# The Now and the Relation between Motion and Time in Aristotle: A Systematic Reconstruction

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*Abstract:* This paper reconstructs the relationship between the now, motion, and number in Aristotle to clarify the nature of the now, and, thereby, the relationship between motion and time. Although it is clear that for Aristotle motion, and, more generally, change, are prior to time, the nature of this priority is not clear. But if time is the number of motion, then the priority of motion can be grasped by examining his theory of number. This paper aims to show that, just as numbers are generated by the soul, time is not presupposed by motion, but emerges through the soul’s articulation of motion. Time is co-constituted by the soul and motion. The now is the key to understanding both the contribution of motion and soul to the being of time. The now is part of the soul’s articulation of motion, and sets the stage for an act that distinguishes a unit from its underlying motion. The now, then, sets up an abstraction by which the soul generates the temporal number from motion. Reconstructing this account of abstraction allows us to formulate more strongly Aristotle’s claim to the ontological dependence of time on motion. The paper then gives a systematic overview of the relationships between the now and number in order to address the question of whether the now might be extended. It closes with an examination of the possibility that motion depends on time, and how universal time is possible.

## Introduction[[1]](#footnote-2)

Time is the number of motion, according to Aristotle (*Phys.* IV.11 219b1). This paper reconstructs the relationship between the now, motion, and number in Aristotle to clarify the nature of the now, and, thereby, the relationship between motion and time.

Although it is clear that for Aristotle motion, and, more generally, change, are prior to time, the nature of this priority is not clear.[[2]](#footnote-3) But if time is the number of motion, then the priority of motion can be grasped by examining his theory of number (Annas 1975). What this paper aims to show is that, just as numbers are generated by the soul, time is not presupposed by motion, but emerges through the soul’s articulation of motion. But time is not simply a creation of the soul, it is co-constituted by the soul and motion.

The now, *to nun*, is the key to understanding both the contribution of motion and soul to the being of time. Since Aristotle holds it to be “impossible for time either to be or to be thought without the now” (*Phys.* VIII.1 251b19-20), to understand how Aristotle’s number theory works in the analysis of time, we must examine what the now is, and how it relates to motion, to time, and to number in general. I shall argue that for Aristotle the now is part of the soul’s articulation of motion, and sets the stage for an act that distinguishes a unit from its underlying subject. The now sets up an abstraction by which the temporal number is generated from articulated motion.

Unfortunately, neither Aristotle nor the scholarship on the subject have given us a systematic examination of the now and its role in the production of the temporal number. Aristotle’s account of time in *Physics* IV.10-14 is a dialectical inquiry: he begins in IV.10 by using the existing authoritative opinions to formulate impasses and rough out conceptual resources.[[3]](#footnote-4)Thereafter what drives the investigation is not an ordinary concept of time, nor is it the *endoxa* he started with, but the attempt to answer these *aporiai*.[[4]](#footnote-5) Throughout these chapters he works dialectically, again and again using impasses to sharpen and reformulate his answers and to extend the analysis to related questions. This means the text does not give us a systematic presentation of how the now relates to number and time, and has made it difficult for scholars to provide an adequate reconstruction.[[5]](#footnote-6) This paper offers a remedy.

The complex dialectical structure of Aristotle’s analytic of time leads to misunderstanding, notably, for our purpose, to confusion about what the now is and what its role is in the account of time. In this context the main puzzle to tackle admits of two formulations: is the now a point, or a unit (Annas, 1975), and to count time, do we count nows, or something else (Coope, 2005, 86)?[[6]](#footnote-7) Although Aristotle clearly argues that the now is not an extended unit and is therefore not counted in counting time (e.g. *Phys.* IV.11 218b5-9 and 220a19-21, with Phys. IV.14 223b13-15), he also says that the now is something numerable (*Phys.* IV.11 219b25-6, cf. b28, b12, and 220a14-17), which could make it seem as though counting time means counting nows. And since counting time appears to be an activity of counting extended units of time (*Phys.* IV.11 219b5-7), Aristotle could appear to claim that the now is extended, which would be a contradiction. The existence of this contradiction mars Aristotle’s account of time. A major goal of this paper, then, is to remove it.

