cause intending their ends. (Suárez 1597, *Disputationes metaphysicae* 23§10¶6, *Opera* 25:887, trans. Des Chene 1996, p. 195).

This way of understanding the finality of inanimate objects (natural agents)—by making them into instruments of an intellective agent, in the final analysis god, has the virtue of avoiding the charge of animism. Whether it holds up as an interpretation of Aristotle—which it is evidently intended to do—will have to be resolved later.

With respect to brute animals, it was widely supposed that efficient causes could not account for animal behavior, especially complex behavior like the building of nests by birds, and the spinning of webs by spiders. Hence it should be noted that although the Coimbrans subordinate the ends of brutes to rational agents (i.e. humans), they do not deny that such animals themselves have ends and engage in end-oriented activity. Those who account for animal behavior according to efficient causes alone tend to deny that plants and animals move themselves or are themselves ends. The anti-Aristotelian Descartes famously maintained this position. But in the Aristotelian camp, Buridan (1300–58) had already maintained the position, though in a different form:

the swallow, when it mates, nests, and lays eggs, no more thinks of the young which are to be generated than a tree, when it leafs and flowers, thinks of its fruit. Nor do the mating, nesting, and egg-laying of the swallow depend in their existence and order on the young ... rather the form and nature of the swallow and celestial bodies at the appointed times and God by his infinite wisdom determine the swallow to mate, and from that follows the generation of eggs, and then, when the swallow is so disposed by its nature together with celestial bodies and God, all of them determine it to nest building and then to egg laying ... All these issue from divine art and celestial bodies and particular agents, both extrinsic and intrinsic. (Buridan, *In Phys* 2q13, p4orb, trans. Des Chene 1996, p. 199)

In this passage Buridan applies the Ockhamist position, that intelligent agents alone are final causes, to the case of brutes and plants. The workings of non-rational (i.e. non-human or non-divine) agents are accounted for by efficient causes, their finality residing either in the art of god, as with Scotus, or in their usefulness to higher grades of nature, especially humans, as with the Coimbrans. The most radical extension of this logic, while still remaining within an 'Aristotelian' framework, is

evident in Hurtado de Mendoza's *Cursus* (1624), where all questions about final causes are treated not in the context of *Physics*, but 'instead among disputations about the will' (Des Chene 1996, p. 169).

The upshot of all this is that we have to recognize that already in the scholastic period there were considerable controversies about how to interpret teleology and the scope of final causes. On the issue of final causes, the debate about the interpretation of Aristotle displayed the same scope of controversy as existed between the early modern philosophers and scientific revolutionaries.

1.3 NATURAL THEOLOGY AND THE CRITIQUE OF TELEOLOGY

The exact term 'teleology', or its equivalents in other languages, is not attested before 1728,⁵¹ when the German philosopher Christian Wolff, writing his Latin *Rational Philosophy or Logic*, recommended *teleologia* as a name for that part of natural philosophy (*philosophiæ naturalis pars*) which explicates the ends of things (*finis rerum explicat*). 'Dici posset Teleologia' (Wolff 1728a, *Philosophia rationalis sive logica*, sec. 85).

Wolff considered it a most important task to discover hidden parts of philosophy that needed to be brought to light and organized into a system.⁵² Although discussion of 'final causes' and their role in physics and other natural sciences was commonplace in eighteenth-century philosophy, and had been for a long time before that, Wolff evidently felt that the study of final causes required designation as a separate discipline.⁵³

For Wolff, there is a general and a specific aspect of physics, and the specific aspect includes cosmology, meteorology, oryctology (the science of minerals), hydrology, phytology, and physiology. An examination of Wolff's table entitled 'The parts of philosophy' in the *Rational Philosophy* (Wolff 1728a, Tabula IV, pp. 13–17) shows that the term 'teleology' was contrived on the model of such terms, and others that occupied different sectors of his disciplinary matrix, like technology, theology, physiology, and psychology. The organization of the table, which is the conspectus of Wolff's disciplinary taxonomy, gives the impression that teleology and experiment are correlative methods of physics. But Wolff in fact holds teleology itself to be a special science, distinct from physics (which explains

⁵¹ OED s.v. teleology; Owens 1968, p. 159; Lennox 1992; McLaughlin 2001, p. 16 and n. 1.

