ABSTRACT

Deciphering Aristotle's *Physics*

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Aristotle's Physics has long been held to be the seminal work on physics as physics progressed from philosophy to science. This thesis unravels certain elements of Aristotle's Physics and gives helpful analysis and commentary so that the reader may approach the Physics and the concepts therein more easily and readily. The thesis is focused on Aristotle's belief in the existence of an eternal and immobile first mover. In order to address the preceding concept, Chapter 1 defines and discusses motion, infinity, time and place. Chapter 2 continues to address motion by looking at contrary vs. contradictory things, as well as the concept of continuity as it relates to motion while also addressing Zeno's argument against motion. Chapter 3 is the culmination of the thesis bringing together Aristotle's concepts discussed in Chapters 1 and 2 to show how Aristotle proved there is an eternal and immobile first mover. Aristotle does this by proving the hypothesis that every moving thing must be moved by something, disproving the disjunction against a first mover, and tying together motion as to the eternal, and motion as to time, and time as to the eternal.

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CHAPTER ONE

Introduction

The goal of this thesis is to decipher and explain Aristotle's long, complex, and involved argument for the existence of an eternal and immobile First Mover as detailed in his book, Physics. The concept of "First Mover" will be discussed later, but for now the concept of "First Mover" can be thought of in terms of the original energy from which all motion and time emanate.

In this thesis, the capitalized term "Argument" will mean Aristotle's argument for "the existence of an eternal and immobile First Mover".

Whenever the word "physics" is capitalized, then it is referring to "Aristotle's Physics".

Aristotle's Argument is indeed quite involved, very subtle, and at times, very difficult. However, analyzing Aristotle's Argument has created a sense of awe in this author for the level of thinking that Aristotle's Physics exhibits. As one who has read and studied many authors of the ancient world, this author is amazed at the intensity of thought that occurs in the pages of Physics. The level of argument and logic is not seen from anyone else writing at that time.

This thesis endeavors to unravel Aristotle's Argument and to give helpful analysis and commentary, so that the elegant arguments composed by Aristotle in a time before the luster of modern scientific thought might be more easily approached. The thesis is categorized into three chapters with a conclusion.

Chapter 1 describes the vocabulary and the devices needed to understand and grasp concepts used in later chapters. Chapter 1 looks specifically at Books III and IV.

Chapter 2 looks at the concept of Continuity (or something being continuous). Chapter 2 looks specifically at Books V and VI.

Chapter 3 discusses the part of Aristotle's Physics where he ties all the concepts together to prove there is an eternal, immovable "First Mover". Chapter 3 looks specifically at Books VII and VIII.

The first chapter looks closely at Books III and IV of Aristotle's Physics, which is where his argument really begins. This chapter lays down the foundations on which Aristotle's Argument rests. The main subjects of this chapter are Motion, Infinity, Time, and Place. This chapter will show how these four concepts relate. These concepts will be carried throughout the thesis.

The second chapter focuses on Continuity. Continuity is another essential, fundamental building block for Aristotle's argument for an immobile First Mover, and he spends considerable time discussing it in his Physics. Specifically, he analyzes the Continuity of Motion, Time, and Magnitude. If the concept of Continuity (or continuous motion) is not proven and accepted, then the overall hypothesis of there being an eternal, immovable First Mover becomes weak.

The third chapter discusses the main thrust of his argument. Having described the premises in Books III, IV, V, and VI, Aristotle then builds the arguments for the existence of a First Mover, and also argues in VII and VIII that the First Mover is immobile and eternal.

The following paragraphs map out the chapters and how they relate to each other. The maps are designed so that one can understand when reading each section how that section contributes to the overall argument.

Chapter 1 Map

Chapter 1 is divided into 4 different parts. The goal of Chapter 1 is to establish the definitions of Motion, Infinity, Time, and Place, and to, in part, detail their involvement with one another. Defining these terms is necessary, in order to have an intelligent discussion later as these terms will be used by Aristotle in proving his Argument. Aristotle uses the nuances of his discussion in the early books of Physics to build his arguments later on.

Chapter 1 – Part 1: Motion

1. The Difference between Actual and Potential Motion: Aristotle begins his analysis into motion by considering the difference between actual and potential motion as they relate to objects that could be defined to be in motion or not. The definition of motion comes from Aristotle's insights into the differences between actual and potential motion. Potential motion also includes the concept of "potentiality".

2. Initial Recognition of what Motion is and here it is located: Aristotle defines motion as something that "seems to be a certain being-at-work, but is incomplete" (75). This definition comes straight out of Aristotle's discussion of an object's potentiality for motion. That motion actually occurs in an object follows straight

out of the logic given regarding potentiality. This will be important in Chapters 2 and 3.

3. Causes of Motion: This section introduces the relationship between things that move and things that are moved, which will carry through the rest of the thesis. This concept will be especially important when considering an immobile mover.

Chapter 1 – Part 2: Infinity

1. The Recognition of the Concept of Infinity: Most people can perceive the notion of infinity easily. One just has to imagine a set of integers, whereby if an element n is in the set, then n+1 is also in the set. This will produce a set containing an infinitely many elements. However, in reading Physics, it seems Aristotle makes clear that he does not find any actualization of infinity, and concludes it is not there. It exists only potentially, as in the process of unlimited division or in the process of unlimited addition, but not actually.

2. Exposé into relations between mathematical concepts vs. sensible objects: Aristotle gives a quick exposé into the relationship between mathematical objects and sensible objects to bring home how things in the mathematical world fit into the sensible world. This helps give an indication as to how one makes sense of infinity in the physical realm in a similar way to how a circle exists and is actualized.

3. The concept of Infinity from division: If there is a magnitude of any length, then from mathematics, it is known that one may divide that magnitude an unlimited number of times.

4. The concept of Infinity from Addition: An actualization of an additive infinity with objects is impossible. There can never be an infinitely many sensible objects, given the nature of infinity. This will become an important tool that Aristotle uses in the later chapters to discard impossible theories. Essentially he argues that infinity cannot be whole by its very nature. One should consider an infinite collection of sensible objects, but, rather, a finite collection that may increase in number without bound. In this sense, the whole of a potentially infinite system will gradually unfold.

Chapter 1 – Part 3: Time

1. Without change there can be no time: The implications Aristotle makes out of this point are specifically important when establishing that time and motion are continuous, and as previously stated Continuity plays a pivotal role in the Argument. Time and motion are linked very closely together. Aristotle will argue that if given that one is continuous, the other must be continuous.

2. The Now: The Now helps define what time is. It breaks up time into the past and the future, both of which are required for time to make any sense. In Aristotle's discussion of Continuity, he will argue that motion cannot be analyzed on the basis of Nows alone.

3. Time as a measurement of motion: Aristotle further unravels the relationship between time and motion using the concept of measurement. He shows how one might consider time as a measurement of motion. This does two things. First, it helps the reader understand the relationship even more. Secondly, this helps the

theories that assume an infinite amount of motion can occur in a finite amount of time.

4. Time's relation to other objects: Lastly, Aristotle demonstrates what it means to be susceptible to time. He shows what it means to be in a system governed by time.

Chapter 1 – Part 4: Place

The final section of this chapter discusses place. This section does not have overreaching implications throughout the thesis, except that Aristotle uses this concept to it cover variations when discussing motion. It seems Aristotle's discussion of Place is preemptive, as in it helps show in what context objects move.

Chapter 2 Map

Chapter 2 – Part 1: Contrary and Contradictory

Chapter 2 will address this important argument for a couple of reasons. First, arguing this point will help prove that Motion is continuous, a key component to Aristotle's Argument. Secondly, Aristotle posits that this distinction between contrary things and contradictory things helps distinguish contrary things and contradictory things, where coming-into-being is an example of a change between contradictory states. Motion is between contraries.

Chapter 2 – Part 2: Defining Continuity (the concept of continuous).

In defining what Continuity is, Aristotle establishes all that is needed to complete his view of Motion and that is a good thing because Motion being continuous is important to his Argument. For if motion is not continuous, then his Argument cannot get past Zeno's famous objection that motion cannot even exist.

Chapter 2 – Part 3: Motion is Continuous (or has the properties of Continuity).

As has just been stated, it is important to show that motion is continuous to even get past initial arguments that motion cannot exist. Moreover, the concept that motion is continuous will be essential and assumed in later arguments such as: every moving thing must be moved by some other thing or force.

Chapter 2 – Part 4: Aristotle's Answer to Zeno

Zeno proposed an argument stating that motion cannot exist. Zeno's error, according to Aristotle, is to assume that objects merely move through a series of points, without accounting for the continuity of the motion through those points. This problem does not persist given Aristotle's definition of Motion.

Chapter 2 – Part 5: Magnitude and Time are also continuous.

That Magnitude and Time are continuous seems obvious once it is established that motion is continuous, but Aristotle gives an elegant argument for why these are indeed both continuous. This helps establish the complete view of the system, in which Aristotle argues that there is a First Mover that is eternal and immobile.

