

The Cause of Cosmic Rotation in Aristotle's *Metaphysics* xii 6-7

John Proios

One of the questions about the fundamental structure of reality that Aristotle sets out to explain in *Metaphysics* xii is the rotary motion of the outermost sphere (1071b3-11, 1072a21-23).¹ For Aristotle, this is a question about the metaphysical features of substance that figures in a more general exploration of its principles (1071b3-5, 1069a19-26). In xii 6 Aristotle argues both that eternal rotation is necessary for the existence of motion (κίνησις, 1071b6-11) and that eternal rotation requires a principle of which the substance (ἡ οὐσία) is actuality (ἐνέργεια, 1071b19-22). According to xii 7, an unmoved substance (the 'Prime Mover') produces the sphere's eternal rotation as its final cause.

Some of Aristotle's readers have not found the Prime Mover sufficient, within Aristotle's own system, to cause the sphere's rotation. I attempt to respond to the following challenge:

Contrastive Question: Why does the Prime Mover's causal influence result in the sphere rotating, rather than, or in addition to, thinking, or resting?

That is, the causally relevant features of the Prime Mover could result in the sphere eternally contemplating, or being at rest, irrespective of rotation. This perception that Aristotle offers an inadequate explanation of the sphere's rotation goes back at least to Theophrastus and has remained a source of debate until the present.² The following two claims capture a traditional reply, which will serve as a stalking horse for the position this paper defends:

*Imitation Thesis:*³ (1) For any x , y , and z , if x z s in order to imitate y , y is a final cause of x 's z -ing. (2) The primary sphere rotates in order to imitate the Prime Mover, and this is what Aristotle means when he says that the Prime Mover is an end and moves as an object of love (1072b3).

(1) and (2) have come under fire from certain well-known objections.⁴ My

¹ References to the *Metaphysics* are to the Ross 1924 text. All translations are my own except where noted. In translating the *Metaphysics*, I have consulted Ross 1924 and Alexandru 2014, and I have benefitted from Frede and Charles 2000. For all other references and translations, I have used the Greek in the Loeb editions.

² *Metaphysics* 5a23-5, 5b7-10 (in Gutas 2010). Broadie 1993, 380 and 2009, 240 represents the primary proponent of the challenge today; cf. Berti 2000, 200-206, Bodnár 2016, 251, Laks 2000, 221, and Ross 2016, 218. Often the emphasis is on contemplation as an alternative to rotation: Bradshaw 2001, 8 and Ross 2016, 213.

³ DeFilippo 1993, n22, Elders 1972, 177, Richardson-Lear 2004, 86-90, Ross 1924, i cxxxviii, Ross 2016; cf. Bodnár 2016, Menn 2012, 448. The view is routinely assumed in related contexts (e.g., Henry 2013, 257 and Scharle 2008, 158).

⁴ Broadie 1993, 381-384 objects that (1) involves an 'exemplary' cause, rather than a final cause,

interest in the conjoined claims is only in their adequacy as an answer to the Contrastive Question. Assuming that the Prime Mover is a final cause and a moving cause,⁵ key questions remain regarding how his causal properties account for the sphere's rotation. Section 4 argues that the Imitation Thesis does not answer them adequately.

While one of my aims is to argue for that negative conclusion, the primary aim is to offer an interpretation of Aristotle's account of the cause of cosmic rotation that demonstrates its explanatory adequacy as far as possible. I argue that within its dialectic, Aristotle's argument in xii 7 is supposed to show that the features of the unmoved substance that account for the sphere's rotation are the same features that the sphere takes on by rotating. The sphere's aim is simplicity and actuality as a substance. Rotation makes it satisfy this goal, just as the Prime Mover's activity, contemplation, makes the Mover simple and actual (1072b14-30, 1074b15-1075a10). The relevant argument in xii 7 comes after Aristotle argues that intelligible objects move while being unmoved (1072a23-30), but before his conclusion that the Prime Mover is a specific kind of end (1072b1-4):

Intelligence is moved by the intelligible, and one side of the table (ἡ ἑτέρα συστοιχία) is in-itself intelligible; and of that, substance is primary, and of that, the simple and actual⁶ (yet what is one and what is simple are not the same: for what is one signifies a measure, while what is simple its own disposition). But surely the fine and intrinsically choice-worthy are also in the same side of the table, and the first is always best or analogous.⁷ (1072a30-1072b1)

I call this 'the *sustoikia* argument'. Section 2 argues that it answers the challenge from xii 6 of showing that there is a pure actuality that produces the sphere's rotation by identifying the simple and actual sort of substance as the sphere's

and that contemplation would be a better way to imitate the PM than rotation. Cf. Richardson-Lear 2004, 86-90 and Ross 2016. Broadie 1993 and Berti 2000 object that (2) cannot be squared with the PM's efficient causality. Cf. Judson 1994 and Bradshaw 2001. Berti 2000, 200-206, Bradshaw 2001, 7, Broadie 1993, 384, and Laks 2000, n37 object that Aristotle never talks about the sphere imitating the PM. Cf. Bodnár 2016, 251-254.

⁵ See Judson 1994 and Bradshaw 2001 for responses to the central challenges from Broadie 1993, in addition to the discussion below. Although my account does not exploit the PM's unique form of contemplation as key to his dual causal role, it seems plausible that being a simple and actual substance may account for the dual causal role in the way that any teleological mover is unmoved (cf. *MA* 7.700b4-701a6), or in the way that intelligence may be good and a mover in virtue of the same causal powers (cf. *Meta.* i 2.984b8-22). Judson 1994, 164-166 gives a general defense of the dual kind of cause that does not hinge on contemplation.

⁶ The demonstrative pronouns, ταύτης... ταύτης, indicate the scope of the class being divided. To paraphrase: substance is the primary sort of intelligible, and the simple and actual is the primary sort of intelligible substance.

⁷ νοῦς δὲ ὑπὸ τοῦ νοητοῦ κινεῖται, νοητὴ δὲ ἡ ἑτέρα συστοιχία καθ' αὐτήν· καὶ ταύτης ἡ οὐσία πρώτη, καὶ ταύτης ἡ ἀπλή καὶ κατ' ἐνέργειαν (ἔστι δὲ τὸ ἐν καὶ τὸ ἀπλοῦν οὐ τὸ αὐτό· τὸ μὲν γὰρ ἐν μέτρον σημαίνει, τὸ δὲ ἀπλοῦν πῶς ἔχον αὐτό). ἀλλὰ μὴν καὶ τὸ καλὸν καὶ τὸ δι' αὐτὸ αἰρετὸν ἐν τῇ αὐτῇ συστοιχίᾳ· καὶ ἔστιν ἄριστον αἰεὶ ἢ ἀνάλογον τὸ πρῶτον.

final cause.

Consequently, explaining how rotation achieves simplicity and actuality provides the resources to answer the Contrastive Question. Section 3 argues that rotation is in certain relevant respects simple and completely actual, while it is incompletely actual in other ways. On the one hand, it is an incomplete actuality as a form of motion. On the other hand, the sphere's uninterrupted rotation has a unique structure: any point in the locomotion across the circular rotary path completes the circle. The sphere repeatedly and eternally completes a rotation. Moreover, rotation may indefinitely extend while remaining simple. In this way, the sphere achieves the condition of being a simple and actual substance at which it aims.