⁵² 'There are many philosophical disciplines which still lie hidden. At the proper time they will be brought to light as learned men apply themselves seriously to philosophy . . . Our humble task is to help organize the parts of philosophy even though not all of the philosophical disciplines have yet been discovered' (Wolff, *Discursus*, sec. 86).

⁵³ In this respect he was in vague agreement with Bacon, who thought that final causes should be studied in a discipline separate from physics, which he called 'metaphysics'.

according to efficient causes). This is clear from what he says in the *Preliminary Discourse on Philosophy in General* in the *Rational Philosophy*.

A twofold reason can be given for natural things. One reason is to be found in the efficient cause, and the other reason in the final cause. Reasons which are sought in the efficient cause belong to the sciences which we have already defined. Besides these sciences there is still another part of natural philosophy which explains the end of things. There is no name for this discipline, even though it is very important and most useful. It could be called teleology. (Wolff 1728b, sec. 85, trans. Blackwell)

Physics must precede teleology. Physics demonstrates the efficient causes of natural things, while teleology demonstrates their final causes. Now final causes are seen after the efficient causes have been recognized. (Wolff 1728b, sec. 100, trans. Blackwell)

The story of the adoption of the term begins with the eighteenth-century physicist and inventor George Lewis Lesage of Geneva, who proposed to advance a 'theory of the ends of nature and art' in a book entitled *Teleology*. As Paul Janet points out, 'by this work he responded to the desire of Wolff, who in the preface of his *Logic*, had uttered the wish that the doctrine of ends were handled apart, as a body of distinct science' (Janet 1876, p. 439). According to Janet, Lesage's *Teleology* would have stood out 'from the treatises of physical teleology so numerous in the 18th century' (p. 445), insofar as it would have stated general principles, rules, and theorems about teleology, instead of just specific examples. Janet is referring to works of 'natural theology' (also called 'physical theology') that were common throughout the seventeenth century, and even thereafter throughout the eighteenth century, especially in England.⁵⁴ Unfortunately, Lesage's *Teleology* was never brought to completion, and its fragmentary status has plunged the work into obscurity. But it is clear enough that the technical term teleology was in widespread use in scientific and philosophical circles by the second half of the eighteenth century. Further, it is clear that the works of natural theology are an extension of the strategy—an ancient one, as we have seen—of utilizing final causes in nature as evidence for the existence and providence of god.

This is the milieu that spawned Kant's *Critique of Teleological Judgment* (Part 2 of *The Critique of Judgment*, 1790). This work has had a lasting influence, and a

⁵⁴ The forerunner of these works is clearly Boyle's *Final Causes of Natural Things* (London, 1688). For the eighteenth century, the following are just a sample of titles: W. Derham, *Physico-Theology* (London, 1714) and *Astro-theology* (1715); John Ray, *Wisdom of God manifested in the Works of Creation* (1714); Consider some of the titles by the 'naturalist' Lesser: *Hélio-théologie* (1744); *Litho-théologie* (1757); *Testaceo-théologie* (1744); *Insecto-théologie*, etc. (See Janet, p. 62 n. 1.) In the nineteenth century the movement was at its peak with, most famously, W. Paley, *Natural Theology* (London, 1802), and the *Bridgewater Treatises*, which were printed and reprinted continuously in London from 1833. Here are some illustrative titles: *On the power, wisdom, and goodness of god as manifested in the adaptation of external nature to the moral and intellectual constitution of man* (T. Chalmers, 2 vols., London, 1833, 8th edn. 1884); *Astronomy and general physics, considered with reference to natural theology* (W. Whewell, 2 vols., London, 1833); *Animal and vegetable physiology, considered with reference to natural theology* (P. M. Roget, 2 vols., London, 1834, 5th edn. 1870); *Geology and Mineralogy, considered with reference to natural theology* (W. E. Buckland, London 1836, 9th edn. 1860). For a more complete catalogue, see Barrow and Tipler 1986, p. 117 n. 154.

close examination of some of its main tenets reveals that many of its distinctions have had a great, even if indirect, influence on the post-Kantian interpretation or reconstruction of Aristotelian teleology. In fact, as we will see, it is possible to detect a Kantian strain in much of the twentieth-century work on Aristotle's teleology.