Chapter 2 – Part 6: The Now exists and is Indivisible.

Aristotle argues that the Now exists and is indivisible, as this will be important when he argues that the First Mover must be immobile. The implications of the Now also reinforce the conclusion that Zeno's theory is wrong. Aristotle suggests motion is not composed of mere nows.

Chapter 3 Map

Aristotle's discussions of the topics covered in Chapter 3 are quite extensive and detailed. To simplify this, Chapter 3 breaks down the discussion into three parts. The first part argues that there is a First Mover. The second part of Chapter 3 sets up the foundation for the last part of Chapter 3. The last part argues that the First Mover is immobile and eternal.

Chapter 3 – Part I: There is a First Mover

1. Every moving thing must be moved by something: Aristotle argues this point two times during his Physics. In both situations, it is a vital move of the argument, and both are addressed here as they are addressed in his Physics. Here, it is important to establish that everything must be moved by something, in order to show that there will be an infinite amount of movers, or one First Mover, which is important to the Argument.

2. There is a disjunction in considering the First Mover: Two possibilities arise which must be addressed after it is shown that every moving thing must be moved by something. There is the possibility that there exists an infinite amount of

movers, or there are finitely many movers. Aristotle will argue that the former case leads to a contradiction and the latter to the existence of the first mover.

3. The conclusion that there must be a First Mover: The first of the two possibilities in "2" above is impossible. Then from "1" above, it is shown that there must be a First Mover.

Chapter 3: Part 2: Supporting arguments

1. Motion is Eternal: Aristotle demonstrates that motion is eternal, and the conclusions of his various arguments align with this characteristic of motion. He also discusses that motion is eternal because his argument for an immobile and eternal mover will come in part from this point.

2. Time and Motion have a symbiotic relationship: It is important to emphasize the symbiotic relationship between time and motion, because Aristotle infers qualities of one from the known qualities of the other.

3. Time is Eternal: Aristotle's proof that Motion is eternal, allows the recognition that Time is eternal. Again, Aristotle uses these qualities to infer that the First Mover is eternal.

4. The argument that allows there to be something that can be at rest: Aristotle argues that there four possible cases to consider. These cases involve discussing the ability for objects to either be at Rest, in Motion, or neither combination of Rest and Motion. The four cases are:

Case 1 – everything is at rest
Case 2 – everything is in motion
Case 3 – some are in motion and some are at rest
Case 4 – some maybe at rest or in motion sometimes/permanently

From these cases, Aristotle shows that it is possible for there to exist a First Mover that is permanently unmoved.

Chapter 3 – Part 3: The First Mover is immobile and eternal

1. Everything that moves is moved by something: Aristotle argues this more than one time. He reinforces this point with newer arguments each time that are more pointed due to the walk through the previous concepts, and Aristotle uses his conclusion that everything that moves is moved by something as the first step in proving there is an immobile First Mover.

2. There is some object moved by something that moves itself: Aristotle arrives at the conclusion that there is some object moved by another object and that other object moves itself. This is the next step in his argument to get to the immobile First Mover.

3. Argues that it is eternal: Then Chapter 3 of this thesis concludes with the argument that the immobile First Mover is eternal. Chapter 3 details the several points that prepares the reader for this final thrust of argumentation, and it brings everything back full circle to Aristotle's hypothesis that there is an eternal, immobile First Mover.

CHAPTER TWO

The Foundation

Motion

Aristotle's Physics starts with nature, and then examines motion, infinity, time, and place as seen in nature. He defines each of these concepts as they will be the foundation on which he deduces an eternal, immobile first mover beyond the natural world. Motion, infinity, time and place are the mechanisms by which Aristotle builds his constructs by observing the natural world. Aristotle examines these mechanisms and deduces that these concepts, when looked at for what they inherently are, point to what Aristotle calls the first mover. These definitions are in some cases, as Joe Sachs describes them, "constructed at the limits of thought and speech" (*Sachs* 78).

It befits the exercise to begin with motion, since motion is one of the most fundamental characteristics of nature. The other fundamental characteristics are, according to Aristotle: infinity, time and place.

The inquiry into motion begins with the observation that there is, "that which is fully and actively itself" (200b20) as well as, "that which is what it is, in part, only potentially" (200b20). In other words, some things are fully active in and of themselves or complete, while some things are only in existence partly or potentially. To help clarify, consider the difference between the statue The David by Michelangelo and an un-sculpted marble. The David is fully and actively a

sculpture, whereas the un-sculpted marble only has the potential to be a sculpture. Even here, there is a need to be careful, and note that for the marble to officially be potentially a sculpture, a process of sculpting would have to have begun. The definition of motion, the first goal of our current inquiry, rests in the nuanced understanding of the difference between these two quotes.

That which is fully actively itself is, therefore, something that is devoid of potentiality, because all of its potential is fully activated. To use a common Texas cliché, it is what it is. Here is an example of that which is fully, actively itself. A building is fully and actively a building and stays a building. It can have no potentiality according to Aristotle, because in its current state it does not have an inherent disposition to change or it is not undergoing any change.

However, that which has potential [for motion] even in part, has such because it is alterable in some way, and that alteration looms presently. It is currently susceptible to something changing it.

Motion lies in that which has potential. Therefore, potentiality is a key to understanding Aristotle's argument for an eternal, immobile first mover. That which has potential has its potential in a myriad of ways: either by growing or shrinking, or changing color, etc.[1]. These attributes stand in relation to something. For something to change, it must do so "either in thinghood, or in amount, or in quality, or in place" (201a). That thing being acted upon it causes the change that occurs in things. Aristotle calls the change, which occurs in

[1] This is in 200b of the Physics.

things, motion[2]. This is a key construct: The change which occurs in things is defined as motion.

That which is fully and actively itself, and that which has potential (has potentiality or is a potentiality) in some way, are not mutually exclusive in one object, but are still mutually exclusive with respect to one another. The difference may appear subtle to some, and thus demands some elucidation. First of all, Aristotle points out that it is obvious that something cannot be a potentiality and an actuality at the same time and in the same way, for potentiality by its inherent nature assumes that an actuality has not been achieved. This establishes that they are mutually exclusive to each other. Nevertheless, they still may coexist in an object, assuming a characteristic of that object is actual, while a *different* characteristic *undergoes or possesses* the state of potentiality.

The natural question is what are the necessary and sufficient conditions for something to be a potentiality. Aristotle sets the groundwork for establishing these conditions by first considering a case study for the difference between potential and actual in considering bronze and its capacity to be a statue:

> Bronze is potentially a statue, but it is not the "being-at-work-staying-itself" of bronze *as* bronze that is motion; for the being-bronze itself is not the "being-potentially-something-else", since, if they were simply the same and *meant* the same thing, the "being-at-work-staying itself" of the bronze would be motion. But they are not the same.[3]

Being-bronze is not sufficient for the bronze "being-potentially-something-else" (201a30). This implies that potentiality is an amount of time during which something is potentially something else. Aristotle calls this the "being-at-work-

[2] This is 200b30 Physics.
[3] This is in the physics 201a30

staying-itself of a potency" (201b30). Bronze being potentially a statue must have an initiation to the becoming a statue, which simultaneously initiates the potentiality, and the potential nature of the bronze being a statue exists so long as it is still becoming that statue. The potency then is being-at-work-staying-itself, and does not subsist cease until the change has fully occurred or ceases along the way. Aristotle calls this potency (or potential or potentiality), being-at-work-staying-itself, motion.[4] It is as of now an unrefined definition that will gain more clarity as this paper progresses. For instance, in Chapter 2, we will show that motion is also continuous.

It is important to recognize that motion, "seems to be a certain being-at-work, but incomplete" (201b30). This makes sense, seeing that change and potency are simultaneously enacted and since the potency does not subsist until the change is completed or ceases. Motion being the potency, being-at-work-staying-itself, then must assume something being-at-work but having not yet been completed. For clarity, we are now defining motion to *be potency being-at-work-staying-itself of an incomplete change*.

The definition of Motion also reveals the location of the motion, to put it in terse terms: the motion is in the thing being moved. [5] This makes sense, because the potency, being-at-work-staying itself, occurs in the object. The object's change initiates the potency of the object to be something else. The potency of the object is within the object. This does not mean that the potency is an active force, propelling the object to the completed change, only that potency,

[4] This is found on 201b30 of the Physics.
[5] This is found on 202a10 in the Physics.

being-at-work-staying itself, is in the object and thus motion is in the object. The cause of potency will be discussed in the next section.

Causes of Motions

Aristotle established that motion is the potency being-at-work-staying itself of an incomplete change, and that this occurs with change either in thinghood, quantity, quality, or place. Naturally, the next question is what causes change in thinghood, quantity, quality, or place? The change, occurs because things stand in relation to other things, and there are certain things that act upon these other things, or since motion is the potency, being-at-work-staying itself of an incomplete change, and these things cause change, one can say that these things move one another.