I. The Framework of xii 1-5 and the Problem of xii 6

Aristotle introduces unmoved substance in xii 6 as the third among three kinds of substance (1071b3-5), in addition to the two kinds of natural substance, one sensible and the other eternal (1069a30-31). This introduction comes in the context of xii 1-5, where Aristotle articulates the principles (*ἀρχαί*), causes (*αἰτία*, 1069a16-17), and elements (*στοιχεῖα*, 1069a30-33) of natural substances. In 1-5 he offers an account of the types of causes of changes in substances and how they interact with each other. The moving cause, the form it produces, and the form's privation, account for the changes in substances. The form-privation distinction also corresponds one-for-one to pairs of contraries (e.g., heat and its privative). Combined, on Aristotle's account the moving cause produces a (positive) form in a (privative) material substrate that underlies the change (1069b3-7). This analysis explains generation or substantial change, alteration of quality, increase and decrease, and locomotion or change of place (1069b9-14), which exhaust all changes of substances.⁸ Aristotle also maps the actuality/potentiality distinction into this framework. Every material is potentially the actual form it becomes, e.g., the surface that is potentially white becomes actually white (1069b15-20; cf. 1070b20-21).

These distinctions help to explain the particular problem Aristotle produces as motivation, in xii 6, for the existence of an unmoved substance identical to an actuality. Time and motion are both necessarily eternally continuous (*συνεχῆς*), by the following considerations. If time were not eternally continuous, there would be a *before* and *after* time itself, which is impossible (1073b8-9). Time, then, has to be eternally continuous in order to be possible (and we observe it exists, so it is possible). Parallel considerations apply to motion, since time is either the same as motion or an affection (*πάθος*) of it (1071b9-11). The only continuous form of motion is rotary locomotion (1071b10-12). Moreover, since eternal rotation requires *some* eternally rotating substance, necessarily there is an eternally rotating substance, since necessarily there is time and motion (cf. 1069a19-21, 1071a34-35; *Ph.* iii 1.200b33-201a3).

The actuality/potentiality distinction also has work to do for the problem of xii

⁸ Cf. *Ph.* i 7.190b28-191a5, *GC* i 1.314b26-28, 2.315a26-28, 5.320a9-26.

6. Before he explains how there is an eternally rotating substance, Aristotle articulates the following principle:

Priority Principle: If something is capable of moving or producing, but is not acting (μὴ ἐνεργοῦν), there will not be motion: for what has a power could fail to activate (ἐνδέχεται γὰρ τὸ δύναμιν ἔχον μὴ ἐνεργεῖν). (1071b12-14)

If a substance has a capacity for a corresponding actuality, the possession of the capacity does not explain its actuality. The activation of a substance's capacity requires a separate actuality to bring it from capacity to actuality. Since the problem regarding motion shows that there is necessarily an eternally rotating substance, and the Priority Principle shows that for that substance to rotate eternally, there has to be a purely actual source of its motion that does not require a further actuality as its own cause (1071b18-19), Aristotle concludes that there is a principle whose substance is actuality (ἐνέργεια, 1071b19-22). The purely actual source of motion cannot be the same as the rotating substance.⁹ Eternal beings' motion entails capacity, even if their substance is actuality: the sphere can be otherwise than it is 'in place, even if not in substance' (1072b6-7; cf. ix 8.1050b6-27).¹⁰

There are two final features of the arguments that anticipate the Prime Mover that are important to the position I defend. First, it is clear that the actuality responsible for the sphere's rotation is its moving cause. In the analysis of natural change in xii 1-5, every pair of contraries (the form and privation) has a moving cause that produces or eliminates the form, for instance, the medical art produces health or disease in a body; carpentry produces a house or 'a certain disorder' out of bricks (1070b26-30); a human gives birth to a human (1070a8 and b31). All change happens 'by art or by nature' or by their opposites, 'by chance or by spontaneity' (1070a6-9). The Prime Mover plays the role of nature or art (1071b31-36). Additionally, some moving causes are type-identical in form to what they move while being ontologically separate as moving causes. The moving cause is in a way the same as the formal cause, as the medical art is in a way the same as health, the art of building the form of the house, and as a human being produces a human being (1070b33-34). Yet the formal and moving causes make distinguishable causal contributions to the existence and nature of an individual natural substance. The form is an elemental principle and cause, inhering in the subject of change (cf. 1070a21-24 and a7-9), while the moving cause is external (1070b22-35).¹¹ For while the human reproducer and the human

⁹ Pace Broadie 1993, 386-388 and 2009, 240-242. Cf. Judson 1994, 162-163.

¹⁰ The sphere's capacity for relocation is the subject of section 3. However, one might also worry that my account does not explain why the PM satisfies the Priority Principle. According to my account, the PM produces rotation because the PM is simple and actual as a substance, in virtue of its contemplation. I do not think this means that the PM does not necessarily act, since on my account the PM is simple and actual because of its eternal self-contemplation, so in the service of being completely actual, the PM must engage in the activity of thinking.

¹¹ Consequently, some movers, like the Sun, are causes of the generation of many particular beings with which they are identical neither in matter nor form (1071a15-17). But even the moving causes that share a form universally with what they cause are movers in virtue of forms that are

offspring each have human forms organizing each one's composition, the reproducer's form as a *moving* cause is ontologically separate from the offspring. Because the father uses his human reproductive organs to produce the offspring (making his form as human its moving cause), some offspring generates into a human being (making its form as human its formal and final cause). In this way, the parent and child share a form 'universally' or 'in general', even though there is no causally active universal form, just the particular, separate, forms acting in different causal roles in the shared process (1071a19-24, cf. a15).

I suggest that the Prime Mover is the sort of moving cause that is type-identical in form to what he causes.¹² Aristotle plausibly associates actuality with this type of moving cause: one sense in which everything has the same causes is that what is 'first in actuality' is the cause (1071a35-36). While it is possible that this is a reference to the Prime Mover (Tredennick 1933 and Elders 1972, 136), I suggest instead that one sense in which everything has the same cause is that everything that changes has as *an* efficient cause of its change something that is already in actuality the form (universally) that the subject of change is in potentiality. A plausible backreference is the claim that 'the primary principles of all things are that which is first in actuality here and another first in potentiality..., <as> Peleus is the principle of Achilles, your father of you, and the B here of the BA there' (1071a18-23).¹³ Since the Prime Mover is the principle whose substance is pure actuality, we should expect Aristotle to think that he is the kind of moving cause whose actual form is type-identical to the form it causally brings from potency to actuality. Certainly, the Prime Mover cannot be or have a form in the sense of arrangement of some material, or actuality of some capacity. But the *sustoikia* argument describes the Prime Mover as certain positive terms in pairs of contraries. We have seen that in xii 1-5, the analysis of change involves a moving cause instantiating one of a pair of contraries in a material. Since the *sustoikia* argument identifies the Prime Mover with positives in a particular series of pairs, it is plausible that the Prime Mover's causal features stem from the formal condition the *sustoikia* argument attributes to it: simple and actual substance. Below I maintain that the Prime Mover's eternal self-contemplation and the sphere's eternal rotation are coordinate activities in virtue of which each instantiates the shared form of being a simple and actual substance.¹⁴

separate from the elemental forms inhering in what they move; their own forms are elemental causes *in them* while being external movers of separate substances.