The primary reason to think that the now is a unit seems to be the idea that to count nows is to count an extent of time. But there seems to be a way to argue that the now is only a limit, and never a unit. For the now could be numerable without its number being a unit or extent of motion, and, in addition, the fact that we can count nows (a number of limits) does not imply that to count nows is to count time (a number of motion). So it is possible to defend a view in which Aristotle’s account of the now is consistent, as I intend to do.

But Coope and Annas’s assertions that counting time means counting now-units had the benefit of making it easier to say what, for Aristotle, time is. So to accept my solution is to re-open a basic question: if the now is not what we count when we count time, then what do we count when we count time? And since time is what is counted, what is time? But this is the same problem that confronts us in the contradictory account of the now, sketched above: at best, that we have not adequately understood the relationship between the now and time in Aristotle, and at worst, that we do not understand what time is. My attempt to show that the account is consistent, then, casts us back on the question of what it is we count when we count time, that is, what the process of counting time is, and it has consequences for an account of what time is.

Aristotle’s account, I shall argue, is that articulating and perceiving differences in one thing (motion) generates a new abstract being (number, time). For this reason it is analogous to distance: a unit of distance, e.g. a meter, is a length that we abstract from a particular body by marking off that body. The act of defining the length detaches it from the body and makes it transferable to other bodies. A length is not merely an intelligible entity: because the thought ‘7 meters’ is not 7 meters long, length is and remains necessarily related to bodies. The activity of the soul in defining this length, then, produced a new sort of object, a hybrid object: an abstract unit of length.

Similarly, a unit of time is an extent that we abstract from a particular motion by marking off that motion. The act of marking it off detaches the extent from the motion and makes it transferable to other motions. A unit of time is not simply an intellectual entity: because the thought ‘7 seconds’ is not 7 seconds long, a time-unit is and remains necessarily dependent on motions. The activity of the soul in defining this extent generates a hybrid abstract object: a unit of time.

I shall argue that on Aristotle’s view the process that generates the time-unit is as follows: each motion constitutes a pre-temporal, pre-numeric continuity oriented toward an implicit completion. When this continuity gets divided, a new arrangement arises: there is something that precedes and something else that follows. To mark such a potential division is to create a now, a point-like limit dividing a line-like continuity. A number is generated when a soul takes these nows to define or mark off a unit. The temporal unit is generated in the following way: one marks off a motion twice, and when one grasps the two divisions together, the divisions define the extent between them. This is to generate a new kind of entity by defining it. This determinate extent is a unit separate and abstracted from the underlying continuity, usable as a standard of measure. This unit of measure is ontologically distinct from the existing continuity of motion. This is so even though it is a unity generated out of motion, and arising from the articulation of motion. Taking this measure as though it were indivisible and using its limits to mark off other motions, is to use it as a unit. To use this unit to count, that is, to use it as a number, is to use it as time.

I shall establish that this is Aristotle’s account in three sections:

* Section One: motion, time, and the now all differ by definition, i.e. in what they are, their being
* Section Two: the structure of motion nevertheless makes both the now and time what they are
* Section Three: two now-limits, by dividing a continuity of motion, define and thereby produce a unit of time

After this systematic reconstruction of the ontological status and role of the now, Section Four aims to resolve the confusion about whether nows are point-like or extended units by presenting the various ways that the now is related to number, and arguing that insofar as the now can be numbered, it remains point-like rather than being a unit of motion or of time. Section Five consists of reflections on the results of this reading, and addresses further concerns.

The meaning of Aristotle’s distinction between the now as both changing and staying the same, while perplexing, receives adequate attention from scholars,[[7]](#footnote-8) and is incidental to the primary concern of this paper, namely the way the now is related to number.

## Aristotle’s Theory of Number

Before we begin the reconstruction, however, since time is a number, it will be helpful to put the account briefly in the context of Aristotle’s theory of number. At Aristotle’s time, the generation of numbers and of diagrams is being used as a fruitful philosophical resource. Aristotle aims to contribute to the theory of mathematics and geometry by thinking about the generation of mathematical objects more clearly and concretely. In her introduction to *Metaphysics* M and N, Annas observes that “Aristotle distinguishes various senses of ‘exist’ (or ‘be’) and in none of them is it literally true that numbers exist…” (Annas 1976, 27). Instead, “Aristotle wants to say that time, place, etc. do not exist in their own right, but are dependent for their existence on the existence of individual Aristotelian substances…” and on the soul, since, Aristotle argues (at *Met.* IX.9 1051a21-32) that “a proof of a given geometrical construction can be said to exist just to the extent that the successive steps are actually carried out by the geometer” (Annas 1976, 28-29). There are good reasons to call Aristotle’s view constructivist, since he frequently discusses the generation of numbers (*hē genesis tōn arithmōn*, cf. *Met.* VII.13 1039a3-12, XIV.4 1091a29, XIV.6 1093b26). But these discussions are difficult to reconstruct. The analytic of time in *Phys.* IV.10-14 may be the most sustained presentation we have of how this occurs.

