

Aristotle on Motion, Change, and Predication

Jim Bogen and James E McGuire

I

Our aim in this paper is to explain how Aristotle admits local motion into his ontology. This is a special instance of a larger ontological issue which derives from his view that everything which has being either is a substance or depends for its being upon its relation to one or more substances. That this was his view is clear from his general classification of things that are (τὰ ὄντα) (*Categories*, ch. 3), and the canonical enumeration and discussion of the categories it prefaces (*Cat.* chs. 4-9). The problem we address is that although Aristotle speaks at least once as if local motion might fall under one category and other sorts of change might fall under others (*Physics* 227b3-7), local motion (change of place) is not listed as a category or an instance of any of the categories in the work entitled *The Categories*. The more general problem is that neither change in general (κίνησις) nor any other specific kinds of change are explicitly included. Although this paper is concerned with local motion (including the rotation of the cosmic spheres and the natural and forced motions of Earth, Water, Air and Fire) we believe that what we say about local motion applies to other kinds of κίνησις as well. The view we develop is that local motions are actualities or exercises (ἐνέργεια, ἐντελέχεια)¹ of items which fall

¹ English translators have traditionally used jargon derived from the word 'actual' (e.g., 'actuality', 'actualization') to translate these terms. Jargon derived from the term 'potential' is usually used to translate 'δύναμις', 'δυνατότης' and the like. In an earlier paper we used 'ability' for 'δύναμις'

under the categories of doing (ἡ ποιόν) and suffering or undergoing (ἡ πάσχειν). Things that move locally are substances. What makes it possible for a substance to move is its possession of an ability (δύναμις) to do or to suffer. Abilities fall under

and 'exercise' for 'ἐνεργεῖα' (Bogen and McGuire, 1987: *passim*). One reason for this is that the traditional translations import a great deal of baggage into the text taken from what we consider to be misleading commentaries dating back as far as the thirteenth century.

Jonathan Beere points out that it would be far better to think of a sleeping Euclid as an actual geometer who is not exercising his ability to do geometry than as someone who is not actually a geometer. By the same token, 'potential geometer' is not a very good description of Euclid when he is sleeping or occupied with something other than geometry.

Beere also points out that the traditional translation can be confusing to readers who are used to using 'actual' in contrast to 'possible' and 'necessary'. Aristotle typically uses the term 'δύναμις' not to say that something is possible, but to signify a factor upon which the possibility depends. We think that to say that John Carter had the δύναμις by virtue of which clarinet players are able to play their horns is *not* to say that it was possible for him to play, let alone that he was a possible or potential clarinet player. It is easy to think of cases in which he had the ability to play even though the circumstances made it impossible for him to play. When John Carter was not playing, he was, nevertheless, a real, rather than a potential clarinetist. When he was actually playing, we think it is both more natural and more faithful to Aristotle to say that he was exercising or using his ability. than to say that either he or his ability was actual, actualized, or in a state of actualization. We note also that ἐνεργεῖα, e.g., a cosmic sphere's exercise of its ability to rotate, can be a matter of necessity rather than mere actuality.

'Fulfillment' is sometimes used to translate 'ἐντελέχεια', and occasionally, to translate 'ἐνεργεῖα'. But locutions like 'John Carter exercised his ability (δύναμις) to play the clarinet' make better sense, and sound more Aristotelian to us than such locutions as 'John Carter fulfilled his ability to play the clarinet'. The same considerations argue against 'perfection' as a translation of 'ἐνεργεῖα' or 'ἐντελέχεια'.

Heidegger's discussion and eventual rejection of 'Wirklichkeit' as a possible translation raises a number of issues which argue against the traditional translations (Heidegger, 1981: 160-224). Unfortunately there is no English word which connotes both being at work and being actual as does the German word 'Wirklichkeit'. Hussey's use of 'operation' fits the ἐνεργεῖα of something which has the ability to engage in some sort of activity, but not the ἐνεργεῖα of matter, e.g., bronze, which has the ability to be an individual, e.g., a bronze sphere (Hussey, 1983: 61-62).

Beere's and Cooper's use of 'activity' is far better. The reason we haven't followed them is that some abilities (e.g., the ability of an oily rag to be set on fire) are passive, and their exercises are undergoings or sufferings rather than activities. Other abilities are what we call 'impassive'. To exercise them is to resist change, rather than to engage in an activity (*Metaphysics* Θ. 1).

On the other hand, 'exercise' has its disadvantages, and it is important to appreciate that there really aren't any perfectly satisfactory English translations for 'ἐνεργεῖα' or 'ἐντελέχεια'. Indeed, 'ἐνεργεῖα' had no standard usage in Greek at Aristotle's time. To the extent that this term suits Aristotle's purposes, it does so because he coined it as a technical term. Beere and Cooper rightly emphasize Aristotle's insistence in *Metaph.* Θ. 6 that although 'ἐνεργεῖα' is not an ambiguous term, to understand it is to grasp analogies between things as different from one another as a completed statue of Hermes which has been separated out of a block of wood, a half line produced by cutting a whole line, a man who is actually studying (as opposed to a man who has the ability

the category of quality (*Cat.* 9a13ff, 2b3 and *Topics* 103b20).

II

Aristotle says that things that can be of the following four kinds: (a) individual subjects (e.g., individual horses or men) which are neither 'in' nor 'said of' (λέγεται) anything; (b) things like the species man which are said of but not in a subject (ὑποκείμενον); (c) things which are in but not said of a subject (the color of Calias' skin is an example), and (d) things (like knowledge) which can be said of a subject (like mathematics) but can also be in a subject (as knowledge of mathematics was in Cauchy's mind) (*Cat.* 1a20-29).

Following Ackrill, we suppose that as Aristotle uses these terms, what is *said of* or *in* something is not a bit of language, but rather, an extra-linguistic item which we use words and phrases to talk and think about (Ackrill, 1965: 75-76, 78ff). What is in Calias' skin is not the word 'pale', but a pale color. The mathematical knowledge in Cauchy's mind was not the phrase 'knowledge of mathematics'; it was a bit of mathematical knowledge. To say of Socrates that he is a man, is to say that he is a human being, not that he is the phrase 'human being'. We will use the term 'metaphysical predicate' for *pallor*, *knowledge*, and the other extra-linguistic items which can be said of or can be in metaphysical subjects. We use the term 'metaphysical subject' for the individuals and other extra-linguistic items which metaphysical predicates can be in or said of. We use the term 'metaphysical

to study but is not exercising it), the process of building (as opposed to the ability to engage in it), seeing (as opposed to the condition of a sighted person with closed eyes), waking (as opposed to sleeping), and so on. Speaking generally (though not very informatively) Aristotle says that ἐνεργεῖα contrasts with δύναμις in the way motion or change (κίνησις) contrasts with ability or in the way that substance contrasts with matter (1048a25-b8). Neither our preferred translation ('exercise') nor 'operation' nor Beere's and Cooper's 'activity' fits the way in which the finished Hermes differs from the Hermes in the uncut block of wood as well as it fits the way in which the builder's activity differs from the skill whose exercise it constitutes. In this paper we frequently use the phrase 'exercise or actuality' in connection with 'ἐνεργεῖα' and 'ἐντελέχεια'. Even though 'exercise' is our preferred translation, we use 'actuality' (and sometimes, 'actualization') because this usage is unfortunately so well entrenched that we think some readers will prefer it.

We gratefully acknowledge John Cooper and Jonathan Beere for generously letting us consult their unpublished manuscripts on *Metaph.* Θ. 6. Beere's doctoral dissertation, *The Priority of Active Being: An Interpretation of Aristotle's Metaphysics* is an invaluable contribution to Aristotelian scholarship; the sooner it is published, the better. We learned of it from 'Aristotle on *Energeia*', an unpublished talk drawing on Beere's work, delivered by his dissertation supervisor, John Cooper at a recent conference in honor of Allan Gotthelf at the University of Pittsburgh.

predication' for the ontological relation between metaphysical subjects and what is in or said of them. By contrast, *linguistic subjects* are bits of language (typically nouns and noun-phrases) used to refer to metaphysical subjects, and *linguistic predicates* are bits of language (typically verbs and adjectives) used to ascribe metaphysical predicates to metaphysical subjects. Linguistic predication is a grammatical relation between the parts of a sentence. It is not to be confused with ontological relations which may obtain between the things the sentence mentions. Using this jargon, we agree with Ackrill that the things that are (including things in and things said of other things) are metaphysical, rather than linguistic subjects and predicates.² For an individual like Socrates or Trigger, to be is for it to exist, and for Aristotle, to exist is to be the subject of other metaphysical predications including place and time. For things of the other three kinds, to be is to be metaphysically predicated of (to be either said of or in) one or more metaphysical subjects (*Cp. Metaph.* 1071a8-35).

At *Metaph.* Θ. 10. 1051a34ff, Aristotle says that being and non-being are said (a) with reference to the categories and (b) with reference to capability (*κατὰ δύναμιν*) or *ἐνέργεια* (exercise or 'actualization' if you prefer). We understand Aristotle to have coined the term 'ἐνέργεια' to signify one of two ways in which a metaphysical predicate, Y, its contrary, or its privation, can be in or said of a metaphysical subject, X. He uses the phrase 'κατὰ δύναμιν' (already available in the Greek of his time) for another kind of metaphysical predication – a connection between X and Y which obtains by virtue of one or more of X's abilities. We will use the term 'capability' to talk about this kind of metaphysical predication. According to *De Anima* 417a22ff, – a well known passage we will return to below – having an ability and exercising or actualizing an ability are two different ways in which a particular metaphysical predicate (Aristotle's example is being a knower) can be predicated of a metaphysical subject. This illustrates our supposition that exercise and capability are different ways in which a subject can be, or can have an item from a category, its contrary, or privation.