¹² An obstacle to this suggestion is that at xii 4.1070b34-35 Aristotle says that there is in addition 'that which as first of all things moves all things'. This is traditionally taken as a reference to the PM and to be a case of non-type-identical moving causes (Crubellier 2000, 158-159, Ross 1924, ii 361), Tredennick 1933). However, it is not clear to me why Aristotle would deploy the PM before he establishes its existence, especially when the Sun is a ready example. Further, Aristotle has just listed type-identical moving causes (1070b33-34), and 'still beyond these' could indicate a forceful example, rather than a contrast in kind.

¹³ See also the universally quantified claim in xii 3.1070a4-5 that every substance comes to be from something that shares in name the form it comes to be.

¹⁴ Moreover, the Prime Mover in some respect stands to the sphere as parent to offspring

The Contrastive Question problematizes the Prime Mover's production of rotary motion in the sphere. One especially pressing issue is that I claimed that the Prime Mover's formal condition is the aim that causes the sphere's rotation. If rotation is the form of the sphere's change, but the Prime Mover does not move, this seems impossible.¹⁵ The rest of this paper is devoted to vindicating Aristotle's account as far as possible.

II. Explaining Rotation

I suggest that xii 7 discharges its primary dialectical duty of coherently articulating the purely actual principle of the sphere's eternal rotation (1072a19-23) in the *sustoikia* argument. Given that the sphere's mover must be unmoved (1072a23-26), Aristotle argues that it must move as an object of intelligence moves (1072a26-30):

The object of desire and the object of intelligence (τὸ νοητόν) move this way: it moves while not being moved. The primary of these are the same. For the desired seems fine, but the primary thing wished for really is fine. And we desire because it seems <fine> rather than it seems <fine> because we desire it. For understanding (ἡ νόησις) is the principle (ἀρχή). (1072a26-30)

This passage presents two candidates for an unmoved mover, the object of desire and the object of intelligence. It argues that the object of intelligence is more fundamental than the object of desire. Things seem desirable because of an intellectual grasp of them as attractive.¹⁶ Hence, the most fundamental source of motion is the intellectual source. Dialectically, the argument identifies the type of object that can be the principle (ἀρχή) whose substance is actuality (1071b20): 'understanding is the principle'. The subsequent *sustoikia* argument elaborates the intellectual principle of the sphere's rotation:

Intelligence is moved by the intelligible, and one side of the table (ἡ ἐτέρα συστοιχία) is in-itself intelligible; and of that, substance is primary, and of that, the simple and actual (κατ' ἐνέργειαν) (yet what is one and what is simple are not the same: for what is one signifies a measure, while what is simple its own disposition). But surely the fine and intrinsically choice-worthy are also in the same side of the table, and the first is always best or analogous. (1072a30-b1)

The *sustoikia* argument specifies what is fine such that it moves the sphere as its final cause. All of the subsequent arguments are devoted to explaining how

(1072b35-1073a3, discussed below). Cf. Broadie 1993, Kosman 1994, and Matthen 2001, which argue that the Prime Mover is the sphere's soul, and so a formal cause of its rotation. Yet this is problematic; see Judson 1994.

¹⁵ One of the main challenges from Broadie 1993, 377-386.

¹⁶ See Laks 2000, 221-223, Bradshaw 2001, 4, and Ross 1924, ii 375-376 for more discussion of this argument.

Aristotle has answered the challenge he set for himself in the previous chapter. He concludes next that making a division among kinds of ends explains how there is an end among the unmoved substances (1072b1-2). The end among the unmoved substances is an aim (τινός) rather than a beneficiary (τινί, 1072b2-3).¹⁷ That Aristotle now *defends* there being this sort of end among the unmoved substances suggests that the argument he gives immediately before *claims* that there is an end, such that the disambiguation is necessary. Aristotle then explains that the Prime Mover moves as an object of love,¹⁸ while what it moves moves everything else (1072b3-4), a view defended in the previous chapter (1072a9-19); he argues that the Prime Mover is purely actual in a way that the sphere's capacity for rotation precludes (1072b4-10), explaining how he has answered the primary problem from the previous chapter; he establishes that the Prime Mover is necessary (1072b10-13), the claim announced and problematized at the start of xii 6 (1071b4-5); he also explains that the Prime Mover's necessity makes him fine, and because fine, the principle of the sphere's motion (1072b10-11).¹⁹ Aristotle treats his own dialectical responsibility as limited to defending the argument that there is a certain kind of unmoved substance such that it is a final cause of the sphere's rotation and explaining how it meets the *desiderata* he set out in xii 6. This implies that he has already articulated the relevant teleological features of the sphere's mover, and I suggest that he does so in the *sustoikia* argument.

It seems reasonable, then, to try to understand how the *sustoikia* argument establishes the relevant teleological features of the intelligible object first identified at 1072a26-30 such that it is an unmoved mover of the sphere. Aristotle employs a *sustoikia* in a number of places (*Meta.* i 5.986a23, iv 2.1004b27, xi 9.1066a15, xiv 6.1093b12, *GC* i 4.319a15, *DS* 7.447b30, 448a16, *PA* iii 7.670b21, *Ph.* iii 2.201b25).²⁰ It is a series of contrary features, such as being and non-being, one and many, or odd and even, organized into two columns of a table; the positive contraries form their own column because they have the contents of the features, whereas the members of the other side are essentially privative. In the present context, Aristotle uses the argument identifying the object of intelligence as the most fundamental source of motion (1072a26-30) to divide the *sustoikia* into its two positive and negative columns. Since the relevant unmoved mover moves as an intelligible object, and since one side of the *sustoikia* is intrinsically intelligible, the Prime Mover's causally

¹⁷ The distinction is also made at *DA* ii 4.415b2-3, *Ph.* ii 2.194a35-36, and *EE* viii 3.1249b15.

¹⁸ Many defenders of the Imitation Thesis emphasize that the Prime Mover moves as an object of love (e.g., Richardson-Lear 2004, 85, Bodnár 2016, 249-254). But I would suggest that the *sustoikia* argument provides *what* the sphere loves, which helps us understand the causal basis of the sphere's love.

¹⁹ I would suggest partitioning the rest of xii 7 into (i) a discussion of the divine life of the PM (1072b14-30), (ii) a response to an objection (1072b30-1073a3), and (iii) an addition that the PM must be without spatial dimension (1073a3-13).

²⁰ The helpful collection of references is due to Ross 1924, ii 376, reproduced in Laks 2000, n47, which adds *Meta.* i 3.1054b35 and x 8.1058a13.

relevant features are in that column, if anywhere. Aristotle then divides the intrinsically intelligible side using primacy as the criterion, first identifying substance, then identifying, within substance, the simple and actual.²¹ That is, ‘substance’ (ἡ οὐσία) picks out the primary member of the intelligible column of the table, of which the simple and actual (ἡ ἀπλή καὶ κατ’ ἐνέργειαν) is the primary subordinate kind.