Annas stops just short of saying Aristotle’s theory of number is constructivist, but bases her hesitation on a misreading of the argument of *On the Heavens* I.10 279b32-280a10. In that passage,Aristotle uses the same word to describe both the coming into being of the world and the production of the figure, using the word *genesis*, coming to be, generation. There is a clear continuity between his use of *genesis* for mathematical entities and natural ones. Aristotle’s objection is not to the idea that numbers are generated,[[8]](#footnote-9) but to the idea that the object produced is the same in both cases: geometrical objects, he observes, do not perish, but objects whose being includes time and change do.[[9]](#footnote-10) That Aristotle sees a continuity between the genesis of geometrical and natural objects is clear from other passages as well. For example:

“Also, the coming into being of a mathematical magnitude makes this clear. For first it comes to be along its length, then along its width, and last into its depth, and it has its completion. So if what is later in coming to be is prior in *ousia* [as argued in *Met.* IX.8 1050a4-17], body would be prior to surface and length…” (*Met.* XIII.2 1077a25-8).[[10]](#footnote-11)

Aristotle draws a conclusion about bodily genesis *directly* from the order of mathematical genesis. His conclusion even makes bodies conceptually continuous with mathematical entities.

What sort of genesis is Aristotle proposing? In the passage in *On the Heavens* just addressed,Aristotle uses *genesis* interchangeably with the words *poiēsei*, to make, build, or construct (280a3) and *tithemi,* to place, set, or posit (280a4).[[11]](#footnote-12) This is in line with his descriptions of the genesis of geometrical and mathematical objects elsewhere. Aristotle also describes this activity as an act of *poiēsis* in *Phys.* 218b26, Met. IX.9, 1051a29-33, and XIV.2 1090a9. He also uses *sunistanai*,to compose or join (*Met.* XIII.7 1080b20), *sugkeisthai*, to compose or arrange (*Met.* XIII.7 1082a28-1082b2, 1083b15), and *kataskeuazein*, to furnish, build, or make(*Met.* XIV.4 1091a23-9). Since Aristotle’s terms for the generation of numbers include such a variety of terms for making, it appears Aristotle is a constructivist about mathematical objects.

However, we should hesitate to assign Aristotle this title, though for different reasons than Annas, because Aristotle is also clear that time, which is the number of motion, is not a completely free construction accomplished by the soul (McGinnis 2003, 163), nor does time reside in the soul as one of its properties or intuitions (Loughlin 2015, 309-11). Time is instead something whose being depends primarily on motion (*Phys.* IV.14 223a27-29), and secondarily on the soul (*Phys.* IV.14 223a22-27). Time is a hybrid being, produced both by the soul and movement. Aristotle has a co-constitutivist theory of time and number.

With these general remarks in place, we can begin the reconstruction of Aristotle’s account of the now.

## I: The Formal Distinctions between Now, Time, and Motion

There are four possible ways for time and motion to be ontologically related:

1. Time and motion are simply the same thing.
2. Time and motion are ontologically independent (even if epistemologically dependent, on the Verificationist Hypothesis).
3. Time and motion are different, but motion depends on or presupposes time (and space, on the Modern Hypothesis).
4. Time and motion are different, but time depends on or belongs to motion

Aristotle takes the last position, that time depends on motion, but not vis-versa. This is because, as he claims

1. “time is not motion except insofar as the motion has a number.” (*Phys.* IV.11 219b3-4).[[12]](#footnote-13)

Time and motion coincide, but differ from one another. Things that coincide can differ in what they are, in their definition and thereby in their being. For example, being a doctor and being a patient are two different ways of being: even when a doctor treats himself, he does not get healed insofar as he is a doctor, but insofar as he is a patient. Aristotle’s account of time advances by making such distinctions.