We emphasize that, general and abstract as it is, Aristotle's fourfold classification of things (other than capability and exercise or actuality) is meant to cover every kind of thing that is now, ever has, or ever will be found anywhere in the cosmos. In order to be – either now, in the past, or in the future – something

2 We disagree with Porphyry who thinks Aristotle's categories are linguistic. But Porphyry also says (what is more congenial to our view) that in order to understand them, we must have a theory of what we would call metaphysical subjects, predicates, and predication (Porphyry, 1992: 32-33, 35).

must be, or be reducible to the capability for, or exercise of, one or more categorial items. What fails this test – be it an individual, an event, a process, a feature, or an item of any other kind – did not, does not, and never will occur, exist, and so on. But Aristotle does not explicitly include change or examples of change in his enumeration and explanation of the categories or his treatment of metaphysical predicates (*κατηγορία*).³ The categories he lists explicitly include substance, quantity, quality, features which belong to things relative to one other (*πρός τι*), spatial and temporal location, position or attitude, disposition or trait (*ἢ ἕχεν*), doing, and suffering or undergoing something (*Cat.* 1b25-2b3; *cp. Topics* 103b20-30).⁴ Aristotle's failure to include local motions in his list of things that are is surprising.⁵ His scientific works leave no doubt that he believed that local motions have always, are now, and will always be going on in the universe. Indeed he argues that change of all kinds depends upon local motion and therefore that it is the most fundamental kind of change (*Phys.* 251b1-8, 260a27-261a13). This is what raises the question of how local motion can find a place in Aristotle's ontology. We turn now to Aristotle's answer.

When a ball rolls down a hill, the ball (a metaphysical subject) ceases to have one metaphysical predicate from the category of location (it ceases to be at the top) and comes to have another (it comes to be located at the bottom). This, like every other change (*κίνησις*) is a process in which something comes or ceases to be such and such. For changes other than local motion this involves contrariety. Thus,

... [e]verything that comes to be or passes away comes from, or passes into its contrary (*ἐναντία*) or an intermediate state ... derived from the contraries –

-
- 3 The Greek word 'κατηγορία' can be translated 'predicate', but as the title of Aristotle's treatise on predicates, its plural form is usually translated 'categories', a term commentators often use to refer to groups or kinds of predicates such as relatives, quantities, quality, etc. We will use both translations, assuming that the context will make our choices clear.
- 4 While the *Categories* list includes substance, under which Aristotle explicitly includes individuals of specific kinds (e.g., individual men, and individual horses) (*Cat.* 2a15) the *Topics* list does not. Instead it includes 'what a thing is' (*τί ἐστίν*) (e.g., what it is to be a man, a horse, etc.) (103b21). Thus the *Topics* categories include things which can be said of or can be in individuals, but not the individuals themselves. We have no explanation for this.
- 5 In what follows, we will refer to *κίνησις* of all kinds as changes except where further specification is needed. 'κίνησις', 'μεταβολή', and 'ἀλλοίωσις' are the terms Aristotle uses most often to signify changes. 'ἀλλοίωσις' and 'μεταβολή' are used for the most part (though not exclusively) for changes other than changes in place. 'κίνησις' is used sometimes for local motion, and sometimes as a general term for changes and motions of all kinds. Unless indicated, we will use 'change' to translate both 'ἀλλοίωσις' and 'μεταβολή' and 'change', 'motion' and 'local motion' for 'κίνησις' as the context warrants it.

colors for instance from dark and light. Everything therefore that comes to be by a natural process is either a contrary or a product of contraries (*Phys.* 188b21-26 (*cp. Metaph.* 1055b16-17, *De Caelo* 270a14ff, *On Generation and Corruption* 323b28-324a9)).

Local motion is highly analogous to, though not quite the same as, a change from the metaphysical predication of one contrary or intermediate to another (*Phys.* 241b3ff). Ignoring the rotations of the cosmic spheres which we consider below, every local motion is a matter of ceasing to be at one place along a line, and coming to be at another. But although nothing can have more than one contrary, something can move in any number of different directions from any given place. Thus the end of the line along which something moves does not qualify as the contrary of its point of origin, and locations along the line do not qualify as intermediates between contraries. But any two locations along the line are opposed to one another in exactly the same way as a pair of contraries or intermediates. Although it is not the case that every object must occupy one or the other of any two locations along any given line, no object can occupy both at the same time. Furthermore, the line an object moves along is a continuum such that every location along it is uniquely related to every other, as well as to the extremes. In this respect, the extremes and intermediate points along the line are related to one another in the same way as the extremes and intermediates of Aristotle's color continuum.⁶

Although local motion is a matter of ceasing to occupy one location and coming to occupy another, it does not fall under the category of location. Nor can it be reduced to the metaphysical predication of a location; moving from one place to another is not the same thing as occupying either one of them. Our view is that Aristotle believed he could accommodate local motion into his ontology by appeal to the actualization or exercise by a metaphysical subject (a mover) of its ability (*δύναμις*) to do (*ποιεῖν*),⁷ or to suffer (*πάσχειν*) something. Doing, suffering and ability do belong to Aristotle's canonical lists of metaphysical predicates. The rest of our paper is devoted to spelling this out.

6 We suppose the tightness of the analogy accounts for the passage in *Phys.* v. 2 where Aristotle says we have a pair of contraries for every motion in place (226a25).

7 Readers of Aristotle's moral philosophy may think of 'ποιεῖν' as a term for human actions. But in the context of *Metaph.* Θ. 1 it is clear from 1046a19ff that 'ποιεῖν' and 'πάσχειν' are general terms used in connection with changes of all kinds.

III

Aristotle develops his view on the status of motion in the tortuous discussion which takes up most of *Phys.* III. 1-3. He begins by pointing out that change is always change with respect to something – place, for the case of local motion – and by reminding us that everything in every category may belong to a metaphysical subject either by virtue of the possession of an ability (*δὲ δύναμει*) or by virtue of its exercise or actuality (*ἐντελέχεια*) (*Phys.* 200b25-201a10).

Next Aristotle says that every change is,

the actualization of what is capable (*τοῦ δύναμει*) as such, *e.g.*, [the actualization of] the alterable as alterable is alteration, of what is increasable and its opposite, [what is decreasable] ... increase and decrease, of what can come to be and pass away, coming to be and passing away ... (*Phys.* 201a11-14).

For example, a collection of bricks, boards, *etc.*, is said to be buildable insofar as it has an ability by virtue of which it can undergo the building process – the process which transforms building materials into buildings. Its change is the exercise⁸ of its ability to undergo that process (*Metaph.* K. 1065b17-19). We emphasize that the ability in question is not the ability of the materials to *be* a finished edifice. That ability is not actualized until the materials have been assembled into a building and are no longer changing, *i.e.*, no longer undergoing the building process (*Phys.* 201a15-16, b9-14). Similarly, learning is not the actuality or exercise of the student's ability to know something. It is the exercise of her ability to undergo the process by which she comes to know it. Rolling and jumping are not exercises of abilities to be in certain positions one after another, but to engage in or undergo a process which carries the subject from one position to another (201a17, b14-15). Similarly, to move from place to place is to exercise the ability to be carried along (201a14). Local motion is not the moving thing's exercise of its ability to occupy any given place. It is the exercise of an ability by virtue of which it engages in the process of taking itself or being taken from one place to another. This is how local motion can be understood, in keeping with Aristotle's views about what there is. It is the metaphysical predication (the actualization or exercise) of an item (an ability to engage in or undergo the relevant process) which belongs to the category of

8 Notice that the notion of exercise is not essentially anthropomorphic. Builders exercise their abilities to build; that is anthropomorphic. But there is nothing anthropomorphic about a brick's passive ability to be moved and mortared.

quality (*Cat.* 8b15ff, *cp.* *Phys.* 202b23-29).⁹

Aristotle repeats his characterization of change (including local motion) several times throughout the opening books of *Phys.* III. (201a28ff, 201b5, 202b23-29), and devotes the bulk of chapters 2 and 3 to the consideration and rejection of alternative accounts of the actualization which constitutes change, and to solving some problems his own account faces. He begins *Phys.* III. 2 by saying he will defend his characterization of change by considering alternatives and demonstrating their weaknesses (*Phys.* 201b16-18).

The first account he rejects identifies change with ‘... difference or inequality or not being’. Its defects are obvious: Things that are different from or unequal to one another need not move; nor do things which lack being (201b21-22).

Aristotle says the proponents of this unacceptable view are led to it by their realization that motion is indefinite in the sense that (a) as long as something is changing from A to B, it is no longer A and is not yet actually B, and (b) neither the privation of B nor the ability to change to B is sufficient for the occurrence of change. Here is an illustration of these facts. The poet, playwright, and musician, Richard Barnes once walked from one Southern California town, Arrowbear, to another, Barstow. In accordance with (a) he neither remained in Arrowbear, nor occupied a place in Barstow while he was walking from one to the other. In accordance with (b) there were times during which he had the ability to be in Barstow but remained at rest in Arrowbear. Thus the local motion which took Barnes from Arrowbear to Barstow is indefinite with regard to spatial locations. As long as something is in motion from one place to another, it is not exercising its ability to be in either place, or any place in between. We believe that Aristotle accepted both (a) and (b), along with the conclusion that change is indefinite (ἀόριστον). But the unsatisfactory characterization of motion which he rejects, responds to (a) and (b) by identifying motion with not being at A, B, or any intermediate place.