My main claim is that these positive formal properties of the Prime Mover, being a simple and actual substance, teleologically account for the sphere’s rotation. After clarifying what he means by ‘the simple’, Aristotle adds that ‘but surely the fine and the intrinsically choice-worthy (τὸ καλὸν καὶ τὸ δι’ αὐτὸ αἰρετόν) are also in the same side of the table’, and ‘the first is always best or analogous’. I suggest that in these lines Aristotle explains why it is *justified* to view the class of entity he has just identified on one part of the *sustoikia*, simple and actual substance, as the final cause of eternal rotation. By ‘but surely the fine and intrinsically choice-worthy are on the same side of the table’, Aristotle does not mean that there are separate entries for ‘the fine’ and ‘the intrinsically choice-worthy’ on the intelligible side of the *sustoikia*. He means that *what he has just identified* is fine and intrinsically choice-worthy, because there are such entries on that side of the table.²² This is why Aristotle then explains that ‘the first is always best or analogous’. ‘The first’ is the simple and actual substance he just partitioned within the intelligible side of the *sustoikia* on the basis of their primacy. That the first ‘is always best or analogous’ explains that it is *because* simple and actual substance is primary that there is an object with features that are teleologically sufficient to explain the sphere’s rotation.²³ After all, Aristotle

²¹ Why is primacy the main criterion of division? One way to explain its use is that the PM must be primary in the sense that its realization does not depend on the realization of anything else (satisfying the Priority Principle; cf. *Ph.* viii 1.251a19-23, 251b29-252a6). But my account may make additional sense of the primacy criterion in the following way. The *sustoikia* argument, on my account, serves its dialectical purpose by identifying a class of objects to which both the PM and the sphere belong: simple and actual substance. Since the sphere’s rotation is the primary form of motion, it is reasonable to divide by primacy in order to identify the relevant class to which both the PM and the sphere belong. Moreover, if the actuality of the mover and the movable are the same (e.g., *Meta.* xi 1066a26-34), the mover of primary motion must itself be primary and acting in its capacity as primary.

²² On the one hand, he may mean that the whole the intelligible column contains the sort of entries that are fine and intrinsically choice-worthy, in the same way that the whole side is intelligible. At *Meta.* xiv 6.1093b11-14 he discusses the ‘table of the fine’ (τῆς συστοιχίας... τῆς τοῦ καλοῦ). This would justify *inferring* that the simple and actual are fine. Aristotle may intend it only to be *plausible* that the simple and actual are fine and choice-worthy. The ἐν + dative structure in τὸ καλὸν καὶ τὸ δι’ αὐτὸ αἰρετόν ἐν τῇ αὐτῇ συστοιχίᾳ may suggest that the fine and intrinsically choice-worthy are merely among the entries in the positive column.

²³ I do not believe that I am committing Aristotle to a fact/value distinction. While it is *possible* to account for the relations between the simple, actual, and primary, and the fine, choice-worthy, and best, with a fact/value distinction, it is also possible to understand the first set of concepts as normative. Compare, e.g., concepts of standards, paradigms, harmonies, wholes, and unities, which have normative senses plausible in an ancient Greek philosophical context. Moreover, I am committing Aristotle only to the minimal and reasonable recognition that in order to establish that the sphere

needs to secure the goodness of the intelligible object in order to establish adequately that it has the final causal feature of moving without being moved (1072a27-30, b10-11). In the same way that identifying intelligibility as among the Prime Mover's features explains how the Mover is able to move without being moved (because intelligible objects move that way), identifying simple and actual substance as among the Prime Mover's features explains how it is able to move as a final cause because the simple and actual sort of substance is fine and intrinsically choice-worthy.

I claim that the sphere's rotation and the Prime Mover's contemplation are coordinate activities instantiating this type-common form, simple and actual substance. While the Prime Mover is soon identified with thinking about thinking (1074b33-35), the argument in xii 7 that establishes the Mover of the sphere does not identify him with pure thinking. Rather, it picks out the simple and actual as the features of the intelligible substance in virtue of which it moves the sphere. Indeed, the articulation of the principle on which depends heaven and nature (1072b14) concludes without identifying the source of the sphere's motion with a thinking being—the Mover of the sphere is at that point only an intelligible, simple, actual, fine, and choice-worthy substance. This warrants viewing the Prime Mover's contemplation as coordinate, instead of prior, to rotation: rather than being the *source* of the sphere's rotation, contemplation and rotation each help their substances instantiate a type-common form, ἡ ἀπλή και κατ' ἐνέργειαν.²⁴ In virtue of engaging in each activity, the sphere and its Mover belong to the primary form of substance, the simple and actual, such that each is intrinsically good.

That the sphere rotates in order to be in the Prime Mover's formal condition is implicit in Aristotle's response to an objection from Speusippus and the Pythagoreans later in xii 7. According to their objection: 'The finest and best thing is not in the principle (ἀρχή), because of the fact that among plants and animals the principles are causes, but what is fine and complete (τέλειον) is in the things that come from the causes' (1072b32-34). This is an objection to making the principle, the Prime Mover, a final cause. Aristotle rejects it on the grounds that the core claim, that what is fine and complete comes about *from* the principle, but could not *be* the principle, is false:

For the seed is from other, prior, and complete beings, and the first thing is not the seed, but the complete being. For instance, one could say that a man is prior to the seed, not the one

rotates because of some good end, he has to identify content for that end beyond its goodness. This does not require him to identify non-normative content *per se*.

²⁴ Consider also the interpretation of Elders 1972, 168 that the *sustoikia* plays a role in division: a term on the *sustoikia* 'signifies in particular the main line of the division'. Elders compares the division at *Top.* 143b1 of living beings along three axes: footed—without feet; two-footed—multi-footed; featherless—feathered. I have suggested that Aristotle employs the *sustoikia* to identify the simple and actual among substance; following Elders' interpretation, the contemplating god and the rotating sphere are plausibly members of the simple and actual substance as species of a genus, which may be reflected through different axes of the genus.

coming about from the seed, but a different man from whom the seed is produced. (1072b35-1073a3; cf. ix 8.1050a4-7).