Here Aristotle articulates the coincidence and difference at once: since time is a number, it is not motion, yet insofar as motion *has* a number, and *only* to this extent, time *is* motion. This relationship can be clarified by examining how being a number differs from and relates to what it numbers, that is, how number is an abstraction of the thing numbered. So Aristotle turns immediately to articulate the internal structure of the act of numbering:

1. “But number is [so called] in two ways: we call number both the counted and the countable, and that by which we count. Time is that which is counted, and not that by which we count (That by which we count is different from that which is counted).” (*Phys.* IV.11 219b5-7).[[13]](#footnote-14)

The word *arithmein*, ‘to count,’ ‘to number,’ reduces to two meanings: the counted (or countable), and that by which we count, which allows counting to occur. The distinction here, I shall argue, is between what is counted, time, and that through which we count, namely the now, which defines the temporal unit.

In *Met.* X, Aristotle argues that, to know an amount, one must first choose or define a measure:

1. “a measure is that by which the amount of something is known; and (2) it is either by a one or by a number that an amount is known… while (1) every number is known by a one” (*Met.* X.1 1052b20-3)[[14]](#footnote-15)

The measure of something is ultimately a one, e.g. one sheep, one inch, one second. Since a measure is a continuity, it is divisible, but it is taken as though it were simply one.The first stage in knowing quantities, then, is defining a one:

1. “a number is a multitude measured by the one” (Met. X.6 1057a4)[[15]](#footnote-16)

This definition confronts us with two questions: (a) if time is a multitude, of what sort is it? And (b) what is the one that measures it? We shall examine these questions in order:

1. “Each thing is counted by some one thing of the same kind (units by a unit, horses by a horse), and therefore time too by some definite time” (*Phys*. IV.14 223b13-15)

Time is countedby time. It is a multitude composed of times. A line is counted by line segments, a stretch of time by seconds or minutes or hours.

The now, by contrast, is a limit without extension. It follows that the now is not time, nor is it a portion of time:

1. “the now is not a part of time and the division is not [part] of the change, any more than the point is [part] of the line (it is two lines that are part of the one). (*Physics* IV.11 220a19-21).

Time is composed by continuous stretches of time the way a line is made up of lines. The now, by contrast, is like a point on a line. Nows, then, are neither portions of time, nor of change.

1. “The now is not a part, for a part measures [the whole], and the whole must be composed of the parts, but time is not thought to be composed of nows… [but a now] appears to be the boundary between past and future” (*Phys.* IV.10, 218a6-9).

Time is not made up or composed of nows, and therefore is different in kind from time. The now is an extensionless limit, rather than a part. A part is the same in kind as its whole.

1. “(i) time is not composed of indivisible nows, any more than any other magnitude is composed of indivisibles… [Moreover,] (ii) Zeno is wrong to say that ‘time is composed of nows’” (*Phys* VI.9 239b8-9, 30-33).[[16]](#footnote-17)

Passage (8) draws two different conclusions: the first, that time is not composed of extended indivisible now-units, because time is divisible, while the second concludes that time is not composed of now-points, because lines are different in kind from points. We saw in (6)-(7) that nows are not (divisible) portions of time either. Time is not in any way composed of nows.

From this we can reach two further, related results: if according to (6), (7) and (8) the nows are notportions of time, and if (5) time is counted by portions of time, it follows that time is notcounted by nows. Furthermore, if (2) time is what is counted, it follows that what is counted when we count time cannot be nows. The argument that we count time by counting nows cannot be accurate (Coope 2005, 86, cf. Section IV, below).

But the picture will not be complete until we examine what the ‘one’ is, by which the multitude of time is measured. Here Aristotle supplies something he argues his contemporaries did not: an account of “how the first *one* was composed [*sunestē*] as having magnitude” (*Met.* XIII.7 1080b20).[[17]](#footnote-18) The word *sunistēmi*, to put together, indicates both that units require composition as extents. Aristotle’s view of mathematical entities is, to this extent, constructivist.

1. “time is not defined by [*horizai*]means of time, neither by being a certain amount of it nor a certain kind” (*Phys.* IV.218b17-18).[[18]](#footnote-19)

Time may be counted by time, but it is defined or delimited by something else, something that is not time. The obvious candidate for what defines time is the now. But before we can claim that it is, we need to work out what the now is, that is, what its being is, and what is responsible for its being is motion.