An alternative response to (a) and (b) identifies motion with an exercise or actuality which is incomplete. Its proponents suppose that if being in motion from A to B is not the exercise of an ability to occupy place B, it must be an *incomplete*

⁹ It would be circular to *define* change as the exercise of an ability to engage in or undergo a process. But we do not think that is what Aristotle was trying to do. His characterization is meant to tell us that change is an exercise or actualization of an ability, and to tell us what sort of ability is involved.

exercise or actualization of the ability to occupy B (... τὸ ἐνεργεῖα ποσόν ... ἢ τε κίνησις μὲν εἶναι τις δοκεῖ ἀτελής δέ) (*Phys.* 201b31).¹⁰

Philoponus believed this was Aristotle’s own view:

Aristotle does not ... [put] ... change into the category of quantity, nor as a whole into any of the others ... For the categories were said of forms that have been completed and of things that have acquired their complete forms, whereas change is an uncompleted activity (Philoponus, 1994: 16).

Aristotle would agree with Philoponus that:

(1) to be moving from one quality, quantity, place, *etc.*, A, to another, B, is not actually to be, to have been, or to be located at B. Aristotle says as much at *Phys.* 201b28-29 and continues to endorse it elsewhere (*e.g.*, at 234b11-17, *Metaph.* 1066a17ff).

But Philoponus is wrong to attribute to Aristotle the view that:

(2) changing from A to B is the *incomplete* actualization or exercise of the subject’s ability *to be*, or to *have been located at B*.

That, we think, is a view *others* infer from (1). Far from endorsing it, Aristotle says (2) makes it hard to understand what change is (*Phys.* 201b, 34-6, *Metaph.* K, 1066a22). It will be easier to understand change, says Aristotle, if we accept his own characterization of change (*Phys.* 201a10ff) instead.

As we understand it, Aristotle and those who think motion is an incomplete exercise or actuality disagree because they think of change in terms of the actuality or exercise of different abilities. For Aristotle, moving from A to B is not the incomplete actuality of a subject *qua* possessing an ability to be located at B. Instead, it is the actuality of a subject *qua* possessing an ability to engage in or undergo a process which will take it from A to B if it reaches completion. Although the process may be interrupted before it is completed, the actuality or exercise which constitutes local motion is complete in a sense which Aristotle sets out in

¹⁰ We think contrary to Ackrill, (1965: 122) that ‘τέλος’ should be translated ‘complete’ or ‘completed’ rather than ‘perfect’, and ‘ἀτελής’, ‘incomplete’. For example, with regard to *Metaph.* 1048b22 if an incompetent builder finishes a poorly constructed building, his imperfect manipulation of the bricks, mortar, wood, *etc.*, is τέλος in the sense of being completed, but not in the sense of being perfect.

Phys. V. 6 (237a12-237b7) and which we discuss in §VI below.¹¹

IV

Aristotle thought that the ἐνέργεια which constitute change are of a kind which is hard to understand (*Phys.* 202a2). Philoponus would say that what makes them hard to understand is their incompleteness. But he fails to show why the incompleteness he has in mind should be hard to understand. If we are right to think the relevant actualities are not incomplete, what is it that makes them hard to understand?

In our view there are two difficulties. The second of them concerns the rotation of the cosmic spheres. We will defer our discussion of it to §VIII below.

The first difficulty is introduced in the last paragraph of III. 2 (at 202a3-12) which connects to the beginning paragraph of III. 3 (202a13-14). The connected passage states the difficulty. What follows in III. 3 articulates Aristotle's solution. We will begin with the last paragraph of III. 2 (202a3-12) to show this connection and its implications.

11 Our reading of this part of the *Physics* departs not only from the Philoponian interpretation, but also from Ross' idea (endorsed by others including Ackrill) that Aristotle used the term 'ἐνέργεια' in two different senses, one broad and one strict. Commenting on *Phys.* 201a9ff, Ross says the movement (κίνησις) of the building materials is incomplete because,

... every movement is a realization-of-a-potentiality which is a stage on the way to a further realization of potentiality, and only exists while the further potentiality is not yet realized.

So far so good. Unfortunately Ross goes on to say,

Hence it is ἀτελής ... and, though in a sense it is an ἐνέργεια, it is distinct from an ἐνέργεια in the narrower sense in which 'ἐνέργεια' implies that no element of δύναμις is present at all (Ross, 1979: 536).

But in the passage on which Ross is commenting (201a9-b15) Aristotle is recounting and suggesting a motivation for a view (that κίνησις is an incomplete actualization) which he himself *does not hold*. Because Aristotle does not believe the actualization which constitutes motion is incomplete, he has no need for the broad sense of 'ἐνέργεια' which Ross supplies to explain how he could say motion is an actualization. Furthermore, although seeing is supposed to be an actualization in the strict sense, it fails to qualify as such according to Ross' own account. As long as your eyes are in good working order, you retain what Ross would call the potentiality to continue seeing at every time during which you are seeing something. Thus seeing is not an actualization which excludes the ability (δύναμις) to see, or to see the particular thing you are watching. Thus, while Ross believes there are two kinds of actualization, a strict sense that applies to seeing and not to building, and a broad one which applies to building, we believe that the term 'ἐνέργεια' is not ambiguous. For the case of building, we think that instead of distinguishing between two sorts of actualization, Aristotle distinguishes between the ability to complete a building and the ability to engage in the building process.

Every mover is also changed as has been said – every mover, that is, which is capable of change ... For to act on what can be changed as such, is just to change it. But this it [the mover] does by contact with [what is changed] so that at the same time it [the mover] also undergoes change. Hence change is the actualization of what is changed *qua* changed, [the cause] being in contact with what is changed, so that at the same time the mover is also changed.

The change which concerns us is local motion. Aristotle wishes to emphasize that there are movers that are moved because they remain in contact with what they move. But the phrase 'every mover ... which is capable of change' allows for the possibility that some movers are not moved. Aristotle anticipates this possibility earlier at 201a25-27:

... it seems to some that every mover is moved. However the truth about this will be clear from other considerations (for there is something that moves and is unmoved).¹²

12 Why does Aristotle need to allow for the possibility of unmoved movers (as he goes out of his way to do in *Phys.* VIII. 4)? He believed that without movers which are unmoved in a certain sense, the physical world could not be stable in the way his natural science must assume it to be. This leads Aristotle to disagree with the atomists' idea that change results from atoms contingently clashing in the void, reciprocally affecting one another in endless chains of horizontal interactions. The only causes of motion in the world that the atomists envisage are low level agents, each one of which is moved by something else. Despite the admiration for the atomists which is evident in his writings, Aristotle rejected this picture because he believed that the world the atomists describe would be chaotic.

Aristotle wants to establish a science which explains change by appeal to unbroken natural uniformities. He believes the natural uniformities his science presupposes depend on movers which are unmoved in the sense that they can produce or influence changes in other things without themselves being changed in any way which prevents them from continuing to produce the same effects in the same way. Only movers which are immune to change with regard to their causal efficacy can continue for an unlimited time to produce the same kinds of changes always or for the most part. This understanding of what it is to be unmoved does not require unmoved movers to be unchanged with respect to anything other than the abilities by virtue of which they produce and influence change. The cosmic spheres satisfy this condition for guarantors of stability and invariance. They maintain the same positions relative to one another, and to the sublunary realm. They continue to rotate in the same directions and in the same ways. As a result, the inmost surface of the inmost *aetherial* sphere maintains uniform contact with, and exerts an invariant influence on, the outermost edge of the outermost sublunary sphere. By so doing it prevents sublunary bodies from coming to rest in their natural places all at the same time. Without invariant interactions between the outermost sublunary sphere and the innermost superlunary sphere, sublunary motion would either come to a halt, or become too erratic for Aristotelian science to deal with (see *On Generation and Corruption*, II. 10, *Meteorology*; I. 9).

But in the argument we are considering, Aristotle allows for movers which are unmoved in a stronger sense. Barnes' walking to Barstow does not change him with regard to his ability to walk,

Physics 202a3-12 paves the way for the claim that motion which is not caused by an unmoved mover is an exercise or actualization of an active ability to move something and a passive ability to be moved. This generates the first problem Aristotle has in mind when he says motion is an actualization which is hard to understand: How can *one and the same* actuality or exercise, be the exercise or actuality of two distinct abilities? This problem arises at each time during which anything moves. According to *De Anima* II. 5 (417b2-8) the exercise of the ability to do something does not alter that ability. This means that the very same abilities are exercised at every time during which Barnes is walking. Given that Barnes' local motion is numerically one, how can it be the exercise of two separate abilities his ability to move himself, and his ability to be moved?¹³ Having introduced the first difficulty Aristotle directs us toward its solution.