The Prime Mover is prior and complete, and the end for the sake of which the sphere moves, like the way that the complete human being has the form for the sake of which a child grows, the complete condition at which the child aims *qua* potential human (cf. Blyth 2015, 461-462). This suggests that the sphere's motion stands to the Prime Mover's simplicity and actuality as the seed's/child's generation does to the formal condition of a complete adult: the change (rotation, generation) is for the sake of achieving the formal condition attributed to both the source of change and the ultimate result, where the formal condition of the prior being is the cause of the change in the posterior one. Recalling the earlier discussion, in the way that the parent is in actuality the form that is the end (universally) of its child's generation, and it is in virtue of the causal powers of that form that the child generates (i.e., due to the father's reproductive capacities), the Prime Mover is in actuality the form that is (universally) the end of the sphere's rotation, and it is in virtue of the causal powers of that form that the sphere rotates (i.e., due to the goodness of the Prime Mover's simplicity and actuality).²⁵

The position I have defended distinguishes between the features of the sphere's activity and constitution that figure essentially in the causal account Aristotle gives in xii 6-7 and other features of the sphere's activity and constitution. It may be that the sphere has a soul and intelligence and that it eternally contemplates the Prime Mover. It seems possible that the sphere needs to be aware of the Prime Mover in order to for its rotation to be physically coherent. However, it also seems possible that the sphere lacks a soul and that its material constitution's (aether) natural disposition to move in a circle physically explains the sphere's rotation (*Cael.* i 2.269a2-b17, ii 3.286a10-18, 7.289a13-16).²⁶ The claims for which I have advocated are neutral with respect to issues such as these. I have argued that the sphere rotates because rotating achieves the goal of being a simple and actual substance, so that by identifying a simple and actual intelligible substance to serve as the sphere's goal, Aristotle can causally explain the sphere's rotation. Both the psychological and physical accounts of the mechanisms underlying the sphere's rotation are plausible explanations of how

²⁵ One might worry that rotation cannot achieve simplicity and actuality as a substance, because rotation is a change in place rather than substance (cf. 1072b4-7). However, simple and actual substance must include more than necessary existence: Aristotle is supposed to be identifying the goal for the sphere that explains its rotation, but the sphere already has necessary being. Rather, 'the simple and actual' among substances must include all of the activities of the substance, such as locomotion. This is plausible even though Aristotle divides *substance* into the simple and actual: since being a substance is the ontological ground for all of the other kinds of change, it is reasonable to group substances in a way that reflects what kinds of change each kind is capable of, including topical change. The contrast between the sphere's substance and the PM is predicated on such reasoning. In this way, both contemplation and rotation help their respective substances be simple and actual.

²⁶ For a defense of the physicalist reading and discussion of the issue of the sphere's purported soul, see Blyth 2015.

the Prime Mover's formal condition 'attracts' the sphere such that the sphere 'seeks' the Mover's condition.²⁷

III. Being a Simple and Actual Substance

The previous explanation of the sphere's rotation is subject to a plausible objection. Within Aristotle's own system, rotary motion is a κίνησις (motion, change), and in the *Physics* and elsewhere κίνησις is an 'incomplete actualization' of the movable (ἡ κίνησις ἐντελέχεια κινητοῦ ἀτελής, *Ph.* viii 5.257b6-10; cf. iii 1.201a9-18, b5-15), which Aristotle distinguishes from full actuality, in which the potential no longer exists, because it has been fully actualized (201b5-15, *Meta.* xi 1065b33-1066a8). For instance, bricks are buildable into a house. When the house is *being built* the bricks are actual *qua* buildable; when the house is built, the bricks are no longer buildable, and so are no longer actual *qua* buildable. Hence, motion is an actualization of potential *qua* potential, such that it is 'a certain actuality (ἐντελέχεια), but incomplete (ἀτελής)' (*Meta.* xi 1066a20-21, *Ph.* iii 2.201b24-202a3; cf. *Meta.* ix 6.1048a25).²⁸ Aristotle clearly has his classification of motion in mind in xii 7: 'Well then, if something is moved, it could be otherwise, so that if the actuality (ἐνέργεια) is primary locomotion, insofar as it is moved, in this way at least, it could be otherwise—in place, even if not in substance' (1072b4-7; cf. 1050b20-28). The sphere exists necessarily, but it has a potential for locomotive change. In ix 8 Aristotle says that no eternal motion is potential, 'except from where it starts to where it ends' (ἀλλ' ἢ πόθεν ποί, 1050b21), and 'nothing prevents matter from being this way' (1050b21-22) (this 'topical' matter is included in xii 2.1069b26). The sphere's eternal rotation necessitates a corresponding capacity for spatial relocation of its material that it is always activating. Since rotation presupposes this ineliminable capacity, it seems that it cannot be simple and actual in the way my position requires.²⁹

Aristotle offers analyses of rotation in the *Physics* and *De caelo* that explain why, appearances notwithstanding, rotation achieves simplicity and actuality. In *De caelo* i 4.271a5-25 Aristotle presents the following paraphrased arguments against the view that there is a contrary to rotary motion: (1) while rectilinear motions from A to B and B to A are opposite, such bi-directional movements are not opposite when they occur along segments of a period, because the rectilinear motions are 'limited', while any point in any period may be traversed without ending the same, single motion; (2) motions from A to B and A to C within a

²⁷ Reductive, non-psychological accounts of Aristotle's teleological science are explored in Henry 2013, 260-261 and Kahn 1985, 194, 196-202.

²⁸ In two of the passages on the *sustoikia* (*Meta.* xi 1066a15 ff., *Ph.* iii 221b24-202a3) Aristotle explains that it seemed reasonable to other thinkers to classify motion as privative, because motion seems to be neither potential nor actuality. Yet motion is not, by Aristotle's lights, privative (1066a24-26). Rather, motion occupies the space between actuality and capacity as actualization of the potential *qua* potential.

²⁹ This problem is explored lucidly in Broadie 1993, 388-392 and Waterlow 1982, 248-257.

period are not opposites, because both motions are directed at both points at once, along with every other point in the circle; (3) at whatever point in a period a rotator begins, the rotator necessarily traverses every point in the circle. Aristotle offers similar arguments in *Physics* viii 8-9. Rectilinear motion from point A to point B is contrary to the movement from B to A (264a7-264b1), so going from A and toward A involves two distinct instances of motion (264a14-20). Any individual rectilinear motion is necessarily finite, and so incomplete (ἀτελής) (265a20-22). For rectilinear motion to be continuously extended, it would have to consist of composites of distinct contrary motions (265a17-24). In contrast, rotary motion from A is at the same time motion toward A, and, therefore, continuously extended rotary motion is single and possibly non-compound (264b9-19). In *Physics* viii 9 Aristotle takes this structure of rotation to entail that it is necessarily prior to rectilinear motion, on the grounds that rotary motion is 'simpler and more complete' (ἀπλή γὰρ καὶ τέλειος μᾶλλον) (265a16-17). Whereas rectilinear motion can be infinite only as composites of distinct motions, rotary motion can be both infinite and single (265a17-24). Aristotle presents a similar conclusion about rotation in *De Caelo*: rotation is 'necessarily primary. For the complete [τέλειον] is naturally prior to the incomplete, and the circle is a complete thing [τῶν τελείων]. This cannot be said of any straight line...for in every case there is something beyond it, since any finite line can be extended' (*Cael.* I.3 269a18-23, tr. Stocks in Barnes (1984)).