Basic to Kant's critique is the distinction between intrinsic (or immanent) finality and extrinsic (or relative) finality. The former pertains to a natural kind; the latter depends on usability or adaptability by others, and does not warrant absolute teleological judgment (p. 369). Extrinsic finality is defined as 'the finality that exists where one thing in nature sub-serves another as means to an end' (p. 425). Thus there is a relative finality of certain 'products of nature' to humans—for all those things that are adaptable to human use. Individual organisms are the only things that are ends and they supply natural science with the basis for teleology (pp. 375–6). When humans relate to other organisms as means, only an extrinsic or relative finality obtains (p. 378).

Kant discusses the apparent antinomy of teleology and mechanism. Mechanism he considers the basis of all research in physical sciences. But organisms apparently cannot be accounted for solely on the basis of mechanism. So the following dialectic arises:

1. *Thesis*: All production of material things and their forms must be estimated as possible on mere mechanical grounds.

2. *Antithesis*: Some products of material nature cannot be estimated as possible on mere mechanical laws (that is, for estimating them quite a different law of causality is required, namely, that of final causes). (p. 387)

If these principles of investigation are extended to the physical objects themselves, then the following antinomy results:

3. *Thesis*: All production of material things is possible on mere mechanical laws.

4. *Antithesis*: Some production of such things is not possible on mere mechanical laws. (p. 387)

The propositions of the antinomy (3 and 4) contradict each other, so one of them must be false. But since reason cannot prove one or the other of them *a priori*, we have to abandon them as objective principles for determinate judgment (p. 387). That leaves us with 1 and 2 ('the dialectic of teleology and mechanism'), which do not contradict, and are not principles of the objects themselves, but only 'maxims' or 'regulative principles of inquiry'.

Thus teleology is of heuristic value to natural inquiry. One must account for nature, 'as far as we can' (p. 388, cf. p. 413) on mechanical grounds, but in cases where we can go no further, and so need to invoke final causes (that is, in the case of organisms), we are entitled to do so in order to aid our reflection on them. But it does not follow that the objects themselves are not possible solely on a mechanism of nature; rather, it is only a limitation of human reason that we cannot discover the mechanism and so are forced to have recourse to ends. The principle (of looking

to final causality to judge things in nature) is merely subjectively valid and not an objective principle of nature (sec. 72, p. 389). We do not observe the ends in nature, but 'only read this conception into the facts as a guide to judgment in its reflection upon the products of nature' (sec. 75, p. 399).

Although it cannot be said that material things require the agency of a cause that pursues designs, it can be said that 'by the particular constitution of my cognitive faculties the only way I can judge of the possibility of those things and of their production is by perceiving for that purpose a cause working designedly' (sec. 75, pp. 397–8). It follows that final causality is 'absolutely necessary' (p. 398) for the empirical employment of reason in the investigation of nature. So Kant says: 'It is, I mean, quite certain that we can never get a sufficient knowledge of organized beings and their inner possibility, much less get an explanation of them, by looking merely to mechanical principles of nature' (p. 400). Even a being with superior, but still finite, powers would be in the same position:

we can never get rid of the appeal to a completely different source of generation for the possibility of a product of this kind, namely that of a causality by ends. It is utterly impossible for human reason, or for any finite reason qualitatively resembling ours, however much it may surpass it in degree, to hope to understand the generation even of a blade of grass from mere mechanical causes. (*Judgment*, sec. 77, p. 409)