The solution of this difficulty is evident: the change [*e.g.*, the local motion] is in that which is changeable. For it is the actuality of what has the ability to produce change; and the actuality of what produces change is not something other than the actuality of what is capable of change. *For in fact it must be the actualization of both* [our emphasis]. A thing can produce change because it is able to do so, and it is a mover because it is able to do so. But it is in regard to what can undergo change that it is able to act, so that there is one and the same actuality of both alike, just as 1 to 2 and 2 to 1 are the same interval, and just as uphill and downhill are one – for these are one and the same – although their account is not one. So it is also with the mover and what can undergo change (202a13-21).

even though it does change his position. The same holds for the agent which remains in contact with something it pushes or pulls. Both are unmoved movers in the sense we have just discussed. But in order to reject the possibility that moving and being moved are numerically distinct exercises or actualizations on the grounds that it implies that every mover is moved, Aristotle must assume that there are movers which are not moved in any respect whatever. The unmoved mover of *Metaph.* A may be unmoved in this strong sense. The question why Aristotle should require any such mover is a topic for another paper.

At any rate, we should note that important distinctions among different types of agency are enshrined in Aristotle's theory. Things reciprocally moved in moving something possess the lowest level of agency; whereas unmoved movers possess higher types of agency in relation to the things they move. Consequently, Aristotle views his world as a hierarchical structure of agents or movers, descending from movers which are unmoved with regard to everything that is metaphysically predicated of them down to the unmoved movers of *De Caelo* and further down to the moved movers of *Phys.* III. 2 (see, for example, *On Generation and Corruption* 1. 7 (324a24-b6)). Prior to Aristotle's and Plato's time, unmoved movers were generally considered impossible in Greek philosophical culture.

13 Self mover that he is, Barnes is obviously in contact with what moves him. The same question arises for the case in which one thing, A, moves another, B, *e.g.*, by pulling or pushing it. Aristotle believes A moves B only as long as they remain in contact so that A is moved in the process of moving B.

The argument needs careful consideration. Consider the interval example. Aristotle asks how the road from Thebes to Athens can be the same as that from Athens to Thebes (202b13-14). The answer is clear: the road is numerically identical even though it falls under two separate descriptions. Similarly, 'the way up' and 'the way down' are two different characterizations of one and the same road. But how do these examples illuminate Aristotle's claim that the *actualization* of teaching and of learning are one in number (202b10-12)? More importantly, how do they illuminate the claim that the actualization *by which the mover moves something is the same as the actualization by which the mover is moved*?

Aristotle holds that there can be one actualization of two different abilities (202b10) for the same reason one road can be both the road up and the road down. Teaching and learning, though different in account, are one in number.

To generalize: teaching is not the same as learning or agency as patency, in the full sense, though they belong to the same thing, the change;¹⁴ for the actualization of this in that and the actualization of that through the action of this differ in account (*Phys.* 202b19-22).

Someone might object that according to this line of reasoning the teacher could not teach without being made to learn. Aristotle's answer is that it is not,

... necessary that the teacher should learn, even if to act and to be acted on are one and the same, provided they are not the same in respect of the account which states their essence ... but are the same in the sense in which the road from Thebes to Athens and the road from Athens to Thebes are the same ... indeed it [*i.e.*, the claim that the teacher can't teach without learning] by no means follows from the fact that teaching is the same as learning ... any more than it follows from the fact that there is one distance between two things ... that being here at a distance from there and being there at a distance from here are one and the same (*Phys.* 202b11-19).

Since Aristotle is articulating the way in which exercises or actualizations can be considered identical, it is important to notice that in saying that teaching and learning are the same, he is referring to the *numerical* identity of actualizations and not to formal identity. In cases where the mover itself is moved as it makes

14 In saying that teaching and learning belong to ($\delta\pi\alpha\rho\chi\omega$) the change, we take Aristotle to mean that the change consists of the actuality or exercise of one subject's ability to teach the other, and another subject's ability to be taught. We do not think he means to say that teaching and being taught are predicated of the change in the same sense that teaching is predicated of the teacher and being taught is predicated of the learner.

something else move, the required actuality is the exercise of the mover's ability to move something, and in so doing, to undergo motion. Here too, the exercises must be understood to be numerically identical. Of course not all movers are moved. But as we have noted, Aristotle is here considering only those that are (*cf. Phys.* 202a2-3).

To recapitulate: Aristotle uses the interval example to illustrate that what is numerically one can be two in form or description. Although its scope is static and fixed, it provides insight into how two different descriptions can equally characterize one and the same reality. In *Phys.* III. 3 Aristotle's focus is on the dynamics of change, on how actions and activities are identical. But as for the case of the interval, Aristotle is concerned with the numerical rather than the formal identity of activities or exercises of abilities.¹⁵

The terms 'teaching' and 'learning' refer to one and the same exercise or actuality. Suppose McGuire succeeds in teaching Bogen something. At the same time Bogen succeeds in learning from McGuire, he and McGuire jointly exercise the abilities necessary for imparting knowledge. Imparting knowledge involves numerically one and the same ἐνέργεια, the actualization of the abilities to engage in the process which leads to the realization of one and the same goal. And so there is nothing to prevent the formally different actualizations involved in the same process from being numerically identical (*Phys.* 202b30). Thus 'teaching' ('bringing it about that someone learns') and 'learning' ('being taught') are two different descriptions of one and the same actualization. What holds for the learner exercising an ability to learn and the teacher exercising an ability to teach holds as well for a mover and the thing it moves. And just as teaching and being taught are formally different but numerically one, the actualization or exercise by which

15 The canonical example of formal identity is at *Phys.* II. 7, 198a25-28 (*cf. Metaph. Z.* 8 1033b29ff). In this text, Aristotle puts forward his doctrine of the four causes and, while making an exception for material causes, he says:

the last three often coincide – for the what-it-is [*i.e.*, the form] and that for the sake of which [the final cause] are one, while that from which the primary motion comes [the efficient cause] is the same as them in form [τῷ εἶδει].

Again we see the same strategy. In analyzing the causes Aristotle's aim is to show that one and the same causal reality falls under different descriptions. Similarly, knowing and being known are numerically identical activities which fall under different descriptions. And at *De An.* III. 2 (425b26-28) he says that,

... the activity of the sensible and of sensing is one and the same although not the same in account.

Thus, to expand on this example, in the sensory act of tasting salt, my sensation of the salt's astringency is one and the same event as my tasting the astringency of the salt.

Barnes moves himself can be numerically identical to the actuality or exercise by which he is moved. The same holds for movers which are numerically different from the things they move.

V

After presenting this view Aristotle discusses what he calls a dialectical difficulty (ἀπορίαν λογικήν) in order to show that absurdities arise from the view that every change consists of numerically different actualities rather than a single actuality which falls under different descriptions (202a21-22; see Ross, 1979: 540). Aristotle introduces the view he wants to reject as follows:

Perhaps it is necessary that there should be an actuality of the agent and of the patient. The one is agency (ποιήσει) and the other is patiency (πάθησις), and the outcome and end of one is a doing, and of the other a suffering (*Phys.* 202a21-24).

If the agency by which something is made to change, and the resulting patiency (the change it undergoes) are numerically different,

... either both are in what is being acted upon and moved, or the agency is in the agent and suffering is in what suffers (*Phys.* 202a26-27).

Aristotle examines and rejects both of these alternatives in order to show that the actualization or exercise he calls agency cannot be numerically different from the one he calls patiency. He begins with the second alternative, namely, that the agency is in the agent and the suffering is in what suffers. His answer is truncated:

... in the latter case, the motion will be in the mover, for the same account will hold of mover and moved, so that either every mover will be moved, or, though having motion, it will not be moved [our emphasis] (202a28-31).

Thus, if the agency is in the mover, and if it is a change (as is stated at 202a25), then either (a) nothing can move anything without itself being moved, or (b) that which is moving has motion but is not moving. (a) is false since there are movers which are not moved. (Now we can see the importance of the qualifying phrase at 202a3-4 which anticipates this argument, namely the phrase '... every mover, that is, (every mover) which is capable of motion'). (b) is absurd because it would be self-contradictory to say that what has motion does not move.

The argument to show that the first alternative leads to unpalatable consequences is more straightforward but not without its subtleties:

If ... both [actualities] are in what is moved and acted on – both the agency and the patiency (e.g., both teaching and learning, though they are two, in the learner), then first, the actuality of each will not be present in each, and, a second absurdity, a thing will have two motions at the same time. How will there be two alterations of quality in *one* subject towards *one* form (εἶδος). The thing is impossible: the actualizations will be one [our emphasis] (202a31-36).

Aristotle's point is this: If two numerically different actualities – a doing and a suffering – are present in one and the same thing, namely, the patient itself which is moved and made to move, then two different actualities – making something move and being moved – are in the same subject. For example if teaching and learning are distinct actualities going on in the learner, then teaching does not go on in the teacher. But if both go on in the teacher, there is no learning in the learner. In other words either the teacher does not teach or the learner does not learn.

The second absurdity also has subtle import. Aristotle asks: if a thing is undergoing two separate changes at the same time, 'how will there be two alterations of quality in *one* subject towards *one* form?' In Aristotle's ontology there is the closest connection between the form toward which something changes and the end or completion (τέλος) of the actualization which constitutes the change. For example teaching and learning are processes whose end is someone being taught and thus have the same τέλος. But if they have the same τέλος, they cannot be numerically distinct. The important thing to see here is that it is *numerical* difference and not formal difference which makes it absurd to say teaching and learning are different actualities or exercises.