These related beings, (related in that they interact with one another), influence each other's motion, for as Aristotle says, "what moves is a mover of something moved, and what is moved is moved by something moving it, and there is no motion apart from things" (200b30). This also means that the mover is also in motion, assuming that it is moveable.[6] Aristotle utilizes a law that resembles Newton's 2nd Law, by asserting that one way to move something is through contact with something that is moveable, and in that contact the mover will, "too [be] acted upon" (202a20).

This also further expands the definition of motion. Motion can only occur in objects that are moveable, a seemingly obvious observation, but once again

[6] This is found on 202a10 in the Physics.

reinforcing the idea that motion occurs because there is the being-at-work-staying itself of potency, which can only occur in moveable things.

The Infinite

The concept of infinity is plausible because it is easy to conceive a higher number than any number previously conceived. All that is needed is to add one to the number first conceived. Consider a set we call set A. Let's say that set A contains some integer n and has the property that, whenever an integer is in the set A, then its successor is also in set A. Then no finite number will suffice to describe the number of elements in A. Because of the obvious nature of infinity, Aristotle concedes that infinity does exist in at least a theoretical sense. As he observes, this helps to avoid false statements like (i) time has an end, and (ii) counting cannot transcend a specific number, and (iii) it is possible to divide a magnitude into non-existence.[7] The question, however, is whether the infinite can exist in the sense that animals or trees or any substantive objects exist, and Aristotle states it cannot. Aristotle believes the infinite (infinity) is something that must exist, butcannot exist in sensible things.

Aristotle often attempts to detail the nuances of how something that exists theoretically would exist in the physical realm. He does this with the infinite. He acknowledges how it exists in the mathematical realm or theoretical realm, and then attempts to explain how it exists in the physical realm. Aristotle analyzes the necessary and sufficient conditions of infinity's existence or inexistence, and

[7] 202b30

concludes that the infinite is not substantive (or otherwise said, "not physical"). It is also not whole. It cannot become actualized ever, but he will try to show how something whole can be made from it.

In Book M of the *Metaphysics*, chapter Aristotle attempts to clarify the nature of abstract things.

> If mathematical objects exist, they must either exist in perceptible objects as some say, or separate from perceptible objects (some say this too), or, if neither, then either they do not exist or they exist in some other way. So our debate will be not whether they exist, but in what way they exist.[8]

The geometer for instance will not study perceptible objects for their perceptible, substantive quality. He will study these perceptible objects for the theoretical qualities that these perceptible objects exhibit. The perceptible objects do have attributes that will be studied by the geometer but it also befits the discussion to see if theoretical concepts have physical existence. The geometer will concern himself with the attributes belonging to perceptible objects, like length and shape which are things that aren't necessarily perceptible in their physical existence.

In this way it seems that the geometer studies things that really do exist. He studies these attributes that are perceptible so long as they exist within a particular object, but are ultimately just attributes. Aristotle here again emphasizes that things can exist in potentiality or in actuality.[9] The geometer would then study potential attributes actualized in perceptible objects.

Thus it would seem that in one sense mathematical objects do exist separate from physical objects in so far as they are conceived as attributes to be

[8] Part 2 in Metaphysics
[9] 204a10

given to perceptible objects, and in another sense they are in perceptible objects. This gives them the quality of being prior to perceptible objects, while at the same time co-existing with perceptible objects.

To conclude, the nature of infinity can be understood through studying the necessary and sufficient causes of its existence in potentiality or actuality. It seems that given its ambiguous nature with respect to potentiality and actuality, it is best described as an attribute that gives part of its nature to perceivable objects. It has also been noted that other mathematical properties or truths can be seen as attributes in a similar way.

So then Aristotle introduces the concept of magnitude and argues that the irreducible nature of any given magnitude qualifies as an example of how an actual infinite may exist through division.[10] A magnitude cannot be reduced to nothing by division. Dividing a magnitude by half at any time will leave two pieces of equal length (halves of the first). This will continue to be true regardless of how many different pieces are divided. For whenever anyone divides a magnitude of any length, one will always get two different magnitudes, and therefore both will have some length that one may divide. One will never be able to divide a magnitude, to where one arrives at just two points. Thus, when one looks at a magnitude, one views it as a length composed of infinitely many smaller magnitudes.

[10] 204b

Aristotle says that an additive infinite cannot exist, even potentially.[11] With a divisible magnitude, the infinity occurs in a sensible object, whereas an additive infinity merely posits the existence of more substantive things, but in a way ineffectual for the purpose of ever actualizing the potentiality. Simply put, an additive infinity principally cannot be potential because it will never operate fully with substantive things. Thus, Aristotle concedes that an additive infinity cannot have potentiality, in the manner that infinity through division is potential.[12] He describes it as actual in the realm of ideas, but with no substance in the physical realm.

Aristotle then shifts his attention to this concept of the infinite, which he qualifies saying "for the unlimited is not what nothing is beyond, but what is always beyond all things" (207a). The point of this qualification is to contrast the unlimited with what is whole, for in the way that Aristotle reasons, the unlimited implies that there is always more to be added, a characteristic fundamentally opposite to what it means to be "whole".[13] A whole implies a something that is not lacking anything and needs nothing added to it. Aristotle says that the unlimited is the material from which the whole is made.[14] The unlimited is adapted in part to comprise something whole. Essentially, if one assumes that there exists an infinite amount of sensible things in theory, then a system will never be made out of all these things. But a system will be made entirely from some of these things.

[11] 205a10
[12] 205a10
[13] 206a
[14] 206a30

Time

The next basic principle is time. Time's existence, according to Aristotle is as confusing as infinity's existence.[15] First of all, time is clearly a composite thing, made up of the past and present (the Now) and future. The problem occurs when you consider that the past, "has happened and is not, while the other part [the future] is going to be but is not yet, and it is out of these things that the infinite, or any given, time is composed" (218a). The Now is a point in time (the present) and the Now cannot exist for the same reason that a point has no magnitude. A point in time can have no duration. Essentially the problem reduces to dividing a magnitude infinitely many times, as has been previously addressed. If time had a duration, then it could be divided, and it would not be a point of time, since a point may not be divided by definition.

Aristotle assumes that without change there cannot be time[16]. Our consciousness at least understands time by change. If there is no change in consciousness it at least appears that no time has passed. It seems then that time and change are related, and since change is connected to motion, time and motion are connected. But it is clear that time cannot be motion, since motion deals with quantity and place[17]. This obviously assumes that time is measuring the system and is not a part of the system. Time would stay constant no matter how much change would occur. Time essentially is constant, which allows one to give a

[15] 217b29
[16] 218b20
[17] 218a10

certain measurement of motion and change in terms of how quickly or how slowly something occurred. Aristotle concludes that since time is not motion, but time is connected to motion, then time must be ***of*** motion[18]. This follows from the first assumption that there cannot be time without change. Motion is the vehicle for time's theoretical existence.

The next observation Aristotle makes about time is that it is continuous[19]. This is argued briefly for now, but will be covered more thoroughly in Chapter 2. Motion occurs in "place", and the change in place is continuous (at least in most settings), so is motion, and therefore likewise is time. Aristotle approaches the concept of before and after in motion, infinity, time and place by similar logic. There is a before and after in "place", and thus there must be something akin to before and after *in* motion[20]. Unfortunately, the definition of motion excludes this idea, for motion is in the object and is not in the path[21]. Time enables us to measure motion in terms of change in a given parameter, "marching it off by means of a before and an after. And when one says time has happened, one takes cognizance of the before and after in a motion" (219a20).

Aristotle describes the present (the Now) as, "a connection of time… for it connects time past to time future. Aristotle also says the Now is a beginning of time for it is the beginning of one part and the end of another" (222a10). Here the Now acts as a part of a line, which both divides the line and also unites the line[22].

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[18] 219a
[19] 219a10
[20] 219a20
[21] Otherwise it would be susceptible to Zeno's Paradoxes.
[22] 219a20

Essentially, both parts of dividing and uniting happen simultaneously and are the same. They are different only when looking at them in a different way, like an optical illusion. It seems, then that in this way time aligns with the concept of motion.

Consider magnitude, motion, and time in terms of before and after. In magnitude there is a before and after, namely the complete magnitude having been measured before a specified point and the magnitude having been measured after a specified point. It is the same thing with motion whether it be in place or in the quantity or an object, like the temperature of that object. Time follows these.[23] Assume that we take the Now as one, or to put it in different words, let it be instantaneous. There can be no before and after in the instantaneous, just as there can be no magnitude with a point. No motion can have occurred within that instant. Only where there is a before and an after can there be motion. Time cannot exist in the instantaneous Now. The Now is only a theoretical attribute of time. [24] The Now is only a derivative part of time, and what is whole cannot fit into what is truly only a part of it. Therefore, Aristotle says, "whenever there is a before and after, then we say there is time, for this is time: a number of motion fitting along the before and after" (219a10). The Now's function is to divide the before and after. One just wouldn't say that in the Now any time has passed, because no motion has occurred in the instant the Now occupies. The Now divides the before and after like a point divides a line of a certain magnitude. It also belongs to both lines, but with a caveat. It belongs to the first line, when the

[23] 220a20
[24] 220a

first line is considered and it belongs to the second line, when the second line is considered. Again, the optical illusion occurs.