I suggest that these features of rotation supply the resources needed for the *sustoikia* argument to succeed.³⁰ For any of the points in an eternal rotator's path of locomotion, that point completes a revolution from some point in the circle, both that very point and any other point in the circle. Since the sphere is eternally rotating, every point at which its parts are ever located always marks the end of some rotation from any location in the rotary path. This completeness-making feature of rotation is important to appreciate partly because it is present from the same perspective in which the sphere has an ineliminable capacity. On the most widely held view of the nature of topical matter in the scholarly literature, the sphere's sole capacity is localized to line segments within its period. The sphere has a capacity for any part of its body P to move from point A at which it is spatially located at any time T to some other point in its path B at $T + (N > 0)$.³¹ On the view I just sketched, the physical features of rotation that make it completely actual are not only compatible with the continuous series of physical locomotion of its parts, but are part and parcel of the same overall physical structure. The same features that make it the case that the sphere's parts have a capacity for change also make it the case that every point in the period is the

³⁰ My position only requires that Aristotle could reasonably assume these features of rotation. Given the compressed nature of the arguments in xii 7, it seems reasonable that he would establish the PM as simple and actual substance, such that its existence teleologically explains rotation, which is assumed to be simple and complete in the respects I articulate here. Moreover, the completeness of rotation is arguably built-in to the claim that the sphere's actuality is primary locomotion.

³¹ Cf. Beere 2009, 314-324, Elders 1972, 176, Makin 2006, xli, and Ross 1924, ii 265.

terminus of a revolution.³² The same physical facts about the sphere make it both always complete a revolution and always in the process of completing another.

Additionally, the necessary eternity of the sphere's rotation complicates any simple picture of diachronic incompleteness. As Waterlow 1982, 250 observes (cf. Richardson-Lear 2004, 89), since the sphere never started rotating, 'it follows that at every moment every part of the rotating body has just completed a circle; and since it will never end, there is never any falling short of a complete number of circles'. Given that the sphere's rotation is eternal, incompleteness arises only from the temporally bound perspective we take when we isolate some in-progress motion. From the perspective of the eternal, every one of the sphere's rotations is complete.

Finally, numerical individuation over time does not threaten the sphere's simplicity. Both the *De caelo* and *Physics* passages establish that rotation is simple because any revolution from A to B is directed toward every point in the circle, including A. Consequently, every revolution is individually simple: no segment, including an improper one, is a compound of distinct motions. This is clearly true from the perspective of a single revolution. Additionally, Aristotle indicates in *Physics* viii 9.265a17-24 that the feature of rotation in virtue of which each individual revolution is simple also make rotations that traverse the same points more than once simple. The numerically individual motions, those in which the rotator has traversed the same point more than once, are in some sense the same motion. This is why Aristotle thinks rotation can be simple but continuous over an infinite period of time. Moreover, it is plausible that this is part of the reasoning behind the correction that 'simple' is different from 'one' in the *sustoikia* argument: while the sphere engages in numerally distinct revolutions, its motion is the same from the perspective of 'its own disposition'.³³ This demonstrates Aristotle's willingness to overlook the relevance of numerical distinctness over time with respect to simplicity, and to focus instead on undivided activity as the basis for being simple.

IV. Imitation

I want now to support my account by criticizing a nearby and popular competitor, the Imitation Thesis. On the Imitation Thesis, when an agent takes some activity as its end, but it cannot achieve that end, the first end, plus the capacities of the agent, entail another, secondary end, which the agent may actually achieve. It is possible to articulate this view with the following principle:

Next Best: For any x , y , s , and r , there is a privileged set of conditions Δ such

³² Cf. *Ph.* iv 13.222a34-b8—time is always both an origin ($\acute{\alpha}\rho\chi\eta$) of the immediate future and a completion ($\tau\epsilon\lambda\epsilon\upsilon\tau\eta$) of the immediate past—and 12.222a10-17—time is always a limit.

³³ Cf. *DA* iii 2.427a4-5. In *Meta* x 1, one of the senses of 'one' is that whose movement is 'more indivisible and simpler' (1052a19-22); yet Aristotle also emphasizes that what is 'one' is primarily a 'measure' in the sense of a unit of measurement (1052b15-19). This suggests that while each revolution may be 'one' and therefore distinct (and which we may use for, e.g., dating purposes), it may nonetheless be simple in the sense of undivided, continuous activity.

that: if x has y as a goal, but there does not exist a means s by which x is able to act for the sake of y , x ought instead to r iff r best satisfies Δ .

Imitation theorists widely hold some version of Next Best: the first sphere's (x 's) goal (y) is to be maximally like the Prime Mover, but since it has a body, it must move, and so cannot be maximally like Prime Mover (there does not exist an s for this y), but since rotation (r) is most similar to the Prime Mover's contemplation among the available options for the sphere (best satisfying this Δ), the sphere rotates (r).³⁴

The chief difference between the position I defend and the Imitation Thesis is how each view interprets the relation between the sphere's rotation and the Prime Mover in the Mover's capacity as the final cause of the rotation. According to the position I defend, rotation and contemplation are kinds of activities that share a feature, simplicity and actuality, such that the substances that engage in them are simple and actual.³⁵ Possessing that feature is the sphere's goal, and this is how the Prime Mover teleologically accounts for the sphere's eternal rotation, and why the sphere and the Mover are simple and actual substances. By contrast, according to the Imitation Thesis, rotation is *like* contemplation, and the Prime Mover's contemplation teleologically accounts for the sphere's eternal rotation in virtue of that similarity relation. Because rotation is like contemplation, the sphere rotates as a way of achieving the goal of contemplating (and Next Best explains why rotation achieves that goal).³⁶ These two positions are importantly different, since there are clear distinctions between one being performing an activity in order to instantiate a feature in virtue of which it is like another being, and one being performing an activity because it thereby instantiates a likeness-making feature. For instance, I might train at boxing because I want to be a good boxer. Being a good boxer would make me like Muhammad Ali. Alternatively, I might train at boxing because I want to be like Muhammad Ali, and being a good boxer makes me like Muhammad Ali. In the present context, the Imitation Thesis maintains that the sphere rotates because its goal is to be like the Prime Mover, so it does whatever it can in order to have the most features that make it like the Prime Mover.³⁷ In what follows, I criticize some of the purported textual support for the Imitation Thesis and argue that the position I defend makes notably better sense of Aristotle's arguments.

³⁴ Elders 1972, 177, DeFillipo 1993, n22, Richardson-Lear 2004, 86-90, Ross 1924, i cxxxviii, Ross 2016, 209-210, 216-218, and Scharle 2008, 158.

³⁵ As I suggested in n24 above, it is plausible that the PM and sphere stand to the simple and actual substance as species of a genus, and that their respective activities (contemplation, rotation) ground those taxonomical relations.

³⁶ Elders 1972, 177, Richardson-Lear 2004, 89-90, Ross 2016, 217-218; but Bodnár 2016, 251-252 prefers 'congruent with' to 'like'.

³⁷ For this reason, many Imitation theorists maintain that the sphere's rotation does not exhaust its PM-directed activity—primarily, the sphere also *contemplates*. See Elders 1992, 177, DeFillipo 1994, n22, Richardson-Lear 2004, 89. Broadie 1993, 381; 2009, 240, and Bodnár 2016, 251 raise the objection that rotation must be the *direct* product of the PM's causation, rather than a bodily by-product of thinking.