VI

We turn now to a troublesome passage in *Metaph.* Θ, 6 (1048b18-34). Here Aristotle appears to distinguish between actualization or exercise (ἐνέργεια, ἐντελέχεια) and change in a way that is incompatible not only with our account of how local motion can be accommodated in Aristotle's ontology, but also with his own account of change as actualization.¹⁶

We do not think Aristotle changed his mind about his account of motion.

16 Ross says this passage is omitted from some manuscripts and seriously corrupted in others (Ross, 1988: 253). Nevertheless, it is to be taken seriously for our purposes because its apparent distinction between change and actuality can also be found in *Nicomachean Ethics* 1174a14-23, 1174a29-b5, whose authenticity is not questioned.

Furthermore we think the troublesome passage is of interest because it supplies a criterion for completeness which supports our rejection of the Philoponian conception of change as incomplete actualization.

The troublesome passage is a discussion of actualization or exercise as these notions apply to actions or activities (πράξεις).¹⁷ The passage introduces a much discussed distinction between actions which pass what we will call the Done-while-Doing (D-D) test, and actions which do not.

The D-D test: An action, or activity, A, is D-D if doing A during any finite interval of time, *t*, (no matter how small) entails that A has already been done during part of *t*. For example, seeing is D-D because at any time during which one sees, one has already seen during part of that time. Similarly, at any time during which one understands, one has already understood.

Contrary to Ryle,¹⁸ who took this to be a logical test which distinguishes different kinds of verbs and verb phrases, we believe Aristotle uses the D-D test to mark an ontological distinction. Furthermore, we submit that the D-D test constitutes Aristotle's only explicitly and carefully set out criterion for the completeness or incompleteness of an ongoing action or activity. Actions and activities which are by their natures aimed at achieving an end other than their own performance fail the D-D test. For example, during the time when one continues to build a temple, one has not yet built the temple. As long as one is in process of learning some specific thing, one has not already learned it. While one is walking to Barstow, one has not yet walked to Barstow. While one is in process of being cured one has not yet been cured. As long as one is thinning something, one has not

17 The context in which the troublesome passage occurs establishes that this is Aristotle's topic. He begins Θ, 6 by saying that having discussed ability (δύναμις) with regard to change (κίνησις) he will go on to consider actuality (ἐνέργεια) (1048a25-27). Actuality is one way in which something can be present, and capability, another (1048a30-32). As said above, we take this to mean that ἐνέργειαν and κατὰ δύναμιν are different forms of metaphysical predication. In keeping with the *Physics* account change is the exercise or actualization of an ability. Next, Aristotle looks at three sorts of actuality and potentially which need special consideration. The first two are the void and the infinite, neither of which can be actual in the same way that what can see actually sees, or what can walk actually walks (1048b12). The third case is action or activity whose actuality is the topic of the troublesome passage. Having considered them he concludes the chapter by saying that he has demonstrated what sort of thing actuality is (1048b35-36).

18 Ryle, 1962: 102-103. Over and above what Aristotle has to say in *Metaph.* Θ, *Phys.* V, 6 discusses changes with regard to which D-D reflects mathematical features of continua rather than grammatical features of a language.

yet finished thinning it (1048b24-29).¹⁹ These activities are incomplete (ἀτελής) while they are underway. The complete walk takes up the entire interval between its start and its finish; it is not complete during any sub-interval (1050a24-b1).

By contrast, activities which can be defined without reference to any goal beyond their own performance are complete (τέλος) in the sense of passing the D-D test at every time during which they occur. Thus one is seeing only when one has already seen; living well only when one has lived well; thinking only when one has thought, and so on (1050a24-b1). From the fact that whenever one is seeing one has already seen, it follows that having seen does not preclude continuing to see. The same holds for the other D-D activities. Except for special cases like the eternal rotation of the cosmic spheres, D-D activities do not go on forever. But even though something will eventually bring your seeing, thinking, or living well to an end, the mere fact that you have seen (thought, lived well, etc.) is not sufficient to terminate the activity.²⁰ By contrast, the achievement of a goal brings an activity which fails the D-D test to an end. One cannot continue walking to a destination one has already reached; learning something one has already learned; thinning what one has already thinned; undergoing a completed cure; and so on. In section §VIII below we argue that Aristotle needs this ontological distinction between D-D and non D-D activities to explain how an *aetherial* cosmic sphere can continue to rotate at each and every time after which it has already rotated.

Having drawn this distinction, Aristotle says he will use the term ‘exercise’ or ‘actuality’ (ἐνέργεια)²¹ in connection with D-D actions or activities, and ‘change’ (κίνησις) for non-D-D actions or activities (1048b28-34). The moral to draw from this is emphatically *not* that by the time Aristotle wrote *Metaphysics* Θ he had abandoned the *Physics* characterization of local motions and other changes as exercises or actualities.²² Aristotle says that changes are exercises or activities in

19 Since Aristotle means to give us examples of activities whose completion requires the accomplishment of goals other than their own performance, we suppose that in the troublesome passage (1048b18-34) by ‘building’ Aristotle means building some specified thing, by ‘walking’, taking a walk or walking to a specific destination, and by ‘thinning’, reducing a liquid to a specific consistency. This is in keeping with *Metaph.* 1050b30ff, and *Nichomachean Ethics* 1174a18-32.

20 We learned this from Ackrill, 1965: 122-123. For a discussion of Ackrill’s seminal paper and some early responses to it, and useful comments on the troublesome passage, see David Charles, 1985.

21 See fn. 1. Here, as earlier we are using the term ‘actuality’ only because this is the traditional translation of ἐνέργεια and ἐντελέχεια. We do not think this is a very good translation, but we have no better one to offer. Whenever the reader sees terms like ‘actuality’ or ‘actualization’ we hope she will think of the Greek terms.

22 The same goes for *Nichomachean Ethics* 1174a18-32.

Θ. 6 at 1048b9 only nine lines before the troublesome passage, and continues to call changes exercises or activities afterwards (e.g., in Θ. 8. 1050a24-b20, *passim*).²³ Furthermore, what Aristotle says in *Physics* III is his only full account of change. It is hard to imagine him rejecting it without providing a new account to replace it.

In classifying non-D-D activities as changes, Aristotle cannot mean to deny, e.g., that temple building is not the exercise or actualization of the builder’s ability to build. To deny that would be to contradict a great deal of what he says in *Metaph.* Θ and elsewhere. Nor is there any reason to think that in classifying seeing, living well, and other D-D activities as exercises or actualizations Aristotle meant to deny that they are changes.²⁴ Instead of using the terms κίνησις and ἐνέργεια to distinguish changes from goings on which are not changes, we think Aristotle used them to mark a distinction between two kinds of activities, both of which are changes. The difference between them is that by its very nature, a non-D-D activity can be completed only by the attainment of a goal other than its own performance. By contrast, no such result is required for the completion of living well, thinking, seeing, understanding or any other D-D activity.²⁵ This is why D-D activities are not the same kinds of changes as D-D activities.

It is essential to the completion of a non-D-D activity that it brings about a change in metaphysical predication. The activity of building a temple is incomplete until there is a temple where there was none before. The activity of walking from one place to another is incomplete until one has reached a place one did not occupy before. The activity of thinning is incomplete until the liquid one thins has new consistency. The activity of curing is incomplete until the patient’s body stuffs (or their features) have been made to stand in new relations to one another. And so on. In all such cases, one or more metaphysical predicates are gained, and one or more others lost by the completion of the activity. By contrast, to see is neither to gain nor to lose any metaphysical predicate. Seeing is the exercise of an ability one possesses and retains, rather than a change in which a metaphysical predicate is

23 Needless to say this does not commit Aristotle to the view (which he did not hold) that all ἐνέργεια are κινήσεις. See fn. 1 above.

24 A terminological point: Our view that seeing, understanding, and the like belong under the heading of (κίνησις) is compatible with the *De Anima* pronouncement that no such thing is an alteration (ἀλλοίωσις) because change is a genus which includes a great many doings and sufferings which are not alterations (*De An.* 417a30-b8; *cp Phys.* VII b1ff). Notice in this connection that building a building is a κίνησις which does not alter the builder while he is doing the building (*De An.* 417b8-9).

25 Of course one cannot see without seeing something. But as opposed to the non-D-D activity of seeing an entire parade, seeing is not by nature such that one must finish seeing any particular thing in order to have seen.

gained or lost.²⁶ The same holds for living well, understanding, and other D-D activities. (As we suggest in §VII below, it holds also for the rotations of the cosmic spheres). This makes it more natural to understand Aristotle as saying that D-D and non-D-D activities are *zēnōseis* of different kinds than to read him as claiming, contrary to *Phys.* III, and the non problematic parts of *Metaph.* Θ, that changes are not activities or exercises. A non-D-D activity is completed by a full blooded change with respect to metaphysical predicates. By contrast, we think, Aristotle calls D-D activities *ἐνέργεια* because their completion requires nothing beyond the exercise or actuality of an ability.²⁷

Surprisingly, the distinction between changes whose completion requires only the exercise of an ability to engage in or undergo a process, and changes whose completion requires the exercise of an ability to achieve some further result sorts building and walking into a different bin than building a temple and walking to Barstow. *Phys.* V. 6 argues at length that whenever something is moving from one point on any continuum to another, it must already have moved (237a14-15, 17, b5) and says that the same is true for changes between discontinuous contraries and contradictories (237b9). It follows that although walking from one place to another is not a complete activity in the sense of passing the D-D test, walking is complete in this sense: one cannot be walking unless one has already walked. This holds for local motions in general. It follows that moving locally (as opposed to moving from one specified place to another) is complete in exactly the same sense as are seeing, theorizing, *etc.* And although Aristotle does not say so, seeing a parade (as opposed to seeing) is incomplete while the parade is going on in exactly the same sense as walking the length of the parade route is incomplete while one is walking.