Consider further that time is a mapping of motion onto something more quantifiable, where the Now refers to the instantaneous frame of change and the before and after refers to the change that occurred during those times. Aristotle writes, "the number of the change of place is time, and the Now is manifest as the thing carried along, like a unit of number" (220a10). Time is considered a number in the same way that one would consider a number line. Aristotle does not provide any units for time, because the important concept is that the line's magnitude is continuous and is composed of infinite points.[25] In this manner of thinking, any motion, (that which is being-at-work-staying itself of potency of an incomplete change), uses time to measure the change that has occurred, or perhaps how much potency has turned into actuality, with number. It is also the case that time is measured by motion.[26] This follows from the concept that time exists due to motion- it being impossible to have time without motion. An obvious example of this is our measurement of time using the motion of the sun and the moon. It is in this manner of measurement that time is turned into number, albeit of an arbitrary manner, as long as it is consistent.

In this way, it seems that all things in time are surrounded by time, just as by number.[27] Furthermore, Aristotle remarks that, "Since being in time is like being in number, some time may be taken greater than anything which is in time;

[25] 220b
[26] 220b20
[27] 221a10

on account of which all things in time must be surrounded by time, as are any other things in something" (221a10). In other words, (i) things that are in time, (ii) things that are susceptible to time, and (iii) things that experience motion are completely within these things. Time is greater than any one time, such that time encompasses anything in time.[28] Because of this, whatever is in time must be susceptible to motion and whatever is outside time (if there is such a thing) must not be susceptible to motion. The former is clearly of a mutable, changing nature, whereas the latter is of a more stable, constant nature. An example of something constant and not in time is the geometric shape circle. It doesn't change. It is not susceptible to motion. It is not susceptible to time. It makes no sense to say that a circle has been a circle for 3 minutes or longer or shorter. It just is a circle.

Place

Aristotle introduces place with the concept of mutual replacement. An example is that water exists in a region (say in a jar) and then is replaced by air, and so then the water accompanies another region.[29] It is a simple observation, but this observation allows Aristotle to rule out other options for what place could be, what its nature is, and what sort of power it has. With the concept of mutual replacement, he has already ruled out that place is a body. For if place were a body and something occupied place and then another thing occupied the same place, there would still be two bodies in the same place- the body of place and the

[28] 221a20
[29] 208b

body of the object- which is impossible. Thus begins the inquiry into place and its relationship to motion.[30]

The nature of place, is ambiguous, "for it has magnitude, but is not a body… but the elements of sensible things are bodies, and out of intelligible things no magnitude comes about" (209a10). Furthermore, its influence is ambiguous, since it contains none of the four causes identified by Aristotle: material, form, end, and initiation of motion.[31] That is to say, given an object, place does not provide object's material, provide the rational account of its form (logos), determine its purpose, or initiate its motion. Thus far, the nature of place has eluded understanding, but one can conclude that it at least is not a body, and it cannot move objects.

Consider place as form. This consideration derives from viewing place as having limit or extension of magnitude.[32] In some sense, this view of place seems compatible with our understanding of material, for the material determines the limit of magnitude and the extension of magnitude of the place.[33] Unfortunately, this view also bleeds back into the problems that ensue when place is regarded as a body, which it cannot be. The form and physical, like the body, can move to a different place, thus demonstrating that form and physical are not place.

But one can look at place a little differently, not as something with form or material but as "that which surrounds that for which it is the place, and in no way belongs to the thing" (210b20). The distinctions between this way of thinking of

[30] 208b20
[31] 209a
[32] 209a10
[33] 209a10

place and thinking of place as form and physical solve some of the problems of place. For instance, if place is that which surrounds a body within a given space, then it is not place, which has body. It is the material (physical) and form, which is in that place. Furthermore, place is divided from the object that is in the place.[34] It is divided because it can be separated and the two can move differently. For instance, the water in a jar may move within the jar or even out of the jar while the jar itself remains motionless. By contrast, if something is a part of another thing, like the pupil in the eye, then when the pupil moves the eye will also, or vice versa.[35] This is not the case with place. If the object moves, then it occupies a different place. Place then is constant and divided from objects that might occupy it.

Place is like a boundary of a surrounding place.[36] It is the furthest boundary conceivable. It borders and encompasses all the bodies within it. So place can be thought of as two boundaries. The first boundary is that which surrounds everything. The second boundary is that which borders the surrounded one.[37] It is motionless and it has no body, but it allows motion within it.[38] It allows movable bodies to move. It also does not hold intelligible objects, like the idea of the triangle. Thus, it deals exclusively with moveable physical objects.

This, then concludes the discussion of place. Place is defined as a stable surrounding boundary encompassing and surrounding all bodies within it. It

[34] 211a30
[35] 211a30
[36] 211b10
[37] 211b10
[38] 212b20

enables motion, and it belongs only to tangible things, for how can the idea of a triangle have any place?

CHAPTER THREE

Continuity with respect to Motion, Time, and Magnitude

This chapter examines the difference between contraries and contradictories, and it examines Continuity and how Continuity relates to Infinity, and lastly examines the beginning and end of Motion. Contrary assumes that there exists a medium between two points, whereas Contradictory, in this sense, assumes a binary dynamic. It is either A or it is not A.

Contraries and Contradictories, Motion and Coming-into-Being

Aristotle argues that Motion is only between two contrary things as opposed to two contradictory things. First, for there to be Motion, one of these cases must exist:

1. A subject must become another subject but be different in some degree, or
2. one subject must become not a subject (cease to exist) or
3. a non-subject must become a subject.[1]

If none of the above three cases exist, a subject stays the same in Time and no Motion exists. Since non-being and being are opposites, the action from non-being to being at least seems to be an action only if between two contradictory things. For instance, it would be odd to ascribe non-being and being to one subject. How can something exist and not-exist at the same Time? For by Aristotle's law of non-contradiction, it is impossible for the same thing both to belong and not to belong at the same time to the same thing and in the same

[1] 225a

respect. So it is safe to conclude, "change from what is not a subject to a subject, by virtue of contradiction, is coming into being" (225a10). Similarly, destruction is change from what is a subject to what is not a subject.[2] The litmus test for whether two things are contradictory is whether anything can exist in between the two states. If nothing can, and the two are indeed opposites, then they are contradictory states. The change of state from being to not being and its converse prohibits such middle ground.

The question then that naturally follows is whether coming into being may be described as Motion and whether or not destruction may be described as Motion.

So first consider the notion of an object having no existence, i.e. a 'what-is not'.[3] There can be no potentiality with what-is-not.[4] There is no way a what-is-not could be moved, because it doesn't exist. To say that it could move would be to admit that non-existent things can move. So, then, coming-into-being cannot be a Motion, for as Aristotle points out, "it is impossible for coming into being to be a Motion, for what passes into being is what is not."[5] So that which-is-not cannot be acted upon, because it does not exist. So when it is not that it was moved, it just became in a single instant. And to further illustrate that what is not admits of no Motion, it is clear that what-is-not cannot be at rest or be moved in some place or in some kind or in some manner.[6] Since motion is a potency,

[2] 225a 10.
[3] Vocabulary comes from Aristotle. 225a 20.
[4] 225a20.
[5] 225a20.
[6] 225a 30.

being-at-work-staying-itself, and this type of motion never allows any process of change, it is safe to conclude that coming into being is not a Motion.

Moreover, if coming into being is not a Motion, then how could its converse, destruction, be a Motion?[7] At least in destruction there is an object that admits of being moved in some capacity. However, as Aristotle defines Motion, "the opposite of a Motion is either a Motion or rest".[8] We have just described its opposite, coming-into-being, and have concluded that coming-into-being is not Motion or rest, and so this precludes destruction from being a Motion. What this leaves us with then is that Motion is from one subject to another subject and that Motion happens between contraries, in which there is a middle that exists and, as it will be discovered later, is Continuous. This Motion is not between two contradictory things but between two contrary things. This aligns with our definition of Motion from Chapter 1, where we said that Motion assumes an object is undergoing a process towards another state. It is becoming something. If Motion happens between two contradictory states, then there is not process, there is only an instantaneous occurrence. Thus, we have established that Motion must be between two contrary things.

Continuity and the Continuity of Motion

The second goal of this chapter is to define Continuity and to show that Motion must have Continuity and that the Motion and Continuity must be one. To more clearly illustrate what Continuity entails and why Motion must be

[7] 225a30.
[8] 225a30.

Continuous, it benefits the inquiry to define what is coincident, separate, touching, between, next in series, and next to. These definitions will be taken verbatim from Aristotle.[9]

Coincident – whatever things are in one primary place.

Separate – whatever things are in different places.

Touching – those things of which the extremities are coincident.