## II: The Relation Between Now and Motion

The role that the now plays in time starts from its relation to continuous motion. The now is related to the preceding and following (*proteron kai husteron*) in a motion, but it is necessary to understand this precedence to understand how nows relate to both time and motion.

### The Precedence-Structure of Motions

Aristotle characterizes the preceding and following in any magnitude:

1. “The preceding and following [*proteron kai husteron*] in motion is, with respect to what makes it what it is, motion, but its being is different and is not motion.” (*Phys.* IV.11 219a20-21).

Motion is the precedence-structure of a continuity; the preceding and following gets its orientation or sequential meaning from motion. But what the preceding and following itself is, namely ordinal orientation, is different than what the motion is. The two are ontologically distinct, even while precedence is *in* it, *from* it, and *inseparable from* it.

1. “Now, the preceding and following is in place, primarily; there it is set down [*thesei*].” (*Physics* IV.11 219a14).[[19]](#footnote-20)

The ‘preceding and following’ or ‘prior and posterior’ articulates a structure oriented into a sequence. The words do not have primarily temporal senses for Aristotle, although they are frequently translated as ‘before and after.’[[20]](#footnote-21) Precedence is most immediately in place, most authoritatively in nature and being (cf. *Met.* V.11).[[21]](#footnote-22) Thus, one could translate *proteron* and *husteron* variously by closer and farther, before and after, or, more neutrally, preceding and following, prior and posterior. By starting with place and building step-by-step toward a temporal sense of priority, Aristotle argues that temporal continuity is not an independently constituted, already-existing magnitude. But temporal continuity is not based on spatial continuity, it is based on the continuity of motion.

Since preceding and following is the only feature of magnitude that Aristotle brings up, orientation is the crucial feature for examination in this passage. What establishes the orientedness of a magnitude? The preceding and following are in place through being set down or by arrangement, *thesei*. What is it that accomplishes this arrangement? Unlike in classical mechanics, for Aristotle movement and orientation are inseparable. Here, I aim to show, orientation derives from movement. What arranges magnitude into oriented continuities is the moved body, while soul, by positing a division in this continuity, produces a new phenomenon, namely discrete parts that precede and follow one another.

It has frequently been argued that Aristotle presupposes time in his formulation of precedence (Corish 1976; Ross, Aristotle 1936; Annas 1975; Owen 1976). But it seems clear that no temporal sense of precedence is required or implied by Aristotle’s account of motion (Roark 2011, 87–94, Bowin 2009, and McGinnis 2003, 159-160).[[22]](#footnote-23) Taking a kinetic cut to specify a moving being’s spatial position in relation to a goal or end-point of a motion (e.g. Aminah is 42m from the library), Roark grounds kinetic order in spatial inclusion:

“**Kinetic order**: for any pair of related kinetic cuts *x* and *y* (*x* ≠ *y*), *x* is *before y* iff the spatial interval specified in *y* is included in the spatial interval specified in *x*; otherwise, *x* is *after y*.” (Roark 2011, 93)

Kinetic order is the fundamental organization of magnitude. But there is more to Aristotle’s account than Roark articulates. It is not spatial motion (as Roark claims) or motion in general that sets down the orientation of a magnitude, it is this particular moving thing that arranges the motion into a unity:

1. “the moving thing (*pheromenon*)[is that] by which we know motion and the preceding and following in it” (*Phys.* IV.11 219b17-18).[[23]](#footnote-24)
2. “the change and the motion are one because of the moving thing, because that is one” (*Phys*. IV.11 220a6-7).

There is no closer or farther away without a ‘from’ and a ‘to,’ and these are laid out by the mobile, the thing insofar as it is in motion. The change and motion are implied in the thing insofar as it is a moving thing with its specific capacity to move.

What is relevant about the continuous magnitude of motion – its precedence structure – is not articulated abstractly, but by reference to a specific moving thing. When we say it is 30 km “as the crow flies,” taken literally we are articulating the distance through the crow’s capacity to fly directly without obstruction. For a person, by contrast, the distance and proximity to the her destination is defined by her capacity to walk, climb, or run, and limited by roads, forests, and waterways. The path, and thereby the magnitude and its orientation, changes depending on the concrete ability to travel.