VII

At this point an important problem emerges. It is the second of the difficulties mentioned in §V above with regard to the actuality which constitutes local motion. Given our analysis of local motion as the exercise of an ability to do or to suffer,

26 More precisely, seeing and being able to see are two different kinds of metaphysical predication of one and the same predicate. Thus nothing is metaphysically predicated of the seer as the result of her having seen, which did not belong to her before she saw. By contrast, it is essential to walking to Barstow that it brings about the metaphysical predication of a new predicate – a location which did not belong to Barnes until he completed his walk.

27 Although we do not know if she would endorse our implementation of it, we are indebted to conversation with Mary Louise Gill for the suggestion that seeing, thinking, *etc.*, are not *zēnōseis* in as 'strict' a sense as building a building or taking a walk. To avoid the suggestion that D-D activities are inferior in some way to non-D-D activities, we have said instead that they are 'different'.

how do we understand the endless motion (*i.e.*, unlimited rotations) of the cosmic spheres (*cf.* *De Caelo* I. 2)? After all, if there is merit in what we say about Aristotle's conception of local motion, it must be able to explain eternal local motion, a doctrine so central to his world picture.

The chief difficulties with regard to the motion of the cosmic spheres have analogues in the case of the finite motions of garden variety sublunary objects. First, we claim that the exercise or actualization which constitutes local motion is complete. But how can anything completely do or suffer what it has not yet finished doing or suffering? For example, how can a ball's moving down a hill be a complete exercise of its ability to move downwards before it reaches the bottom? Similarly, how can a cosmic sphere, which rotates necessarily and always, be completely exercising its ability to do that during each and every moment of its rotation? In other words, how can a sphere *be rotating eternally* at each and every moment at which it rotates?

The second difficulty is this: how can something completely exercise an ability to do what it *cannot* finish doing? Suppose there is an obstacle in place which will prevent the ball from reaching the bottom of the hill. What is the ball doing during any arbitrary interval of time during which the ball is rolling? It must be exercising its ability to move down the hill. Otherwise, it would not be moving at all. On the other hand, at any arbitrarily small time during its motion, how can the ball be fully exercising an ability to move to a place it cannot reach? Just as the obstructed ball cannot complete its motion to the bottom of the hill, a cosmic sphere can never complete an unlimited number of rotations. That is because, according to *Phys.* III. 6, the unlimited is never fully actual. We cannot say that during any time interval, however small, a cosmic sphere is completing an unending series of rotations which are not yet actually completed. For how can what cannot happen be happening?

Given these questions it is clear that we have to clarify the nature of the actuality or exercise involved in all changes regardless of their scope. Let us inquire into their ontological status as exercises *when they are actually being exercised*. Eternal successiveness is a notion connected with Aristotle's view of the infinite (*i.e.*, the unlimited), whose mode of being is 'that which cannot be gone through' (*Phys.* III. 6 204a17-19). As Aristotle understands it, 'that which cannot be gone through' is *κατὰ δύναμιν*, (*i.e.*, it can be or, if you prefer, it 'is potentially') but only in a special way. To say a statue can be is to say that there can be an actual (*i.e.*, completed) statue. In contrast, the Aristotelian infinite cannot be actual in the sense of being completed. Instead, the sense in which the infinite *is*, is analogous to what we mean by saying 'it *is* a day', or 'it *is* the games'. In regard to such phenomena, in so far as they are occurring or going on, one thing after another continually comes to be

only to pass away. Also, a distinction between potential and actual existence is relevant in the sense that we can say of a game or of a day that it may occur or that now it is occurring (206a20-25).

Now, a day, the games, or indeed a walk to somewhere, possess a characteristic limit (πέρας) such that they are complete when they reach that limit. For example, at any time during which Barnes is walking to Barstow, his walk is incomplete. But even so, he is actually walking. Similarly, an unlimited process can be going on even though it can never be completed. Of course it is contradictory to say that during any limited interval of time an infinite process is *complete*. But to say that an infinite process is underway, or is going on does not imply that it is complete. In other words, while we cannot say that an infinite process, which has no possible completion, is on the way to completion during a given finite interval, we can say that a non-completable process is occurring during any finite time. If this is correct, there is no contradiction in saying that an unlimited process is going on at a time. So much for the question of how the cosmic spheres (or the rolling ball) can fully exercise an ability to do what they cannot finish doing.

Now substances, such as a horse or a person exist as complete wholes through every time during which they exist as they must if they are to be self identical through time. So, throughout every interval of time in which Barnes is present, he is completely there no matter how small the interval may be. In contrast, a process which is going on during any time interval, large or small, is not there completely during any part of the interval. Thus, as Barnes moves from place to place during any finite interval of time (no matter how small it is) what he is *doing*, is moving from place to place. Similarly, processes which lack a limit, such as the rotation of a cosmic sphere, go on during every finite interval of time no matter how small. And so there is no contradiction in saying that an unlimited activity is going on during a limited time. In this respect there is no interesting difference between a cosmic sphere's rotation (the exercise of its ability to rotate eternally) on the one hand, and the ball's exercise of its ability to roll down the hill or Barnes' exercise of his ability to walk to Barstow, on the other.

VIII

We turn now to the ontology of the cosmic spheres nested within the superlunary region of the cosmos.²⁸ In *De Caelo* I. 1-3, we are told that the *aither* which is their

²⁸ It is worth taking seriously (as many commentators do not) that what is outside of the sublunary region of the cosmos is not a single spherical object, but a collection of nested spheres which rotate in different ways. See fn. 34 below on why this is important.

matter is the source of its own motion and that it moves naturally in a circle (269b18-270a35). Probably influenced by the Platonic conception of self-motion (but not its psychic commitments), *De Caelo* speaks of the *aither* as that which 'runs always' (ἀεὶ θεῖν) (270b24). As such it is,

... eternal and suffers neither growth nor diminution but is ageless, unalterable and impassive [*i.e.* not subject to alteration] (270b36-39).

We agree with most commentators that in *De Caelo* the cosmic spheres are self-movers of a special kind.²⁹ One thing that makes them special is that their rotations are paradigmatic examples of activities which pass the D-D test. It is not just that whenever they are rotating, they have rotated. Over and above that, at every time during which they have rotated, it is necessary that they will continue to rotate. By contrast, although at every time during which I am seeing it is necessary that I have seen, it is not necessary I will continue to see – let alone, that I will continue seeing for all eternity. Every D-D activity is such that its having been done does not preclude its continuation. But only the rotations of the cosmic spheres are such that they must continue omnitemporally.

But special as the cosmic spheres are, *De Caelo* I. 2 develops one strict parallelism between the sublunary elements and the *aither* of which the cosmic spheres are composed. Aristotle argues that there are only two sorts of natural motions, rectilinear and circular. The natural (unforced) motions of parcels of Earth, Air, Fire, and Water are rectilinear. As long as nothing interferes with them, Earth and Water move downward toward the center of the cosmos until they reach their

²⁹ The traditional view holds that Aristotle gives up the idea of cosmic self-motion and supports this contention by appealing to the arguments for the necessity of unmoved movers in *Phys.* VIII, and the fact that *Metaph.* Λ posits a transcendent unmoved mover distinct from the cosmic spheres whose motion it in some sense causes. Contrary to the received view, it seems to us that there are no decisive reasons (textual or otherwise) for denying that the Aristotle of *Metaph.* Λ still considers the cosmic spheres to be made of *aither*. Even if (as *Metaph.* Λ seems to hold) the *aither's* capacity to rotate is activated by some sort of desire, that is perfectly compatible with the notion that the sphere's ability to move belongs to the *aither* which is its matter. Similarly we disagree with the traditional view that the arguments for a plurality of unmoved movers in *Phys.* VIII indicate that the *aither's* natural ability for rotation is insufficient to account for their continued rotation. The received opinion seems to be that the *aither* (in so far as one takes it to be presupposed by Aristotle in his later thought) needs to be activated by a mover other than itself, on pain of its otherwise lying dormant. It is further argued that a transcendent unmoved mover must eventually be posited to avoid a vicious regress. We maintain, to the contrary that the nature of each cosmic sphere is sufficient to account for its continued rotation and therefore that whatever the function of the unmoved mover of *Metaph.* Λ may be, it is not required to secure the eternal rotations of the cosmic spheres [see also fn. 13 above].

natural places, and Air and Fire, upward. The natural motions of the cosmic spheres are circular rotations around the center of the cosmos' rather rectilinear motions. The natural motions of bits of Earth, Air, Fire, and Water resemble them in that nothing external to their natures is required to keep them in motion.

With this in mind, consider Aristotle's comparison in *Phys.* VIII. 4 of the natural motions of Earth, Air, Fire, and Water to a knower's use of the knowledge she possesses (*Phys.* VIII. 4 255a30-35). Immediately after distinguishing possessing a skill from exercising it, Aristotle says, 'it is the same in regard to natural things' (*Phys.* 255b30) and embarks on a discussion of the behavior of Earth, Air, Fire, and Water. Suppose someone is using her knowledge to think about something. As long as nothing interferes, nothing apart from the knower is required to sustain her thinking. Similarly a bit of Earth, Air, Fire, and Water which is traveling, unimpeded, toward its natural place requires nothing beyond itself to sustain its motion.