A corollary of the impossibility of the elimination of teleology is that teleology and mechanism must not contradict: nature should be estimated according to both kinds of principles (sec. 77, p. 409; cf. p. 379). But although neither mechanism nor teleology can be eliminated from the investigation of nature, and the employment of both is necessary in diverse aspects of natural science, still one and the same thing cannot be explained both teleologically and mechanistically. Kant's example: if I explain a maggot as a 'product of the mere mechanism of matter' then I cannot 'turn around and derive the same product from the same substance as a causality that acts from ends' (sec. 78, pp. 411–12). Furthermore, because some things must be estimated according to final causality, namely organisms, and we cannot once and for all determine how far the mechanical mode of explanation will take us, it follows that in the case of organisms mechanism is subordinate to teleology (p. 415).

Kant believes teleology to be indispensable to natural science, and he recognizes that 'natural teleology forms a part of physics, and is a method applicable to the solution of the problems of physics' (sec. 68, p. 382). Thus it is compatible with other methods in physics. But since teleology is only a reflective principle of judgment and not a determinate one (like mechanism), it cannot form a science itself, a doctrine of science, or a separate branch of science. In Kant's terms, it is only a 'critique of a particular cognitive faculty, namely judgment' (sec. 79, p. 417).

Although it is possible to consider as relatively final whatever products of nature humans can use or adapt to their own purposes, it in no way follows that these things were predestined for human use (p. 368). In fact, 'if we go through

the whole of nature we do not find in it, as nature, any being capable of laying claim to the distinction of being the final end of creation' (sec. 82, p. 426). Just as it is possible to construct an anthropocentric teleology (as Kant goes through the exercise of doing), a reverse anthropocentric teleology—a phyto-centric teleology—is just as conceivable (p. 427). Nature subjects humans equally to all operations of its mechanism (p. 427), and 'is far from having made a particular favorite of man or from having preferred him to all other animals as object of his beneficence' (sec. 83, p. 430).

Nonetheless, because humans are the only beings on earth that possess understanding, and thus can represent ends as the object of deliberate choice, a human is 'certainly titular lord of nature' (p. 431). Humans are entitled to regard humans as the ultimate end, since they are the space in which nature can go beyond itself, into the kingdom of freedom. And since culture is the final product of all free choice collectively considered, 'it is only culture that can be the ultimate end which we have cause to attribute to nature in respect of the human race' (p. 431). And since human existence involves the highest end, it is an end 'to which he may subject the whole of nature' (sec. 84, p. 435). And if we operate under the assumption that there must be an interconnection of all ends,

then man is the final end of creation. For without man the chain of mutually subordinated ends would have no point of attachment. Only in man, and only in him as the individual being to whom the moral law applies, do we find unconditional legislation in respect of ends. That legislation, therefore, is what alone qualifies him to be a final end to which the entire nature is teleologically subordinated. (pp. 435–6)

These themes, the antinomy of mechanism and nature, the heuristic value of final causes, and anthropocentrism, lurk large in the following study: they are central to the interpretation and evaluation of Aristotelian teleology. And yet Kant doesn't mention Aristotle in his critique of teleology.⁵⁵

The first philosopher I have found who explicitly invokes Aristotle in a discussion of 'teleology' is Hegel. He does so in the context of the distinction between internal and external teleology, which he borrowed from Kant: 'the determination of life by Aristotle already contains this internal purposiveness; hence it stands infinitely far above the concept of modern teleology which had only finite, or external, purposiveness in view' (*The Encyclopaedia of the Philosophical Sciences in Outline*, 1817, 3rd edn. 1830, part 1, 'The encyclopaedia logic' sec. 204). For Hegel, teleology is not in direct opposition to mechanism, but rather is a unity of mechanism (the doctrine that the world as a whole and natural entities operate on mechanical principles) and 'chemism' (the doctrine that the world as a whole and