Roark’s account also needs to be broadened from motion in place to include all categories of change, e.g. a color sequence defined by its ability to get darker or paler. For any motion or change, the body-insofar-as-it-moves (*kinoumenon*) establishes the direction of the magnitude that is marked off by the ‘now,’ and the nature of this continuity. The preceding and following, that is, the orientation of the relevant magnitude is, therefore, constituted by the potency of the moved body, the *kinoumenon*.[[24]](#footnote-25)

### Precedence and the Now

Before any distinctions have been marked in the continuity of a motion, no part of the motion can be said to be prior or posterior to any other, because no parts have been distinguished.[[25]](#footnote-26) And yet there is a structure of orientation, a preceding and following, based on the body insofar as it moves in such and such a particular way. When we mark off a motion, however, by marking where this body is in the sequence, we create a distinction between something that precedes and something that follows in the motion sequence, i.e. we divide it into parts. In this way, the division manifests in a new way the oriented character of the motion continuity that preceded it.

The now is the name for such an actual division:

1. “the now is the preceding and following *as* numerable” (*Phys.* IV.11 219b25-6, cf. b28, b12, and 220a14-17).[[26]](#footnote-27)

The preceding and following is implied in the moved body, and from there unfolded in the expressed motion across a continuous magnitude. In being articulated through the introduction of a limit, the motion gets distinguished into a section that precedes and a section that follows, so the now, which *is* this limit, has the precedence-structure in (12) built into it.[[27]](#footnote-28) The now is not the same as the preceding and following. It is this oriented continuity taken as numerable.[[28]](#footnote-29) So, the now *is* this preceding and following, not simply, but insofar as it can be counted or numbered. Considered on its own, preceding and following is not numerable. It is merely the structure of orientation by which things precede and follow. Put otherwise, the orientation is pre-numerable, pre-schematic, pre-articulate. However, in being articulated as a now, the preceding and following is numerable. Although the now is founded upon the orientation established by the being-insofar-as-it-moves, the now is different from both.

To sum up: insofar as it moves, each thing lays out a particular order and direction, an orientation. Its orientedness or sequential character is what makes the magnitude one. But you can only say one part has priority over another once you divide it up. We divide it up, e.g. by placing a point on a line. So ‘preceding and following’ are constituted by motion, but their being is different, since they only appear through an act of division. When an oriented continuity is marked off by a limit, the division inherits the orientation of the line it marks off. Because (10)-(13) the now inherits the structure of oriented continuity from the moving thing, (14) its being is determined by the oriented continuity, but its being is *different* than that continuity much as the being of a point is different from the being of a line.[[29]](#footnote-30)

1. “from its source in the moved body there in the magnitude, the preceding and following extends to time as well” (*Phys.* IV.11 219a16-20, IV.14 223a5-9).[[30]](#footnote-31)

There is such thing as temporal precedence at all, Aristotle claims, because time inherits features of the continuity of motion from which it emerges. But we do not yet know how the continuity of a motion extends to time, since we do not know how time is related to motion. We need now to show how the now relates this oriented continuity to time. As we shall see, it does so by delimiting and separating off a temporal unit that nevertheless remains a divisible continuity.

## III: The Generation of Temporal Numbers Through Delimitation

Aristotle gives a philosophically rigorous account of the relationship between time and motion through the process of unit-creation. The now is the centerpiece of this analysis.

What would we expect to find in this analysis, based on texts outside of *Physics* IV.10-14? As we discussed above, Aristotle differs from others of his time in the way he describes the generation of numbers. Since number and measure both depend on a one, which is used as though it were indivisible (*Met.* X.1 1052b20-1052b34, 1053a18-25), we would expect an account of how the unit is generated. Since numbers are not independent *ousiai* (*Met.* VII.13 1039a3-14, VII.16 1040b16-27, XIV.5 1092b17-26), their being is their definition. For them to be is not for them to be in potency, but to be in activity.[[31]](#footnote-32) This is why Aristotle holds that mathematical constructions are known through being generated or produced.