What is it by virtue of which a heavy body moving toward its natural place continues to move? It owes its ability to move to whatever generated it and gave it all of its natural abilities. It owes its motion in part to whatever released it so that it can move without obstruction (*Phys.* 256a1). But these are incidental causes whose work is finished once the object has begun to move. They themselves do not sustain the motion they have made possible. The only candidate for what sustains an ongoing natural motion is the nature of the moving body. According to texts from *Physics* II. 1 and *De Caelo* III. 2 a naturally moving bit of Earth, Air, Fire, or Water has by virtue of its very nature an 'innate impulse' (ὁρμήν ἔμφυτον) (*Phys.* 192b18-19) or a natural impulse (φύσει ὁρήν) (*DC* 301a25). This means that the body has by nature an ability in virtue of which it will continue to move toward its natural place as long as nothing interferes with its exercise of that ability. Commentators disagree about just what kind of ability this could be. One long standing tradition of commentary holds that by nature, a simple body is both the active source of the continuation of its natural motion, and a passive source by virtue of which it undergoes the process which carries it from one place to another.³⁰ By contrast,

30 There are two traditional interpretations of Aristotle's views about the motion of simple bodies when they are unimpeded. According to the one we follow, their motion arises from an internal source, power, or cause which actively sustains their natural movement. Some important proponents of this view are Chrysippus, Philoponus, Avicenna, Albert the Great, Roger Bacon, Duns Scotus, Buridan, Oresme, and the Paduan Aristotelian, Jacopo Zabarella. Opponents of this interpretation are the so called 'strict Aristotelians' who, like Simplicius, Alexander of Aphrodisias, and Aquinas base their interpretations largely on *Phys.* II. 1, and VIII. 1. They view Aristotle as holding that only animate things are capable of self motion. In contrast, inanimate

some present day commentators interpret Aristotle as holding that although a simple body does not, strictly speaking, move itself, it has by nature a passive ability whose exercise accounts for the continuation of its motion. In either case, natural motion should be understood as the metaphysical predication (the ἐνεργεῖα) of an item in the category of *doing* or suffering which is fully and actually present at each and every moment during which the body transits towards the termination of its motion.

We granted above that the motions of the cosmic spheres are unique. But what makes them unique is not that they contain the ability by virtue of which they continue to move. In this respect they resemble Earth, Air, Fire and Water. The cosmic movers, composed as they are of *aither*, are the source and subject of their own motion in just the same way as Earth, Air, Fire and Water.

One crucial difference between them is that while obstacles often interfere with the motions of sublunary bodies, nothing can prevent or interfere with the motion of the *aither*. A second crucial difference is that unlike the sublunary simple bodies their ability to move is exercised inexhaustibly at all times. One explanation of this is the way in which the rotational ability of the cosmic spheres resembles the first order abilities of *De An.* II. 5 (417a22-b16). Their exercise does not alter their possessors. Nor does it alter the way or the conditions under which they can be exercised.

Aristotle illustrates the difference between first order and lower order abilities as follows. Children who have not yet learned a subject possess a lower-order cognitive ability for that subject just by virtue of being humans who can learn it. This contrasts with the first order cognitive ability they acquire by learning the subject. The process by which something is learned changes the learner from someone who can learn something (*e.g.*, geometry) to someone who can no longer learn it unless she forgets what she had learned and needs re-education. By the same token a learner is changed, *e.g.*, from someone who cannot actually do any geometrical theorizing into someone who can. For our purposes, the crucial distinction this illustrates is the difference between an ability (*e.g.*, the ability to

things are said to possess only a passive ability to move when nothing prevents it. For a detailed discussion of these interpretations see (McGuire, 1994: 306-329). See also the appendix on Philoponus and Scotus below. The following from Simplicius is an early source of this view.

'If a thing has natural motion, then it either moves by nature in the sense of the so-called natural bodies like earth and fire, or in the sense of so-called self moving creatures which are moved by the soul within them' (translated and quoted by W.K.C. Guthrie; see Guthrie, 1960: xxxiii).

Mary Louise Gill is a present day proponent of this interpretation (see Gill, 1989: 234, 239).

learn geometry) whose exercise changes its possessor with regard to that ability, and an ability (e.g., the ability to do geometry) whose exercise brings about no such change. The ability of the cosmic spheres to rotate is like a first order ability in that its exercise for any period of time does not alter the ability or its possessor in such a way as to prevent or modify its continued exercise.³¹

Aristotle offers two reasons for this. The first is that unlike a local motion from one place to another, cosmic rotation passes the D-D test. We have seen that Barnes had not walked from Arrowbear to Barstow during any time of his walk. By contrast, living well is a D-D activity: our having lived does not (by itself) preclude our continuing to live well (*Nicomachean Ethics* X. 4. 1174a13-19). Because seeing is a D-D activity, we can continue seeing, having seen, and similarly for thinking and having thought. By the very same token, for any time, *t*, the fact that at *t* a cosmic sphere has rotated does not preclude its continuing to rotate after *t*.³²

But the fact that cosmic rotation is a D-D activity does not by itself secure that the cosmic spheres will never stop rotating. After all even though living passes the D-D test, no one lives for ever. What does explain the eternity of the cosmic rotations is the following from *Metaph.* Θ. 8. It is part of a discussion of various sorts of abilities in which Aristotle specifies what is possible and what is impossible in virtue of the natural abilities things possess.

... All imperishable things ... are actual. Nor can any of the things that are of necessity [be only possible]. (Indeed these things are primary: for if they were not, nothing would be). Nor indeed does motion, if it is something eternal [exist only possibly]. If any eternal thing is moving, it does not move according to possibility except with respect to whence and whither (and there is nothing preventing it from having matter for this [sort of motion]). Accordingly, the sun and the stars and the whole heaven are always active [*i.e.*, they are always exercising their ability to rotate], and there is no fear that they may sometime stop, which is what those who study nature fear. Nor do they tire with respect to the exercise of this ability. For movement for them, does not, as it does for perishable things, involve the ability for the opposite [of

motion] so that continuity of motion is laborious. For it is the [kind of] substance that is matter and potentiality, rather than actuality that is the reason for this [*i.e.*, for laborious motion]. And imperishable things are imitated by things that change (ἐν μεταβολῇ), e.g., Earth and Fire. For these [*i.e.*, imperishable things] are always in activity; for they have their movement by virtue of themselves (καθ' αὐτά) and in themselves (ἐν αὐτοῖς) (1050b19-30).

The moral we draw from this is that the matter of the cosmic spheres is not such that their exercise of their natural ability to rotate can be stopped or impeded by any internal or external factor. They rotate by virtue of an ability which they always possess, and which they always exercise by virtue of their very nature independently of what else is going on in the cosmos.

To summarize, here are the salient points concerning the local motion of each cosmic sphere. It is the exercise of an ability which is fully exercised at all times. The possession of this ability is an essential feature of the cosmic movers. That is why they 'have their movement in virtue of themselves and in themselves.' Because their rotations pass the D-D test, the fact that a cosmic sphere has rotated at one time does not preclude its continued rotation. Because a cosmic sphere's ability to rotate is like a first order ability, its exercise at one time does not diminish it or hinder its further exercise. Because the cosmic sphere has no matter of a kind that would allow it to lose its ability to rotate, there will never be a time at which it lacks the ability. And finally, a cosmic sphere does not change in the sense of losing or gaining any metaphysical predicates through the exercise of its ability to rotate.³³ In this respect the cosmic rotations are more like the activities of seeing or understanding than taking a walk or building a building.

Aristotle's view about the nature of the *aither* grounds both his non-modal claim that the cosmic spheres rotate through endless time, and his modal claim that they cannot fail to rotate at any time. In maintaining this he does not commit the fallacy of inferring a modal from a non-modal claim. Aristotle realizes that the fact that a cosmic sphere rotates always is not in itself sufficient to secure that it rotates of necessity. It is part of the nature of each cosmic sphere to have *aither* as its matter; it is *aetherial* by nature. A cosmic sphere moves of necessity because (a) rotation is a natural motion which its *aither* must engage in when nothing prevents it, (b) because there is nothing in the superlunary sphere to prevent it, and (c) because

31 But of course there are disanalogies. One important disanalogy is that a cosmic sphere's ability to rotate is not acquired or developed (like the ability to do geometry) from a lower order ability.

32 Notice that the distinction between D-D and non-D-D κινήσεις is not to be confused with the doctrine we reject according to which ἐνέγγεια and κίνησις are mutually exclusive. While there is no doubt that Aristotle endorsed the D-D/non-D-D distinction and considered it important enough to write about it extensively, we have argued that Aristotle believes that both are activities or exercises of an ability (ἐνέγγεια).

33 Of course a planet, a star, or any other distinct bit of a sphere does change its position relative to other things as the sphere rotates. But the sphere itself does not.

nothing from the sublunary sphere can reach it to interfere with its movement.