Between – that of which a changing thing naturally arrives before it changes to what is by nature last, when it changes continuously.

Next in Series – that which, being after the form, has nothing of the same kind between it and that to which it is next in series.

Next to – that which is next in series and is touching it. If two things are next to one another, then they are intuitively next in series.

Now that these have been established, they will be used to define Continuity. Naturally two things that are continuous with one another must be next to one another. When two things are next to one another, Aristotle then will say that they are Continuous, or have Continuity, "only when the limits at which they are touching become one and the same, and as the name [συνχεσ] implies, hold together [συνεξηειν]".[10] Aristotle does not explicitly define what it means for one thing to be continuous. His discussion rather implicitly assumes that one thing is continuous whenever two of its parts are next in series, then they are continuous with one another.

[9] 226b.
[10] 227a 10.

For example, consider the set of integers on a number line. The points 2 and 3 are next in series in the set of integers, but they are not next to each other because they do not touch. Indeed they are separated from one another by numbers like 2.5 that are between 2 and 3. Similarly, the set consisting of the interval from 0 to 1 together with the interval from 1.01 to 2 would not be Continuous from 0 to 2, because the two intervals do not touch. These two intervals do not form a continuous interval, because they are next in series to one another in the set that is their union, but they are not next to each other because they do not touch. The number line itself is continuous, but would not be if, for example, it were missing all of the numbers between 1 and 2. In that case, the interval from 0 to 1 would be next in series to the interval from 2 to 3, but they would not be continuous with one another.

In some sense, if one accepts that something is Continuous then one admits there being one thing and that it is not somehow composed of things that are disjointed.[11] The extremities of continuous parts are then Coincident and Touching, though these alone do not suffice for Continuity to exist. Aristotle points out that touching does not necessitate Continuity.[12] The water in a jar, for example, touches the jar, but is not continuous with the jar because the boundaries of the water and the jar are not one. The former boundary is made of water, but the latter is not. Thus Touch is a necessary condition for continuity, but is not by itself able to cause Continuity. For parts to be continuous, there extremities must

[11] 227a10.
[12] 227a20.

be one. Loosely speaking, Continuity occurs the whole is not composed of disjointed sets.

Now that there is a working definition Continuity, the goal is to show how Motion is Continuous and one. A Motion is one if and only if the motion is continuous. By motion being one he assumes there are not any breaks in between the motion, no points of rest. As our definition of motion indicates, there exists only motion when the potentiality that occurs because of the gradual process towards another state is being-at-work-staying-itself. If there is rest at state B in between the process from state A to state C, then there are two motions; one from state A to state B, and another from state B to state C. So if the motion is one, then the motion must be continuous.[13] For if it is not continuous then it has stopped at some point and it would cease to be Motion. Instead there would be rest at that one point and there would not be one motion. If motion is continuous, then there cannot be any places that the Motion could cease or stop, for then there would be a discontinuity with relation to time. At one time it is moving, and at another time it is not. And then at another time it is moving again. So if a motion is continuous, then the motion continues being a potentiality being-at-work-staying-itself from point A to point B. So then motion is one. So a Motion is one if and only if it is continuous. A single Motion is Continuous and of one kind.[14]

[13] 228a20.
[14] 228b.

Infinity and Zeno's Paradox

Now that it has been established that Motion is Continuous, there is an answer to the objection that if Motion can be broken into infinitely many parts, then no Motion can ever be completed. How could anything move anywhere? The objection assumes that for something to move from one point to another point, that subject would have to traverse infinitely many parts in between where it started and the intended destination. In fact it would have to cross infinitely many parts to get to the half way point, infinitely many parts to get to the quarter point, and so on. So essentially what Zeno argues is that an object would have to traverse infinitely many parts to move at all.

But considering Motion as being continuous solves this objection. For Zeno is right, and points could not coincide with another point, for that would essentially be the same point. He says that the extremities of separate points then cannot be one.[15] But a continuous interval or a continuous Motion is not made up of indivisible parts or "nows".[16] So, the same distance maybe broken into Continuous units. They are Continuous because their extremities coincide (are Coincident) and are one. As Aristotle says, "it is impossible for anything Continuous to be made of indivisible things; for example a line cannot be made of points, if the line is Continuous and the point indivisible" (231a20). Essentially, new intervals can always be made in any Continuous interval, and since those intervals must be Continuous, intervals can be made in this one and one would never arrive at any singular points touching one another. Within these units there

[15] 231a20.

[16] Or a Continuous Magnitude or Continuous Time

an infinite number of other units, but crossing these distances does not provide any trouble, because those units are very small it takes almost no Time at all to cross them.

The Continuity of Magnitude and Time

One then needs to consider the argument that Aristotle presents for why Magnitude and Time follow the same pattern, so that they too are not divisible into indivisible things.

The Argument for Magnitude

We will assume Magnitude is composed of indivisibles points, and then show that given this, a contradiction arises. In such a way, we will arrive at the conclusion that Magnitude is continuous. So assume Magnitude is composed of indivisible points. Then Motion, through it would be made of indivisible Motions, because there would be a Motion in each indivisible part. So in each individual, indivisible part in Magnitude there would be a Motion corresponding to it, which essentially means that a Motion would be present during the Time it was in that part, and that would be the Motion for that part.

The part is indivisible. Indivisibility is defined where no object can arrive at that part and still be moving in that part. Moreover, how does it pass through that part, when it simultaneously arrives and moves through that part? The movement through the Magnitude moves through each individual part "without being moved through it all", so "the Motion would not be made up of

Motions, but of jumping movements".[17] And since when an object is at A an indivisible part, it does not alter its state at all, it is in rest at A, so it would be at rest when it travels through the Magnitude and it would be in Motion, which is a contradiction. So our assumption must be wrong and Magnitude is not made up of indivisible parts.[18]

This aligns with our conception of a number line as well. For a line cannot be made up merely of indivisible parts either. That is not to say that the indivisible parts are not there, but that the intelligibility of the whole depends upon more than those indivisible parts. It also depends upon the manner in which they fit together. With two intervals that share an extremity, one can discern the manner in which they fit together precisely because they have a common extremity. If two numbers are chosen as indivisible points of a number line, there will always be a number in between them, preventing either of them from possessing any information about its relation to the other.

Thus it has been rigorously argued that Magnitude is continuous and it may not be made up of indivisible parts.

The Argument for Why Time Must be Continuous

It is now important to argue that Time is continuous as well. Consider this: Let there be two objects, object A and object B. And let them be travelling a given magnitude 1-10. Let A be farther than B. Since A is farther than B, then A must be moving faster than B. B will reach 10 in let's say 10 seconds. A goes

[17] 232a.
[18] This is an argument from contradiction.

through 10 in let's say 5 seconds. What Aristotle constructs with this argument is something akin to the equation: Distance equals the rate at which an object travels multiplied by the Time at which it travels. So the rate of B in this hypothetical scenario will be 1 and the ratio of A will be two.

So in 5 seconds, the Time it took for A to travel to 10, B will travel to 5. It will then take A 2.5 seconds to travel to 5. Aristotle points out that the path that B travels at the same Time that A travels will always divide the Magnitude and conversely A travelling the same distance will always divide the Time it takes to reach that distance.[19]

It is clear then that A and B will always divide Time and distance and there will be no indivisible parts of either, because one can never divide anything with length or magnitude to something indivisible. So "every Time is Continuous, because Time and Magnitude will be divided into the same and equal divisions".[20]

And consider when an object traverses a finite Magnitude, that Magnitude may be divided into many different intervals. The intervals maybe as plentiful as one wants. It only takes a finite amount of Time to cross each interval. The number of intervals will always be a finite. It will always be a finite number even though one may divide these intervals infinitely many Times. After every Time that one divides them, there will still be a finite number of intervals. So it takes a finite amount of Time to cross each interval and there are a finite

[19] 233a.
[20] 233a10.

number of intervals and a finite number multiplied by a finite number will always equal a finite number.

The Now

So Aristotle rigorously argues that Magnitude, Time and Motion are all Continuous. That Motion, Magnitude, and Time are all Continuous does not preclude the now to be indivisible or from existing. All it precludes is that indivisible parts comprise the whole, or that the whole is made up exclusively of indivisible parts. Said another way indivisible parts cannot comprise the whole, and the whole is not made up of indivisible parts. The now, then must exist in the same way that an individual number or a point exists on a number line. Consider the number 9. That individual point cannot be divided. Instead 9 separates two sets. 9 separates the set of numbers that precede 9 and the set of numbers that succeed 9. As shown, 9 is the upper limit of the one set and the lower limit of the second set. As the common extremity of the two sets, it binds them together into the whole.