1. “So it’s evident that things that are potentially are found out when they are drawn into activity; the reason is that the activity is thinking; so that the potency [proceeds] out of activity, and it is by this means that in making [the diagrammata] people come to know [them].” (*Met.* IX.9 1051a29-33, cf. 1061a29)[[32]](#footnote-33)

Mathematical things (both geometrical and arithmetical) that are in potency are only known by being drawn into activity, and what this activity does is construct, *poieien*,the number or figure. But for a mathematical object to be actively is quite different than for it to be potentially, and its *energeia* is later in *genesis*. Aristotle uses a half line to illustrate the difference: something can only be a half line in potency, Aristotle argues. Its being as half of something depends on something else—a whole. But to be a half line actively is to be a line, i.e. to be an independent line that has been separated out (*Met.* VII.13 1039a3-14). Thus for a number or figure to be drawn into activity or constructed is to come to be an independent, separate object. Thus, Aristotle presents here a sort of constructivism, in which by drawing a line or figure, i.e. by defining an object, thought generates something active and independent.

The primary sense of *gignesthai* is ‘to generate or give rise to,’ and of artificial objects it means ‘to be produced.’ There is a distinct mathematical use of the word when applied to amounts and other mathematical objects. It is close to the common sense the word has namely ‘to generate a number, create a figure, or produce a result.’Xenophon, for example, uses the word to describe the generation of food in the countryside or the production of tangible things (Xenophon *Mem.* 2.9.4, 3.6.13). Euclid uses the word to describe the creation of numbers through multiplication, *ho… genomenos arithmos* (Euclid, 7.19), and the creation of geometrical shapes (e.g. in Euclid, 10.71, 10.105, 11.27, 12.2 lemma, 12.17 etc.).[[33]](#footnote-34) Moreover, once a line or shape or a property has been added to an existing diagram, the new relationships or states of affairs that result are said to have been produced or come to be (Euclid 5.5, 5.8, 6.28, 10.6 cor. etc.). His theory of number, including the ability to generate numbers and figures, makes it possible to connect geometry and arithmetic.[[34]](#footnote-35)

As we saw, Aristotle treats the generation of mathematical entities as continuous with and apparently of the same type as the generation of natural bodies, and sometimes uses *poiēsis* and other making-verbs instead of *gignesthai* to describe the production of diagrams (see the discussion on page 4on page 4). Everything indicates that he is using the mathematical sense of the term. Since, on Aristotle’s account, time is a number, we would expect him to use the mathematical sense of *gignesthai* for it as well. This part of the paper is devoted to elucidating how this works.

### The Claim that Time is Generated or Produced

Aristotle uses the opening argument of IV.11 to formulate the claim that time depends on motion (*Phys.* IV.11 219a9-10):

1. “just as, (a) if the now [at the end of a sleep] were not other [than the now at the beginning], but were the same and one, there would be no time, so too (b) when we overlook its being other, there does not seem to be an in-between time. But if it happens to us not to think time to be whenever we do not mark off any change… while (c) when we perceive and mark off <change> then we say time has come to be, therefore (d) it is clear that without motion and change time is not. That, then, time neither is motion nor is without motion, is clear.” (*Phys.* IV.11 218b29-219a1)[[35]](#footnote-36)

This passage shows us two things: first, the work of Aristotle’s argument is not to establish that without change there is no time—he simply asserts this at the outset (218b26-7)—it is to show that there is no perception of time independent of motion. More precisely, he argues that the perception of time depends on the perception of motion, and presuming that the perception of motion depends on motion, that the perception of time therefore depends on motion.

This argument lead some scholars to claim that Aristotle advances a Verificationist position, in which time and motion are both independent continuities (whether in the world, in the soul, or *a priori*), but for the mind to notice the passage of time, it must mark off motions. But the Verificationist reading of this passage has been dismantled on textual grounds (Coope 2005, Roark 2011). One can accept Aristotle’s argument here without also asserting that time is a reality independent of motion, or an independent psychic entity only noticed with the help of motion. I aim to show that time depends both on motion and on perception in order to be at all. In other words, articulate perception of movement generates temporal unities.

The other notable feature of this passage is that Aristotle articulates his view of how the temporal number comes to be, namely that the perception and marking off of motion produces it. Aristotle identifies two conditions under which time is said to be at all: on the one hand, the now must change, and on the other, we must perceive and mark off this change with nows. If both are the case, time, the passage reads, has come to be, *gegonenai*. As Euclid might have said, when we mark off a diagram, new relations or unities have come to be.