⁵⁵ Kant does not indulge in a discussion of the history of teleology: he mentions Anaxagoras and Plato (*Judgment*, p. 363, his source is obviously *Phd* 96b f.), and Epicurus (p. 393), but these are only anecdotes. Aristotle is very conspicuously absent from the discussion, even though echoes of him are unmistakable. For instance, Kant says: 'in such a product nothing is in vain, without an end' (*Judgment*, p. 376). Ginsburg 2004 has recently shown, in a penetrating and far-reaching article, that Aristotle is a major influence on Kant's views about science generally and teleology specifically.

natural entities operate according to the operation and arrangement of chemical principles). Hegel's position cannot be said to have had a great influence on subsequent Aristotelian interpretation, except to the extent that some contemporary interpreters of Aristotle agree with Hegel that Aristotle advocates only an 'internal' teleology. It is apparent that the notion of chemism cannot resolve the antinomy of mechanism and teleology discussed by Kant, at least if the subsequent history of chemistry, in particular biochemistry, is concerned.⁵⁶

What importance does the history of the technical term 'teleology' have then for an account of Aristotelian teleology? One thing is the fact that it is only in the modern period that the exact question—What is the nature of Aristotelian teleology?—has been asked. In deciding not only on our answer to the question, but on the meaning of the question itself, we must be aware of the initially highly reified condition of the concept of teleology. It is first proposed as a designation for a separate science coordinate with physics, and then subjected to a critique as a concept of reflective judgment, and then deployed dialectically in opposition to mechanism.

1.4 THEOPHRASTUS AND TELEOLOGICAL APORAI

Although Aristotle is commonly held to be the inventor of teleology,⁵⁷ we have now seen that, technically, he was not. And if we speak non-technically, and so somewhat anachronistically, it is still clear that he was not the first philosopher to have advanced teleological explanations. He was, historically speaking, a developer and refiner of teleological ideas that had been growing in popularity in the decades immediately before and after his birth. As far back as Anaxagoras and Diogenes of Apollonia, philosophers were invoking quasi-teleological notions. By the time of Socrates, the idea that everything in the world has been designed for some purpose (i.e. for humans) was common: Xenophon represents Socrates as a retailer of such positions. Plato represents Socrates as a critic of Anaxagoras for failing to use purposive notions often or well enough. Plato himself develops a cosmology and theology that assigns primacy to the determination of the purposes of things in accordance with the intentions of an intelligent and providential designer.

Aristotle was, however, the first philosopher to examine critically the methodology of teleological explanation, and to argue for limits to its application in specific scientific contexts, such as physics, life sciences, and anthropology. His approach to ends and purposes is aporetic—he scrutinizes proffered explanations of things and processes. He says, 'concerning each kind of nature there is

⁵⁶ Aristotle's 'chemical' treatise, *Meteor* iv, discusses the transition between inorganic and organic substances in ch. 12. But since he treats inorganic substances (the four elements) teleologically themselves, not 'mechanically', there is not much of an analogy to the 'chemism' of Hegel's dialectic.

⁵⁷ 'Aristotle is universally credited with inventing the concept of teleology' (Lang 1989, p. 569).

perplexity and a need for investigation' (περί ἐκάστην φύσιν ἀπορίαν ἔχει καὶ δεῖται σκέψεως)' (EE 1214^a9–10). He shows how factors such as chance, purpose, craft, necessity, matter, and so forth, play different roles in explaining the regularity of diverse natural kinds and processes. Sometimes the solution is to invoke multiple causal factors, while at other times the solution is to eliminate or qualify certain of them.

It has been persistently unappreciated to what extent he was also a critic of the earlier use of purposes and goals, and worked to reign in abusive teleological explanations. Like his contemporary and associate Theophrastus (372–287 BCE), Aristotle was concerned to determine specific 'standards' (ὅροι, 'canons' or 'limits')⁵⁸ for teleological explanation. It is worth briefly examining Theophrastus' call for a determination of specific standards on the application of the kind of explanation that involves 'the cause for the sake of which', because I think that his discussion reveals a concern that Aristotle shared and endeavored to follow in his specific inquiries.⁵⁹

Were it not for the fact that Aristotle showed such great concern about it himself, the question of the appropriate limits of teleological explanation might be considered a Theophrastean question.⁶⁰ For Theophrastus, in his short treatise *Metaphysics*, explicitly raises the problem of the appropriate role of purposive and normative terminology in scientific explanation, with respect to everything from the heavenly bodies to the structure of the bubble,⁶¹ and everything in between, including plants and animals, and their behaviors and parts.