In the same way, Aristotle writes that "the now" is one of the extremities of both sets of Times as he calls them (the Times being the past and future).[21] As Aristotle points out the limits of both Times, the Time that preceded the now, and the Time that succeeded the now must be coincident for if they are different "one could not be Next in Series to the other, since what is made of things without parts is not Continuous, while if they are separate, then a Time would be in

[21] 234a.

between", because as has been said before, Time is Continuous.[22] So the now exists and it is indivisible. It should be noted that time is not made up of just nows, though. It is also true that nothing can be moved through the now because it is indivisible, and it cannot be in rest either, because an object does not admit of being moved in the now. This is because there is no way that any change may happen in the now.

The next issue to discuss concerns the Time in which something moves and Aristotle has split this into two different discussions. One will focus on contradictory Motions or actions like "coming-into being" and "destruction", and the other will focus on the Motion between contraries.

Consider a transition between contradictories. The curious thing about change between contradictory things is that once something has started change, it has ceased. In other words, "what has changed will be in the condition to which it has changed".[23] There is nothing in between contradictories, as has been stated and argued before, and so when it changes it arrives. By the nature of being a Contradictory, there is no process in which it changes; it just changes and is changed simultaneously.[24] That movement then is indivisible since it is simultaneous, and so the change to the contradictory is indivisible.

The same thing applies when change from a contrary has arrived at the opposite contrary. At the moment it arrives it has stopped changing. There is no change happening at the moment that change has been completed. There must

[22] 234a.
[23] 235b10.
[24] 235b20.

be a first instant of this completion in the same way that 0 is the smallest upper limit for all elements in R (real numbers) that are less than 0.

For consider a Magnitude from A to C of any units, and let B stand in between A and C. Aristotle states there are two scenarios to consider, when looking at how change and rest operate.

Scenario 1: If, then, something has changed in AB or else in BC, it would not have changed first in AC.

Scenario 2: If something changed in each of them, it would be changing the whole Time. But it was something that was assumed to have had changed.

So what Aristotle does is assume that the moment of change is divisible, and he subscribes that Time to be AC, which has parts. Because it has parts, he may divide AC into AB and into BC. Once he has done this there are two options that could happen. It could change in one part, but not the other, or it could change in each part.

The first scenario does not work because one has then shortened the Time in which it has changed, and so it has not changed throughout the whole. But if it has not changed in both parts, then the process of change would appear and be evident, which contradicts the first statement that AC is the time-interval of change. And AB may be broken into parts and the problem will persist. So, the opposite is true which is the Time in which something has changed, is completed and its change is instantaneous.

That change is completed instantaneously aligns with the modern conception of Motion. In Calculus I, students learn to find inflection points,

which indicate an indivisible point of Time in which change is at least momentarily completed. For instance, if someone throws a ball into the air, there is an instantaneous, indivisible point of Time that it ceases moving upwards.

It does not seem that one may claim that this is true of initiating Motion, however. The instantaneous point at which Motion begins appears not to exist. If there is an instantaneous point at which Motion begins, then this would be an instantaneous and indivisible point. At this point, Motion is present. Also the Time before must be at rest, so it must be the end of rest, i.e. the last point at which it is at rest. These two points cannot be the same, because one is at rest and one is in Motion, but they also must be next to each other, otherwise they are not the instances in which rest ends and Motion begins. But as Aristotle points out, it is impossible for two points to be right next to each other.[25]

In fact consider another argument that contends, "Everything moving has been moved earlier".[26] For consider a span of Time XR, and in that Time an object has moved from K to L. Then, as the arguments we have stated before contend, the object will move through half the Magnitude in half the Time.[27] Every interval of the Time in which it is moving may be divided in half an unlimited number of Times.[28] This applies to any interval between the end of rest and any point of Time in which the object moves.[29] This corresponds to our conception of Continuity, and the consequence is that, "since [an object] has

[25] 236a10
[26] 236b30.
[27] 237a.
[28] 237a.
[29] 237a.

changed in Time, and every Time is divisible, one [that] object would be changing beforehand".[30]

The Continuity of Magnitude has this same consequence. A single point may end a line of some Magnitude, but there is no single point, which stands to initiate it. Thus it has now been shown that there cannot be any first.[31]

[30] 237a20.
[31] 237b20.

CHAPTER FOUR

The First Mover

Now that the foundation, definitions, structure, and tools are established, the main argument can be addressed.

Deducing the First Mover

First, the conclusion that we want is that every moving thing must be moved by something. It is sufficient to show that an object does not have the source of motion in itself.[1] Therefore, if anything moving does not have the source of motion in itself, then necessarily something else must have moved it or set it in motion. This must hold for every motion an object undergoes.

To start proving the above, Aristotle structures a sub-argument by assuming the opposite of the position, and then proving or disproving that opposite. Therefore, the opposite of the above position is that an object does have a source of motion in itself. He makes his argument using the tool of contradiction and he makes his argument with cases.

When Aristotle discusses things that move themselves, it is not explicitly clear what he is referring to, but it is obvious that there are things that clearly do not move themselves. For instance, a table does not move itself. Aquinas believes that Aristotle refers to things with souls, but the argument works if one

[1] 241b34

supposes only that there are things that move themselves without specifically mentioning what these are.[2]

Consider the position that an object that is moved by itself. Aristotle calls this object AB, so as to clearly indicate that the argument will consider different divisions within the object.[3] As has been established in the prior chapters, since the object is moving, it must be divisible, because a single point cannot travel any distance continuously. The object then moves itself and may be thought of as comprised of different parts, in this case two parts. Then Aristotle says, "To suppose AB is moved by itself, since the whole is moved and by nothing outside it, would be as if, when KL was moving LM and was itself moving, one were to say that KM was not moved by anything" (241b40). What Aristotle is arguing is that since AB is moved by itself, and it is divisible into parts, then one part must be moving the other part and the whole may be considered as moving itself. The whole object may be considered to be moving itself, even though one parts moves another part within it, because as a whole it is one, and it is moving of its own accord due to a source of motion within it (as "moving itself" was defined previously). So the one part would have the source of motion, and the other part would not.

The next step might be considered a little more subtle. If something moves itself and is not moved by anything, then it would not be affected by something at rest.[4] For if something at rest did cause that which is not moved by

[2] See Aquinas Commentary for Chapter 7.
[3] 242b40
[4] 242a35

anything to rest, then that which is not moved by anything is moved by something, which is a contradiction of terms.[5] So in the same way that an object has two parts one of which has a source of motion within itself, and the other does not, then if the other, the one without a source of motion in it, rests, then necessarily the one with the source of motion in it rests.

Furthermore, as it rests because of another object, that object moves the object with the source of motion in it. So everything that moves, then, is moved by something.[6]

Thus, either something obviously is moved by something or at the very least it appears to move itself, but in either scenario, it is still moved by something. So everything that moves is moved by something. And something, say A, that moves something else, say B, is moved by something either by itself or by another thing, and in either case that something is moved as well.

Thus, there appear two options: either there is a first mover, or the preceding objects that cause motion are infinite. The two options are mutually exclusive. For if there exists a boundary for example, then the preceding causation would not be infinite. It would not be infinite, because each causation may be counted and there is an ending, the boundary, to that causation. And likewise if the preceding causations were infinite, no first mover would exist, because no boundary would exist. Thus, it suffices to prove only that the first

[5] 242a35

[6] This is stated in Aquinas at 886, and it is also mentioned in Aristotle.

mover exists or that a preceding causation cannot be infinite. Aristotle emphasizes that a preceding causation being infinite has not yet been shown.[7]

The motion in consideration is locomotion or motion of place, since this motion most clearly demonstrates that objects are moving other objects.[8]

So if A is moved by B then there is something moving B at that same time. For instance, consider a set of gears, in which gear A is moved by B, then B must be moved by C or move itself. But we said that everything that moves must be moved by something. Every gear then is moved by another gear. In the analogy, the set of gears is the Universe. The Universe of gears can be infinite or circular. If it is circular, though, then A would depend on B and B would depend on C et cetera until our last moving object, let's name it Z, would depend on A. But then, A would not move unless it moves itself, and then there is a first mover. So if the Universe is circular, either there is a first mover or there exists an infinite progression of motion.

So then, the argument is that there is a finite time that an object A moves. But there are infinite many things being moved and thus infinite motions occur simultaneous to the time that A moves. So there is an infinite motion being moved in a finite time, because we have already said that the motion of A and every other object is simultaneous. And this is impossible.[9]

[7] 242b50.
[8] 241b50.
[9] The argument begins 242a50.

Motion is Eternal

Aristotle has argued there must be a first mover, but nothing has been said about how this first mover fits in with everything else established. If one posits a first mover, then it is necessary that one makes sure one is not positing something impossible. Nothing has been said about the nature of this first mover, or what qualities this first mover must possess. Book VII and the rest of this chapter, then, details what qualities the first mover must possess and what its nature must be, in order to fit in with what we have shown before

Therefore, the first question to tackle is whether motion and time have always been or whether they were at one time generated. Clearly it must be one of these.

Since motion is defined as a being-at-work of the movable, as movable, then for each type of motion, there must be something that can accomplish that motion.[10] Consider two cases

First case: each of these motions came into being. Then one can surmise that there was motion that brought these movable things into motion.[11] The source of this motion is uncertain.