Finally we need to consider briefly how Aristotle accounts for observationally established changes in the relative positions and speeds of the planets and stars. His explanation is that they are carried around the earth on different spheres which rotate at different speeds and in different directions.³⁴ As we have been claiming, Aristotle thinks that they rotate instead of standing still or moving in a straight line because rotation is the natural motion of the *aither* which is their matter. But if they have the same matter, why do they rotate in different directions and at different speeds?³⁵ Aristotle may have thought that the differences in their speeds could be due to differences in their sizes. He claims in another connection that larger bodies move faster than slower ones if their motions are natural and unforced and, we suppose he would add, if they are made of the same stuff (*De Caelo* 290a1ff). Aristotle's explanation for differences in directionality is that the cosmic spheres are ensouled (*De Caelo* II. 12). This raises thorny questions about the compatibility of Aristotle's position in *De Caelo* with what he says about unmoved movers in *Phys.* VIII and *Metaph.* Λ. Fortunately this paper's only concern is the way in which local motion, including the rotations of the cosmic spheres, is to be understood as the metaphysical predication of items from the categories. Commentators disagree about *how* souls contribute to the motions of the cosmic spheres, and about whether the natural ability which enables the cosmic spheres to keep moving is passive or active. But nothing in the Aristotelian *corpus* or the standard commentaries requires us to deny that their rotation is the exercise of an ability which belongs to them by nature. Thus we see no reason why the doctrine that the cosmic spheres are ensouled should not be compatible with our views about Aristotle's theory of motion.

IX

Aristotle holds that all of the things that are (τὰ ὄντα) are said to be with reference to items from the categories and their opposites either *κατὰ δύναμιν* or as *ἐνέργεια*. The fact that local motion is not explicitly included in Aristotle's canonical

inventories of the categories raises the question of how local motion can be accommodated in Aristotle's ontology. We maintain that *κατὰ δύναμιν* and *ἐνέργεια* are two kinds of metaphysical predication – two ways in which something can be, or can have, one or more items from the categories, their contraries, or their privations. Abilities by virtue of which individuals initiate activities or undergo processes of different kinds belong to the category of quality. We have argued that local motion is the exercise or actualization of an item's ability to engage in a process through which it is carried from one place to another, and that this holds even for the extraordinary case of the rotations of the superlunary *aithereal* spheres. We note also that with respect to the questions we have been discussing, there is no interesting difference between the local motions of sublunary bodies and the rotations of the cosmic spheres. Both are exercises of natural abilities which are fully exercised at every time during which they move.

34 At *De Caelo* 289b32ff, the supposition that the stars and planets are attached to spheres which carry them through the heavens is the only hypothesis which allows us to explain why '... changes occur not only in the position of the stars, but also in that of the whole heaven' (*De Caelo* 289b1). (In the context of the relevant chapters of *De Caelo* (II. 8 and II. 12) we must assume that Aristotle uses the term 'ἄστρον' for planets as well as stars, and *κύκλον* for spheres as circles.) According to *De Caelo* II. 10, the fixed stars are carried by an outer sphere whose motion is swifter than that of the inner spheres which carry the sun, the planets, and other fixed bodies. In addition to moving more slowly, at least some of the inner spheres move in a different direction (291b1ff).

35 For a discussion of this and citations of some relevant secondary literature, see Judson, 1994.

Appendix

Philoponus and Scotus on the Motion of the Simple Bodies in Physics VIII. 4

In *Physics* VIII Aristotle argues that the simple bodies move in virtue of their natures if nothing prevents or constrains them. How can Aristotle believe this if he also holds that what initiates a change must be distinct from the thing that is changing? In his fragmentary commentary on *Phys.* VIII Philoponus considers how a fully continuous parcel of Earth, Air, Fire, and Water is both the source and subject of its own motion. His view is that the simple or elemental bodies possess active abilities for motion in virtue of their intrinsic natures. On the basis of this conception he argues:

Things that move by themselves are able to move not in one way but in many ways. Yet these considerations [*i.e.*, those Aristotle puts forward in *Phys.* VIII] show that the bodies of the elements do not have their motions from themselves. Nevertheless, in so far as each is moving, [when] each is moving in itself, to that extent the mover is distinguished from what is moved not by place, but by nature. For if it were distinguished only by place, what is like could not be affected by what is like (Philoponus, 1887: 888.225a12).

We suppose that for Philoponus, things which occupy different places are numerically distinct. In distinguishing difference in place from difference in nature we take him to distinguish what we call numerical difference from what we call conceptual difference or difference in form or description. Philoponus grants Aristotle that in the case of the simple bodies, when they are actually moving, mover and moved are not numerically distinguishable. Nevertheless, Philoponus holds, they can be distinguished conceptually or, as he says, ‘by nature’. If the mover and the moved cannot differ formally without differing numerically, Aristotle cannot reconcile his claim (*Phys.* VIII. 4 255b30) that the simple bodies are the source of their natural motion with his requirement that in their movement the mover is to be distinguished from the moved. This requirement reflects Aristotle’s commitment to the view that in all episodes of *ongoing* change the cause of change is spatially in contact, or contiguous, with the thing whose change it is causing. It is important to remember that in his interpretation of Aristotle, Philoponus conceives the simple bodies as being the intrinsically active cause of their own change. Philoponus is probably the earliest Aristotelian commentator to suggest that we can understand the simple bodies as the sources of their own natural motions by treating the distinction between mover and moved as a conceptual rather than a numerical distinction in this case.

Commenting on *Phys.* VIII, Duns Scotus challenges Aristotle’s view that self-motion reduces to a real distinction between mover and moved, *i.e.*, that the one is separate from the other in reality (*in rebus*). Where Philoponus speaks of a conceptual distinction, Scotus speaks of a formal distinction – a distinction which is intermediate between real and conceptual differences and is therefore a less-than-real distinction. What Scotus claims is that two items are formally distinct if they are numerically one, but the concepts referring to each of the items mutually exclude each other. For Scotus, the way we think of these items is not a mere artifact of our thought or language: our concepts refer to features which are really intrinsic to the nature of the reality in question. Thus, our ability to distinguish the mover from the moved in a body moving downward in and of itself is grounded in the real nature of the body. This chimes with Philoponus’ view ‘that the mover is distinguished from what is moved not by place, but by nature.’ The distinction Philoponus makes between a change marked by place (where the separability of the mover and the moved is possible) and the distinction which marks a change according to items intrinsic to a thing’s nature, mirror Scotus’ real and formal distinctions. For a detailed account of Scotus, see Peter King, 1994: 273-275, 284-286).

Bibliography

- Ackrill, J. 1965. ‘Aristotle’s Distinction between *Energeia* and *Kinesis*’, in *New Essays on Plato and Aristotle*, ed., R. Bambrough, 1965, pp. 121-142. London: Routledge and Kegan Paul.
- Bambrough, R. 1965. *New Essays on Plato and Aristotle*. London: Routledge and Kegan Paul.
- Bogen, J. and McGuire, J.E. 1987. ‘Aristotle’s Great Clock: Necessity, Possibility, and the Motion of the Cosmos in *De Caelo* I. 12’. *Philosophy Research Archives* Vol. XII, April. 1987. Bowling Green: Philosophy Documentation Center.
- Boudouris, K. 1985. *Language and Reality in Greek Philosophy*. Athens: Greek Philosophical Society.
- Charles, D. 1985. ‘Aristotle’s Distinction between *Energeia* and *Kinesis*: Inference, Explanation, and Ontology’, in *Language and Reality in Greek Philosophy*, ed., K. Boudouris, pp. 173-181. Athens: Greek Philosophical Society.
- Gill, M.L. 1989. *Aristotle on Substance: The Paradox of Unity*. Princeton: Princeton University Press, 1989.
- Gill, M.L. and Lennox, J.G. eds. 1994. *Self-Motion: From Aristotle to Newton*. New

- Jersey: Princeton University Press.
- Guthrie, W.K.C. 1960. *Aristotle on the Heavens*. Cambridge: Harvard University Press.
- Heidegger, M. 1981. *Aristotle's, Metaphysik Θ 1-3 von Wesen und Wirklichkeit der Kraft*. Frankfurt Am Main: Vittorio Klostermann.
- Hussey, E. 1983. *Aristotle's Physics Books III and IV*. Oxford: Oxford University Press.
- Judson, L. 1994. 'Heavenly Motion and the Unmoved Mover'. in *Self Motion: From Aristotle to Newton*, ed., M.L. Gill and J.G. Lennox, 1994, pp. 155-171. New Jersey: Princeton University Press.
- King, P. 1994. 'Scotus on Self-Change'. in *Self Motion: From Aristotle to Newton*, ed., M.L. Gill and J.G. Lennox, 1994. New Jersey: Princeton University Press.
- McGuire, J.E. 1994. 'Natural Motion and its Causes: Newton on the "Vis Insita" of Bodies'. in *Self Motion: From Aristotle to Newton*, ed., M.L. Gill and J.E. Lennox, 1994, pp. 306-329. New Jersey: Princeton University Press.
- Philoponus, *Excerpta Veneta in Physicorum*, ed., H. Vitelli, 1887. *Commentaria in Aristotelum Graeca* 17. Berlin: G Reimeri.
- Philoponus, *On Aristotle's Phys 3*, trans., M.J. Edwards, 1994. Ithaca: Cornell University Press.
- Porphyry, *On Aristotle's Categories*, trans., S.K. Strange, 1992. Ithaca: Cornell University Press.
- Ross, W.D. 1979. *Aristotle's Physics: Revised Text with Introduction and Commentary*. Oxford: Oxford University Press.
- , 1988. *Aristotle's Metaphysics: A Revised Text and Commentary*, Vol. II. Oxford: Oxford University Press.
- Ryle, G. 1962. *Dilemmas*. Cambridge: Cambridge University Press.