A central motivation for the Imitation Thesis is that it claims to capture one essential feature of Aristotle's account: the sphere, in pursuing its end, is less well-off than the Prime Mover, who is absolutely perfect. This is because the sphere's rotation is a secondary means of achieving contemplation, in accordance with Next Best. However, my view may satisfy the same motivation. I argued that the sphere's rotation makes it simple and completely actual in certain respects, and that the Prime Mover and the sphere are alike insofar as they share this common kind. Yet the Prime Mover's contemplation makes him *simpler* and *more* completely actual than the sphere's rotation makes the sphere.³⁸ The Prime Mover's eternal noetic activity involves no motion at all, since he does not have a body, is unified with its own end (himself), and has no temporal dimensions (xii 9). The sphere eternally and successively reaches an end conceived as points along its circular path. As I argued in the previous section, the sphere also has an ineliminable capacity for spatial relocation. In this way, the Prime Mover is superior to the sphere relative to being a simple and actual substance. Moreover, the underlying ontological ground of the difference is the fact that the Prime Mover lacks material and therefore a capacity for spatial relocation. Hence, while both the sphere and the Prime Mover achieve simplicity and actuality with their activities, there is a hierarchy among the activities with respect to that condition.

The Imitation Thesis also purports to handle well Theophrastus' critical question of why the sphere neither contemplates nor rests but rotates. I explained in section 2 that, on my account, cognition of the Prime Mover plays at most an enabling role for the sphere's rotation. My thesis is that being a simple and actual substance, and not contemplation, is the sphere's goal, which Aristotle uses to explain why it rotates. However, it is not obvious why, on my account, the sphere moves rather than rests. First, it is no more obvious that rotation is a better imitation of the Prime Mover than resting, by the same considerations.³⁹ Second, on one recent interpretation of topical capacity, the sphere's capacity is for motion *as such*, rather than for relocation of particular parts from particular points to other points (Judson 2016; cf. Broadie 1993, 399-401, DeFillipo 1994, n22). If the sphere has any such capacity for motion, then one way that the sphere achieves simplicity and actuality is that it activates its capacity to move. If it did not rotate, the sphere would have an unactualized capacity for motion. Moreover, since, according to the *De caelo*, the sphere is composed of a material that naturally moves in a circle (*Cael.* i 2.269a2-b17, ii 3.286a10-18, 7.289a13-16), resting would leave at least one natural capacity unactualized. Indeed, Aristotle maintains in *De caelo* i 7.276a22-26 that objects rest naturally only when they are located at the places to which they are naturally disposed to move. If the sphere did rest by nature, its failing to move in a circle would leave another

³⁸ That some types are included in the class of F things does not preclude there being comparative distinctions as to how F each type is. Compare Socrates' ranking of kinds of knowledge at *Philebus* 55c-59e.

³⁹ That rotation is a better imitation of the PM than resting is assumed in Elders 1972, 177, Richardson-Lear 2004, ch. 4 n17, and Ross 2016, 218; cf. Bodnár 2016, 251.

capacity unactualized. Additionally, since the sphere's natural capacity is to move in a circle, it has no natural resting place.⁴⁰ Finally, Aristotle criticizes the position of other thinkers who classify motion as a privative in the *sustoikia* (*Meta.* xi 1066a24-26, *Ph.* iii 2.201b16-202a2), favoring his own definition of motion as actualization of the potential *qua* potential, and he additionally suggests that rest and motion are contraries (e.g., 1068b6-7). If rest falls on the negative column, resting could not achieve the positive condition of being a simple and actual substance.

In favor of the Imitation Thesis, Aristotle seems to commit to Next Best in *De caelo* ii 12, which responds to an *aporia* about the distribution of motions across the celestial bodies:⁴¹

For it is plausible that what has the best achieves the good without action, that what is nearest to it should achieve it by little and simple action, and that which is farther removed by a complexity of actions, just as with men's bodies one is well-off without exercise at all, another after a short walk, while another requires running and wrestling and hard training, and there are yet others who however hard they worked themselves could never secure that good, but some other thing... In action, again, when it is necessary to do this for the sake of that, that for the sake of another thing and again this for the sake of something else, one step or two present little difficulty, but as the series extends the difficulty grows... One thing then has and partakes of the best, another thing strives for it through few actions, another through many, while another does not even try but it is enough to come to something near the extreme. (*Cael.* ii 12.292b1-13)

In context, the passage explains why there is greater diversity of motions among the celestial bodies between the Earth/lower planets and the outermost sphere of fixed stars, rather than a gradual increase of complexity between the sphere and the Earth. The explanation is teleological: the first sphere is able to achieve the 'divine principle' with one motion, the intermediary bodies with many, while the Sun, Moon, and Earth are too far removed from the goal to achieve it directly with any motions, so that they resort to few (292b19-25).⁴² The teleological

⁴⁰ The PM is still explanatorily necessary, given these considerations, in the following way. It is possible for the sphere to fail to rotate, given merely that it is composed of a material with a disposition to move in a circle, in the same way that it is possible for fire to fail to move toward the extreme given only its natural capacity to be moved to the extreme. A corresponding principle of activity is necessary to explain what activates the natural capacity. The existence of the simple and actual intelligible as the sphere's aim explains why the sphere in fact moves by nature by providing a causal account of its actual motion.

⁴¹ This passage is cited in defense of the Imitation Thesis in Bodnár 2016, 256-257, Richardson-Lear 2004, 88, and Ross 2016, 210.

⁴² The divine principle is apparently the goal of each of the celestial bodies (292b19-25), but I will not speculate about it or its relation to the PM.

explanation Aristotle offers presents four kinds relationships agents may have with a goal: (i) what ‘has the best’, which has no need of action, (ii) what undertakes few motions for the goal, (iii) what undertakes many motions for the goal, and finally, (iv) one kind of agent has a goal that she is trying to achieve in action (e.g., health), but when she lacks the means to that goal, she may do things for the sake of the actions that would achieve the goal (e.g., preparing herself to run). Aristotle accounts for this taxonomy by arguing that ends conditionally necessitate actions, and the longer the chain of actions leading to the end is, the more difficult it is for the agent to achieve the end; when none of the actions within the agent’s power make it all the way up the chain of actions to the goal, that agent may engage in whatever actions are within her power that are closest to the goal, but fall short of achieving it (e.g., an agent who loses weight for the sake of being healthy, but who is unable to be healthy). This last kind of teleology entails Next Best (the conditions Δ are being the closest action to the ultimate goal).