Second case: objects of motion were always present even when there was no motion. But this is inherently flawed for when the system begins with no motion and then assumes that there is first motion, then there must be a preceding motion to that motion. And there would always be a preceding change.[12]

[10] 251a10.
[11] 251a20
[12] 251a20

Essentially Aristotle identifies the two obvious options. Either objects came into being or they have always been. In the first case, there must be motion to bring these into being. In the second assuming that there is some first motion implies that there is motion before this to cause the first motion. The second is perhaps more problematic, only because the first mover would be implicit in the system in which nothing moves. This is not insurmountable, but it is a further difficulty in the second option. Either case assumes that motion is eternal until an immobile mover is posited.

Now consider what was argued in Chapter 2. Time and motion have a symbiotic relationship in that the existence of one necessitates the existence of the other. Consider the case that there is no motion. Then if someone were to say, "Well let's measure the amount of time in which there is no motion", then there would still be motion. If there is any measurement of time, there is still motion. So what if one suppresses even the motion associated with the measurement of time. Then nothing can consciously mark time passing, and time freezes. For time must be relative to something. That is why when there is motion, there is time, and when there is time there must be motion.

In Chapter 2 then, it was noted that time cannot exist without the now, but the now always separates the before and the after. And so, if all time and therefore every now has a before and an after, then time must be eternal.[13] And every now does have a before and an after, as was said in Chapter 2, so then time must be eternal, until we get to an immobile first mover. This again shows that

[13] 251b20

motion must be eternal. Otherwise, a finite thing would move in relation to an infinite time. And if something moves only finitely in an infinite time, then it must rest in an infinite time. But then when would there be motion, since there would be an infinite time of rest? So, motion too must be infinite.[14] Thus from what has been said, there is not time without motion and no motion without time.

The First Mover is Immobile

Aristotle now intends to argue that the first mover is the first mover is immovable. The argument considers four possible cases concerning the motion and rest of all objects, and after dismissing three of them for logical inconsistencies, Aristotle chooses the best of the remaining two options. Aquinas points out that from this option Aristotle deduces that the first mover is eternal and immobile, by showing that an immobile mover is even possible.[15]

The four cases are:

Case 1: Everything is in rest
Case 2: Everything is in motion
Case 3: All things are either always in motion or always at rest.
Case 4: Somethings are at rest and some are in motion and some fluctuate between the two.

Consider the first case- that everything is in rest. Aristotle refutes this argument simply by saying it is a moronic statement.[16] Nothing about the natural world would suggest it, and even uttering any argument for such a view is inherently self-contradicting, since motion would be involved. One would also essentially

[14] 252a10.
[15] 1005 6th paragraph
[16] 253b.

have to give up knowledge of everything one knows to believe such a view. So for these reasons, Aristotle disposes of this view.

Consider the second case- that everything is in motion at all times. Aristotle levies several arguments against this theory. First, he says that the motion of increase and decrease do not continue infinitely, but at some point stop and stay either as they are or reverse their motion.[17] He levies another argument against this view, that if someone is sick, then there is a time in which that someone gets well.[18] The intuition comes from the arguments derived in Chapter 3. The alterations are between contraries, and so if at some point that change must stop. The other contrary acts as a terminus, so either the alteration stops at that terminus or it gets arbitrarily close to that terminus, which for all intents and purposes is stopping at that terminus. Lastly, he says that, "the earth and everything else stay in their proper places" (253b30), which would indicate that with respect to place, some things are at rest. But even if we admit that the earth is not at rest, one can still say that a desk is at rest relative to certain other things and for this reason rest exists. This aligns with natural observation as well.

Consider the third case- that all things are either always in motion or always at rest. The arguments against the first and second cases argue against this case as well, since when we argued against the first and second case, we did not show that there was at least one thing always in motion to show that not all things are in rest, and we did not show that there was at least one thing always at rest to show that not all things are in motion, but we showed that some things are at one

[17] 253b10
[18] 253b20

time at rest and at another time in motion. Therefore, it is safe to conclude that, some things are moved and are at rest at different times, which falls under Case 4. Nothing has yet been said about the other things in the Universe. However, we can conclude that Case 4 is the best option, and this is important for showing that there can be an immobile mover.

So what we have argued so far is that some things move and rest at different times, but it is important to consider now whether there are any things that remain in motion or remain at rest.

So in considering the question concerning an immobile mover the next step that Aristotle takes is to revisit the argument that everything that moves is moved by something.[19] He argues this particularly and thoroughly, so as to show even more explicitly that everything that moves is moved by something. So then the next part of the chapter will examine these arguments briefly and will arrive at the conclusion that everything that moves is moved by something, and from here he will show that there must be an immobile mover.

When considering all objects that move, Aristotle makes two primary divisions first: he says that all moving objects are moved incidentally (per accidens) or in their own right (per se).[20] The way to distinguish these two categories is to ask whether that which is being moved is a part of mechanism moving the whole object, or if it is the whole object. If A is a part different from that which moves the object and not the whole object itself, then A is moved per accidens. For instace, a stern of a ship is moved per accidens because the ship is

[19] 249b
[20] 254b

moving and the stern is moving because it is a part of the ship. When an object is moved per se, that object that is moved is something whole, like a boulder or a ship or an animal. Each of these is moved as an entity and not as a part of something else that is being moved.

That which is moved per accidens is clearly moved by something as it has no source of motion within itself. Aristotle then breaks those that are moved into things that are moved naturally and those which are moved against nature.[21] Aquinas gives an elegant and concise definition of something naturally moved, saying things are moved naturally when they move according to some, "intrinsic principle" (1023). Again these things that move contrary to nature are moved by something else, so the things one must consider are these objects that move per se and their own nature. These are further divided into objects that are moved per se according to nature with souls and objects that are moved per se that are soulless. As has been argued previously, those things that move themselves are moved by something else. So the last thing to consider are those things that are moved per se naturally without souls.

To this, one argument is sufficient. These things only have one part, the soulless part, and in that sense, their being is one continuum. A continuum does not have a part, which moves itself, and a part, which is moved, as the object with a soul does, and so there is nothing in the soulless thing to move itself.[22]

[21] 254b20.
[22] 255a10.

Now that Aristotle has established that everything that moves is moved by something, he will now show that there exist logical inconsistencies unless one posits an immobile mover.

Consider the first argument for why there exists an immobile first mover or a mover that moves itself. Since we have shown that everything moved is moved by something, then some object, let it be D, is moved by another object, let it be C, and C is moved by B and B by A. If we assume that this does not proceed to infinite, which is impossible as shown before, then A either is an immobile mover or A moves itself.[23]

Consider a similar argument proceeding from the opposite direction. Assume that an object B moves an object C. Then object B either moves object C directly or through another object, object A. Suppose that B moves one of these object C on its own accord, then by definition B causes motion with itself. But if B moves not on account of its own motion, but because of object A, then object A must move on its own accord. And the sequence cannot continue to infinity. So, there exists some object that "is moved by something that moves itself, or comes at some point to such a thing" (256a30).

Now, from what has been said before, all things move incidentally (or *per accidens*) or all things move necessarily (or *per se*) or somethings move incidentally and some move necessarily. All things cannot move incidentally, because then it would be possible that all things would not move at some point.[24] This is impossible, as was previously shown, and since this impossibility is

[23] 254a20.
[24] 256b10.

possible given that all things move incidentally, we must rule out that things move incidentally. For the nothing precludes the impossibility from occurring given such an assumption. If only circumstance precludes the impossible from happening, unless there exists a mover that need not move.[25]

Consider another argument from the same premise.[26] There are potentially three distinct objects that take part in motion, the thing moved, the mover, and what Aquinas calls the "instrument by which the mover causes motion" (1044). The thing moved is by definition being moved, as is the instrument, so we may discard these two cases because what we are searching for is something that moves and is either immobile or mobile. The instrument is obviously being moved, since this is how it is able to move the thing being moved. But the mover is also moved, for this is how it moves the instrument, since the instrument is moved *per accidens*. The mover does not have any source of motion within itself. But then it begs the question what moves this mover. It is important to note that Aristotle must assume here that the mover must be the last thing in the order of sequence of objects that move other objects. That is why he does not label it an instrument. So, then what moves this mover? Aristotle says it is reasonable to assume a third mover that is immobile.[27] He does this because the current system currently lacks an essential mechanism to make all the parts move. Thus given a *per accidens* perspective, Aristotle concludes a third mover that is immobile.

[25] Aquinas 1044.
[26] This argument is found on 256b10.
[27] 256b20.

Then he evaluates the hypothesis that a thing is moved via itself or *per se*, and he considers two cases: the first hypothesizes that the "mover is moved according to the same species of motion as that which it causes" and secondly he hypothesizes that the "the mover moves according to one species of motion, and is moved according to another" (1046).[28]

These arguments, in my opinion, are not these cleanest or most compelling arguments, and for that reason they can be troublesome. Nevertheless, they are a part of Aristotle's overall argument, and thus deserve attention in order to give the best picture of his argument. The merits of doing so will be that one may look at his arguments and see which the weaker arguments are and which the stronger arguments are. Then one may decide if which of these should be topic of further debate.