Theophrastus' treatise is not a commentary on Aristotle.⁶² It is not meant to explain the thought of Aristotle or anyone else. (Theophrastus names and criticizes many philosophers, such as Plato and Speusippus, but he never mentions Aristotle explicitly. It is possible that this is because his *Metaphysics* was composed while Aristotle was still alive.) The treatise is aporetic.⁶³ It discusses things that seem irrational or absurd (ἄλογον, παράλογον, ἄτοπον), gives a reason for mentioning them, suggests possible solutions, and discusses the merits and likelihood of the solutions. The conclusion or resolution of an aporia is frequently accompanied by a qualification, and its complications are discussed. We find interrogation

⁵⁸ 'It is clear that for the inquiry into nature, too, there should be certain standards (ὅρους), such that by referring to them one can appraise the manner of its proofs, apart from the question of what the truth is, whether thus or otherwise' (PA 639^a12–15, trans. Lennox, CLAR).

⁵⁹ Theophrastus was Aristotle's pupil and immediate successor. We know that he worked directly with Aristotle for about thirty years, and continued after Aristotle's death many of the projects envisioned in the school after Aristotle's death.

⁶⁰ Lennox takes Theophrastus' text to contain a critique of the excesses of Aristotelian teleology (1985b). Repici (1990) criticizes Lennox's position by documenting much agreement between Aristotle and Theophrastus. But see Lennox's response (2001a, pp. 226–7), which makes it clear that he sees Theophrastus' arguments as a concern shared by Aristotle.

⁶¹ For the 'bubble' see also Plato, Tim 66^b4; [Aristotle] Prob 913^a19–33, 936^b1–9; 939^a25–7.

⁶² It is possible that the treatise was written during Aristotle's lifetime, perhaps before *GA* (Most 1988, p. 233). Cf. Lennox 1985b; Van Raalte 1988.

⁶³ Van Raalte 1993, pp. 2–7; Laks and Most 1993, pp. xxiii–xxvii.

and critique of various positions, but no ultimate commitment to an answer or advocacy of an alternative. (This is a method that Aristotle himself frequently follows, as we will see). Theophrastus justifies the procedure methodologically: 'perception both observes the differences and seeks the causes; or perhaps it is more in accordance with reality to say that it provides the thinking faculty with suggestions, some by simply seeking, others by producing in it a perplexity (ἀπορίαν) through which, even if it is unable to advance, some light appears in what is lit if one seeks further' (8^b12–16, trans. Van Raalte).

An important implication of the aporetic attitude of Theophrastus' treatise is that in it we do not find a definite rejection or acceptance of teleological explanations, either generally or with reference to any of the many examples adduced by Theophrastus. What we have is a demand for evidence or proof that a process or thing is for the sake of something. What Theophrastus rejects is the uncritical assumption that everything without qualification is explicable according to final causality. That is why he calls into question general teleological formulae such as: 'all things are for the sake of something and nothing in vain' (τοῦ πάνθ' ἕνεκά του καὶ μηδὲν μάτην) (10^a22–3); 'for the sake of something and towards the best' (τοῦ θ' ἕνεκά του καὶ εἰς τὸ ἄριστον) (11^a1–2); 'nature strives for the best in all things, and where possible makes them eternal and orderly' (τὴν φύσιν ἐν ἅπασιν ὁρέγεσθαι τοῦ ἀρίστου καὶ ἐφ' ᾧ ἐνδέχεται μεταδιδόναι τοῦ ἀεὶ καὶ τοῦ τεταγμένου) (11^a5–7); 'where the better is possible, there it never fails' (ὅπου γὰρ οἶόν τε τὸ βέλτιον, ἐνταῦθα οὐδαμῶς παραλείπει) (11^a8–9).