Yet, *De caelo* ii 12 cannot serve as evidence for the Imitation Thesis. The Imitation Thesis would need rotation to be for the sake of the Prime Mover, but for the sphere not to be able to perform any actions higher along the chain necessitated by the Mover, such that rotation is the closest it can come to its goal while also failing to achieve the goal. But this would reproduce the problem of explaining how rotation is instrumental to the sphere’s goal and why it is higher up the chain than either rest or contemplation. Further, Aristotle does not suggest that when Next Best applies, the agent to whom it applies settles on an action because that action *imitates* the goal. At best, imitation is a special application of Next Best that Aristotle never mentions. Moreover, Aristotle offers Next Best not as an explanation of the teleological structure in the relation between the Prime Mover and the sphere, which achieves its goal directly and with one motion, but between the Earth/lower planets and the good achieved by the sphere. Indeed, when Aristotle talks unambiguously about cosmic imitation, the object is the sphere itself: elements imitate the sphere’s rotation by cyclically changing into each other (*GC* ii 10.336b25-337a7, *Meta.* ix 8.1050b29-34); living things reproduce as species in order to attain the divine eternity of the cosmos (*DA* ii 4.415a23-b7).⁴³ The only passage where it is possible that the object of imitation is the Prime Mover is *De caelo* ii 12, but that requires taking the ‘divine principle’ to be the Prime Mover, which is at least not obvious (cf. Berti 2000, 201, Blyth 2015, 448, and Judson 1994), and ignores the fact that the relevant relation obtains between the Earth/lower planets and the cosmic goal, specifically in contrast to the relation between the sphere and the goal.

I believe that the position I defend is considerably more appealing than the Imitation Thesis. The core of the Imitation Thesis is the idea that similarity is the teleological ground for the sphere’s rotation, conjoined with the purported similarity between rotation and contemplation. Yet as I pointed out above, Aristotle never says that the sphere is trying to be like the Prime Mover and does

⁴³ This observation is made in Berti 2000, 201, Bodnár 2016, 252, and Broadie 2009, n9.

not deploy this idea in his account of the sphere's rotation. He says that there is a simple and actual intelligible substance among the unmovables, that this substance is a final cause in the sense of an object of love, and that its teleological properties make it the moving cause of the sphere's eternal and constant revolution. My position captures these core claims without grafting similarity onto the account. While the sphere's motion allows it to instantiate a feature in virtue of which it is like the Prime Mover, that feature explains its rotation just because it is intrinsically good. In this way, Aristotle explains the sphere's rotation by identifying a corresponding substance of the same kind, which causes the sphere's rotation in virtue of belonging to that kind but without requiring a cause of its own.⁴⁴

Department of Philosophy
Cornell University
Ithaca NY 14853

BIBLIOGRAPHY

- Alexandru, S. 2014. *Aristotle's Metaphysics Lambda: Annotated Critical Edition Based upon a Systematic Investigation of Greek, Latin, Arabic and Hebrew Sources*. Leiden: Brill.
- Barnes, J. ed. 1984. *The Complete Works of Aristotle*. Princeton: Princeton University Press.
- Beere, J. 2009. *Doing and Being: An Interpretation of Aristotle's Metaphysics Theta*. Oxford: Oxford University Press.
- Berti, E. 2000. 'Unmoved Mover(s) as Efficient Cause(s) in *Metaphysics* Λ 6' 181-206 in Frede and Charles edd. 2000.
- Blyth, D. 2015. 'Heavenly Soul in Aristotle' *Apeiron* 48: 427-465.
- Bodnár, I. 2016. 'Cases of Celestial Teleology in *Metaphysics* Λ ' 247-267 in Horn ed. 2016.
- Bradshaw, D. 2001. 'A New Look at the Prime Mover' *Journal of the History of Philosophy* 39: 1-22.
- Broadie, S. 1993. 'Que fait le premier moteur d'Aristote? (Sur la théologie du livre Λ de la "Métaphysique")' *Revue philosophique de la France et de l'Étranger* 183: 375-374.
- Broadie, S. 2009. 'Heavenly Bodies and First Causes' 230-241 in G. Anagnostopoulos ed. *A Companion to Aristotle*. Chichester, West Sussex, UK: Wiley-Blackwell.
- Crubellier, M. 2000. '*Metaphysics* Λ 4' 137-160 in Frede and Charles edd. 2000.
- DeFillipo, J. 1993. 'Aristotle's Identification of the Prime Mover as God' *Classical Quarterly* 44: 393-409.
- Elders, L. 1972. *Aristotle's Theology: A Commentary on Book A of the Metaphysics*. Koninklijke: Van Corcum.
- Frede, M. and D. Charles edd. 2000: *Aristotle's Metaphysics Lambda: Symposium Aristotelicum*. Oxford: Clarendon Press.
- Gill, M.L. and J.G. Lennox edd. 1994. *Self-Motion: From Aristotle to Newton*. Princeton: Princeton University Press.
- Gutas, D. 2010. *Theophrastus. On First Principles (known as his Metaphysics)*. Leiden: Brill.
- Henry, D. 2013. 'Optimality Reasoning in Aristotle's Natural Teleology' *Oxford Studies in Ancient Philosophy* 45: 225-263.
- Horn, C. ed. 2016. *Aristotle's Metaphysics Lambda: New Essays*. Proceedings of the 13th Conference of the Karl and Gertrud-Abel Foundation, Bonn, Nov. 28th-Dec. 1st, 2010. Berlin: De Gruyter.
- Judson, L. 1994. 'Heavenly Motion and the Unmoved Mover' 155-171 in Gill and Lennox edd. 1994.

⁴⁴ This article is greatly indebted to the *AP* editor and reviewers for their many insightful comments, suggestions, and objections. I would also like to thank Rachana Kamtekar and Dougal Blyth for comments on an earlier draft, and Sarah Broadie for sending me the English original of her 1993.

- Judson, L. 2016. 'Aristotle, *Metaphysics* Θ .8, 1050b6-28' *Phronesis* 61: 142-159.
- Kahn, C. 1985. 'The Place of the Prime Mover in Aristotle's Teleology' 183-205 in A. Gotthelf ed. *Aristotle on Nature and Living Things*. Mathesis Publications.
- Kosman, A. 1994. 'Aristotle's Prime Mover', 155-171 in Gill and Lennox edd. 1994.
- Laks, A. 2000. '*Metaphysics* Λ 7' 207-243 in Frede and Charles edd. 2000.
- Makin, S. 2006. *Aristotle, Metaphysics Book Θ : Translated with Introduction and Commentary*. Oxford: Oxford University Press.
- Matthen, M. 2001. 'The Holistic Presuppositions of Aristotle's Cosmology' *Oxford Studies in Ancient Philosophy* 20: 171-199.
- Menn, S. 2012. 'Aristotle's Theology' 422-451 in C. Shields ed. *The Oxford Handbook of Aristotle*. Oxford: Oxford University Press.
- Richardson-Lear, G. 2004. *Happy Lives and the Highest Good*. Princeton: Princeton University Press.
- Ross, A. 2016. 'The Causality of the Prime Mover in *Metaphysics* Λ ' 207-228 in Horn ed. 2016.
- Ross, W.D. 1924. *Aristotle's Metaphysics: A Revised Text With Introduction And Commentary*. Oxford: Oxford University Press.
- Scharle, M. 2008. 'Elemental Teleology in Aristotle's *Physics* 2.8' *Oxford Studies in Ancient Philosophy* 29: 341-365.
- Tredennick, H. 1933. *Aristotle Metaphysics II: Books X-XIV*. Loeb Classical Library. Cambridge: Harvard University Press.
- Waterlow, S. 1982. *Nature, Change and Agency in Aristotle's Physics: A Philosophical Study*. Oxford: Oxford University Press.