So then, the way that Aristotle dismisses the first is he points out that this is ostensibly false in certain cases.[29] If a mover is moved according to the same species of motion as that which it causes, then something that pushes is pushed, and something that pulls is pulled, something that burns is burned, something that teaches is taught etc. And when these must be simultaneous. So something that pushes is pushed at the same time. But this is clearly false for some cases. Something that teaches cannot simultaneously be taught that material. Then he directs his attention to the second that the mover moves according to one species of motion, and is moved according to another. The genus of species is not infinite

[28] 266b30. He does not make clear how these objects move *per se*.
[29] 257a

as was discussed earlier[30]. So, one mover, let it be object C, moves another, let it be object D, according to one species of motion, and then A in turn is moved by another object, say B, according to a different species of motion, and that object B is moved by another object A. This would continue on till infinity, which is impossible.

Aquinas considers an objection to this latter argument.[31] What if the object moved by the last species of motion moves the first object in that sequence by a previously used species of motion? His objection to this is that essentially there can be no possibility of any recontres or any fixed points. And this would happen, he says. The problem is of the pigeon-hole principle nature. If there are n pigeon-holes and at least n+1 pigeons, then there is at least two pigeons in one pigeon hole. And if this appropriation is appropriate,[32] then there exists a time at which the system reverts back to the first thing hypothesized, that objects are moved by the same species by which they move other objects, which was shown to be false in certain cases. Or consider it this way. Suppose some object is being built, then eventually by some appropriation of the pigeon-hole principle[33], something else along the sequence will build something. So, Aristotle suggests that this thing cannot build something if it is dependent upon something being built.[34]

[30] In Chapter 5
[31] 1047
[32] I do not think that it is.
[33] For this to work, I think that the motion would have to be generic.
[34] 257a20

So, then Aristotle posits that all things are moved *per accidens* which he argues leads to an impossibility. He then considers things that are moved *per se* both the objects that move another object by the same species of motion by which it is moved, and the objects that move another object by a different species of motion. It was not made clear to me how this pertains to our definition of *per se*, but in any case he dismisses each conjunction. The problem with each theory is that there is no consideration to an object that moves itself (which I thought was motion *per se*), or an immobile mover. So the next step is to consider an immobile mover.

Next, Aristotle examines motion again, and then concludes that there exists an immobile first mover. For the first mover must be immobile. From the arguments in Chapter 2, we know that if something is moving, then it is infinitely divisible. For all things in motion are continuous. This applies to things that are moved *per se* as well. Again, from the arguments made prior (in Chapter 2), we know that a thing moved as a whole *per se* is comprised of parts. This is because a whole cannot move itself. For remember what was said previously in Chapter 1, that motion is, "something that is moved potentially, not actively-completely, and what is the case potentially goes over into being-active-and-complete, and motion is an incomplete being-active-and-complete of the movable thing" (257b). So then, if something is whole and moves itself, it is both complete and not complete in the same sense.[35] For instance consider the example that Aristotle uses at 257b10. Something cannot both be hot and not hot in the same sense, but this is

[35] 257b10.

what it would mean if a thing that is whole to move itself. If the whole thing were to heat up itself, then it would have to do it because it was hot. But if the whole thing were to heat up itself, then it would mean that it lacked heat. So, then it would be hot and not hot and this is impossible. Thus as has been argued before and now, if an object moves itself, then one part of it initiates the motion and the other part is acted upon and moved.

Furthermore, it is not possible that part A move part B, and for part B to move part A. Rather one part, say part A, will move B and will move AB, i.e. the whole object made of parts A and B.[36] As Aquinas points out, we have already argued that it is possible for a mover to not be moved, and we have argued that motion ceases as some point.[37] So then, if we consider the first mover, then, "it is not necessary that the thing causing motion be moved except by itself, and therefore it is incidental that the other part should cause motion in return" (257b20). In other words, since this object is the first mover, then it moves itself and so it is not moved incidentally (*per accidens*). So then one part of that object is moved *per accidens*. But the other part cannot be moved *per accidens*, because then, as has been argued before, it would be possible that there would be no motion. So one part moves and one part is moved. And the whole does not move itself, as has been argued, so the part that moves is motionless. For what can move it?

This is a very important step, since as Aquinas points out, Aristotle uses this to show that the part which moves is motionless, even though there other part

[36] 257b10.
[37] 1056.

is not motionless *and* the whole is not motionless, as was argued before, when we argued that all things that move are moved.[38] Thus what we will now argue is that this object that moves itself must be made of "something motionless but causing motion and also of something moved but not necessarily causing motion" (258a). Consider A, B, and C.

1. Let A cause motion, but let it be motionless.
2. Let B be moved by A and move C
3. Let C be moved by B, and move nothing.

A, B, and C are all parts of an object that moves itself. So ABC moves itself. But since C is only moved, and does not move any of the other parts, if it were removed, one could still say that AB moves itself. If C were removed, then B is only moved, and does not move any of the other parts. So then that which moves itself has a part that moves the other part and a part that is moved by the first part. For if one removes B, then one has a part which moves itself as a whole, which was shown to be impossible. The part A must exist, otherwise C would be moved by B, which would be moved by something, and if there were no motionless thing, then this would be moved to infinite.

The picture just portrayed shows that this object needs a motionless mover and something moved that does not move anything. These two parts can be touching like in AB or they can be like ABC and connected through a process of transitivity. But considering only the primary case, AB moves itself and that is all that we need to consider. A and B do not constitute a continuum, for as was noted in Chapter 2, it would be impossible to say which moves which. Rather they must be separate entities or parts that touch one another.

[38] 1060

One might ask, if these things are parts, then they are themselves divisible, and if divisible, then AB cannot be the primary parts, since they are divisible. To this, Aristotle says that they are indivisible in their potentiality.[39] In other words, if one were to remove a part from A or if one were to remove a part from B, then it would be if one were to remove the essential component of an electronic device. The absence of that component would render that device useless. So then it is clear that there the first mover must be motionless, since it is separate from the object that it moves, but within the object that moves itself.

Now Aristotle gives *another* argument for why there must be an immobile first mover. He considers it from another angle. He has shown that the first mover is immobile if one ascends, "from moved to moves", and he has shown that there is a first mover if one considers a first mover that moves itself. This is the last bit of his argument for why there is an immobile first mover. But now he argues this and takes it one step further. He argues that is one and perpetual.[40]

So consider the last stretch of argument. From what has been argued before, we know that, "There must always be motion and not be any gaps" (258b10). Because of this, Aristotle concludes that in order for there to be motion devoid of gaps, there must be an eternal or everlasting mover that initiates this motion.[41]

Immediately there is a problem with assuming that the motionless moves that initiate motion sometimes not be. Something is responsible for the motion of

[39] 258b
[40] 259a
[41] 258b10

those objects that enter and exist existence, especially the ones that move themselves.[42]

But this cannot be on account of motionless being that sometimes are not, for there exists an inherent problem of continuity given such a supposition. The reason is that something must exist that accounts for the continual and eternal process of things coming into being and things leaving being. And this thing must be everlasting.[43]

The reason that he gives is that if it were not everlasting, then the motion would not be continuous, but something akin to overlapping sequences, which is not identical to continuity.[44]

Now recall what has been shown: that everything that moves is moved by something, either something that may also be moved or something that is motionless, and that objects in motion are moved *per accidens* or *per se*, and that given a whole system of motion, there is something that is motionless. And for there to be continuous motion, "there must be something that first causes the motion that is without motion of even an incidental kind" (259b20). This brings us back full circle.

[42] 258b20
[43] 259
[44] 259a20

CHAPTER FIVE

Conclusion

Aristotle's Arguments are subtle and the language is impossible. But there is really a beauty to the *Physics*. Aristotle's *Physics* stands as one of the greatest achievements of human thinking. I am not certain whether he intended to argue for a first mover or if he merely just followed his intuition. Having spent a great deal of time in this particular work, I am inclined to think it is the former.

His influence is tremendous. As Dean Hibbs mentioned in my thesis defense, Jewish, Christian, and Muslim scholars have argued extensively since the middle ages that the first mover, which Aristotle argues for, is their Deity. Though I think such arguments go beyond the scope of Aristotle's *Physics*, I believe that those scholars should look at Aristotle's *Physics* not as a point of contention, but as a reference in discerning the characteristics that their Gods must have. If Aristotle's arguments hold up, then wouldn't the Jewish, Christian, and Islamic scholars conclude that the God that they purport to exist must contain also be immobile and eternal?

Such considerations are indeed beyond the scope of Aristotle's *Physics*, and beyond the scope of this thesis, though hopefully this thesis might provide insight into those topics of later discussion. If this is the case, then I have accomplished the goal that I intended with this thesis.

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