Theophrastus raises *aporiai* about teleological explanations with respect to the cosmological, meteorological, and biological domains, and the *aporiai* have a common structure. His criterion for whether or not something is teleologically explicable is as follows: If an explanation of a given phenomenon according to necessity, accident, or spontaneity is equally plausible, then it has not been shown that the phenomenon is necessarily teleologically explicable. Theophrastus raises the possibility that perhaps incidental causes, necessity, and spontaneity can just as plausibly as 'the cause for the sake of which' account for such phenomena, including the motions of the heavenly bodies and other living and non-living things.

With regard to the issue that all things are for the sake of something and nothing is in vain, the delimitation required is not easy anyway (as is said frequently: where should we begin, and with what sort of things should we end up?), and some things in particular are difficult because they do not seem to be such, but some of them coincidentally, others by some necessity—as in the case of the heavenly bodies and of the majority of things on earth. (*Metaphysics*, 10^a21–7)

Theophrastus adduces many examples and asks whether accident, necessity, or spontaneity could possibly provide an equally plausible explanation.⁶⁴

⁶⁴ The examples are numerous, but fall into three groups. *Cosmology*: Various aspects of the motions of the heavenly bodies do not seem to be for the sake of anything. Why do the heavenly bodies move at all instead of remaining at rest? Why do they move only in circular motion, and not with

In later chapters, the details of his examples and their treatment in the works of Aristotle will be examined. Then it will become clear that Aristotle explicitly treats the examples and in fact formulates his position on teleological explanations in light of such concerns. Many medieval, Renaissance, and contemporary debates about Aristotle's teleology are prefigured in Theophrastus' work; for example, whether rainfall and the motions of the elements are teleological, whether teleology is anthropomorphic, whether teleology requires a conscious agent, or whether teleology is otiose given adequate efficient causal explanation. A close examination of Aristotle reveals that such concerns are actually present in his own work.

The big issue for Theophrastus is that the difficulties in providing accounts of the cause for the sake of which in cosmology, meteorology, and biology call into question the extent of order in the cosmos.

But again, the actual assignment of a formal account to each entity by referring to something for the sake of which in all cases is difficult, in the case of animals and plants and in the very bubble;—unless it happens through the order and change of other things that all sorts of shapes and varieties of things in the air and on earth arise; the main example of which according to some are the facts of the yearly return of the seasons, on which generations of animals, plants, and fruits depend—the sun being, so to speak, the begetter. These questions too call for an inquiry into them somewhere here, requiring as they do a delimitation of how far the ordered extends, and why more of it is impossible or the change would be for the worse. (*Metaphysics*, 7^a19–b8, trans. Van Raalte)

the great variety of motions of other ensouled things? Are the heavenly bodies moving themselves for a purpose, or under the influence of a mover? What is the relation between the movements of the heavenly and mundane bodies? The bodies that move in a circle do not seem to be for the sake of anything (καὶ τὸ ἀνήνυτον καὶ οὐ χάριν ἀφανές, 5^a17). Their circular motion, although it is the first, does not appear to be the best (εἰ δ' οὖν τῆς κυκλικῆς αἴτιον τὸ πρῶτον, οὐ τῆς ἀρίστης ἂν εἴη, 5^b7–8), because the motion of the best is rather that caused by thinking soul. On the other hand, it is questionable whether the bodies that move about the center are even part of the cosmos, or whether they happen incidentally under the influence of the circular rotations of the heavens (συμβαίνει γὰρ οἶον κατὰ συμβεβηκός ὑπὸ τῆς κυκλικῆς περιφορᾶς, 5^b23–5). It is even possible to raise the question whether the motion of the first heaven itself is due to its essence, or to accident (κατὰ συμβεβηκός, 6^a9–10). *Meteorology*: Various oceanographic, climatic, meteorological, and geological phenomena seem not to be for the sake of anything. For example: the incursions and reflexes of the sea, droughts and humidities, destructions and generations of topographic features of the earth, etc. *Biology*: Various biological phenomena do not seem to be for the sake of anything. For example: male nipples, menstruation, beards and hair growth in general, the enormous horns of deer, the violent nature of heron copulation, and the futile existence of the day fly. Finally, plants have shape and definite nature, but what for? A great variety of inanimate objects, plants, and animals, appear to be explicable by appeal to environmental and climatic factors such as the changes in seasons, whose profound effects on the things in the air and on the earth can themselves be traced back to the sun which is, 'so to speak, their begetter' (7^b5). The most important facts about animal generation and nutrition seem not to be for anything but rather due to concurrence and other necessities (οὐθενός γὰρ ταῦθ' ἐνεκα, ἀλλὰ συμπτώματα καὶ δι' ἑτέρας ἀνάγκας, 10^b18–19). Theophrastus also finds plausibility in the account that most things acquire their forms and differences 'spontaneously' (τῷ αὐτομάτῳ, 10^b27) and through 'the rotation of the whole' (10^b27–11^a1). This is very curious, given the fact that, as Balme points out, Theophrastus, in botanical contexts at least, 'expresses reluctance to accept evidence of true spontaneity, preferring to suppose that production is due to seeds latent in the ground or brought by rain and streams' (1962, p. 102, cf. 104).

Theophrastus seems to assume that the incomplete analysis of the extent to which things can be accurately explained as existing for the sake of something—some good—calls into question the extent of order itself in the universe. We might think this a strange assumption. We have become accustomed to thinking about order without purpose, intention, design, ends, or goods. But Theophrastus wonders how can there be said to be order without an identification of something for the sake of which the order exists. It poses an interesting question, even for us: what exactly do we mean by ‘order’ when we describe organization without any reference to ends, purposes, or goods? Furthermore, if we are able to determine more and more order in nature and the universe without reference to ends, then we call into question the existence of any ultimate purpose in or of the world.

There is a familiar flip-side to so-called ‘teleological arguments’ like those that have been employed in proofs for a god, who designs and orders things for the good: every identifiable case of what is futile, ugly, or disordered, or bad counts as an argument against any ultimate purpose or good in the universe, and seems to show that it as a whole exists in vain. This is why Theophrastus calls for an investigation (σκέψιν) into the measure of order in the universe. And he hints at an interesting possible solution to the problem of why there should not be more order or good in the universe when he calls for an investigation of ‘why it is impossible that the order be extended further, or else the change would be for the worse’ (7^b5–8). Here we see the seeds of a kind of theodicy, almost a ‘best of all possible worlds’ position, but with reference to order itself instead of god: were there to be more or less order, then there would be less good—the change would be for the worse (εἰς τὸ χεῖρον).

But Theophrastus initially requires a survey or ‘delimitation’ of how far order itself extends. Alas, ‘the delimitation is not easy’ (ὁ ἀφορισμὸς οὐ ῥάδιος, 10^a23). Nonetheless, Theophrastus insists that it is necessary to establish limits (ὅρους, 11^a2) on the use of teleological principles, and not to put them down indiscriminately or to apply them to everything without qualification (οὐκ ἐπὶ πάντων ἀπλῶς, 11^a3). Later in this book it will be made clear that these are also Aristotle’s concerns, and that they motivate the Stagirite to call for discrimination and limits in the application of teleological notions. This is already evident in Aristotle’s programmatic statements about explanation, such as *Physics* ii 7 and *Parts of Animals* i 1. A thorough analysis of such texts, and of the specific examples mentioned by Theophrastus and Aristotle, should make it clear that Aristotle could not have disagreed with the following remark, with which Theophrastus ends his treatise on *Metaphysics*:

But these things should be inquired into. As has been said at the beginning: one should try to grasp some limit, both in nature and in the being of the whole, both of the <explanation of things as being> ‘for the sake of something’ and of the impulse towards the better. For this is the starting-point of the study of the whole, in what things reality consists, and how they relate to one another. (11^b24–12^a2, trans. Van Raalte)