In this passage, since the subject is time, translators sometimes gloss *gignesthai* and its cognates with ‘happen, occur,’ and, farther afield, ‘elapse.’ At first this seems to make the text easier for us to understand, but these words introduce the possibility that time flows along independently, as we moderns suppose it does. But this is a mistranslation.[[36]](#footnote-37) In the context of a discourse on mathematical objects, in a passage whose purpose is to show that the number does not exist without the motion it is *of* (*Phys.* IV.11 219a9-10), it would be contradictory to claim that time is an independent quantum.[[37]](#footnote-38) Since the claim—repeated twice—is that without motion and change time *is not*, that *it has no being*, translations like ‘elapse’ are misleading.

The question, then, is how does time come to be? What makes time *be*? To show that Aristotle’s account of marking off is an account of generation, it should be sufficient to observe that Aristotle uses both negative and positive formulations to establish: (b) when we do not mark off any change, we do not think time exists(*einai*), and (c) “when we perceive and mark off change then we say time has come to be (*gignesthai*).” Importantly, (a) in these cases it is just as if the now did not change. Therefore, he concludes, time does not exist without motion (*ouk estin aneu*, repeated twice). The subject of the discussion of marking off is the being and coming-to-be of time. This idea, as we shall see, is repeated and elaborated as the text proceeds.

But, one might say, since the explicit focus of this passage is on a seemingly much simpler idea, namely that time depends on motion, perhaps the references to perception and marking off are inessential fluff rather than a robust claim. To show that this is not the case, let us examine Aristotle’s claim that time depends on the soul as well. In particular, time is not generated independently by motion.

When, in IV.14, Aristotle raises the *aporia* that time might not exist without soul, he argues that although motion is possible without soul, the number of motion, time, is not:

1. “And one might be at an impasse whether, if the soul were not, time would be or not. For if it is impossible for there to be a counter it is also impossible for there to be anything counted; so it is clear that neither can there be a number. For a number is either what has been counted or what is capable of being counted. But if nothing else is of such a nature as to count but the soul and the intelligence in the soul, then it is impossible that time be if soul is not…” (*Phys.* IV.14 223a22-27)[[38]](#footnote-39)

If number depends on the soul, then if there is no soul, number does not exist. Since time is a number, without soul, time does not exist. The argument is laconic: Aristotle makes no effort to persuade the reader that number or time in fact do depend on souls, even though his contemporaries would have pressed him on this point. But the claim is already serious and intelligible because he has previously (in IV.11-13) given a detailed description of how the soul counts time.[[39]](#footnote-40) The impasse the passage confronts is not whether time depends on the soul, it is whether, when souls are sleeping, motion and time would stop and no-one would ever wake up. In other words, it arises from a further premise, that motion seems to depend on time. But Aristotle rejects this premise. Even if time is not:

1. “…there would still be that which time depends on the being of, such as motion, if it is possible for it to be without soul. (*Phys.* IV.14 223a27-29)[[40]](#footnote-41)

If time is not, motion, on which it depends, will nevertheless be.[[41]](#footnote-42) Similarly, without perceivers, the things that cause perception would nevertheless exist (*Met.* IV.5 1010b33-5). Coope writes: “If there were no counters, change might exist, but the *countable aspect of change would not*” (Coope 2005, 169). Therefore, motion does not depend on time in order to be.[[42]](#footnote-43) This passage, then, provides two reasons that motion does not on its own generate time: on the one hand, since motion could exist without time, it follows that nothing about motion itself would generate time, and on the other hand, since time depends on soul, without soul, time *is not*. Time comes to be, then, through both motion and the soul. It is ontologically rooted in motion, but comes to be because of soul.

When we return to passage (17), we see a clear explanation of how the soul generates time, namely (b)-(c) by perceiving and marking off change. Time is not an external event, nor is it an ongoing experience internal to the soul.[[43]](#footnote-44) Time depends on a certain perception of motion, namely an *articulate* perception:

1. “And time, too, we know when we divide motion, dividing it with a preceding and a following; and we say time has come to be whenever we grasp in perception the preceding and following in the motion.” (*Phys*. IV.11 219a22-25).

Again Aristotle presents the soul’s articulation of motion with divisions or limit-marks as resulting in the coming to be of time. Time comes to be when we make it known and perceive it, and we do this by dividing motion.

### The Activity of Marking Off Time

We saw in (16) that mathematical entities are drawn into activity (*energeia*, actuality, being-at-work). Now we can see that leading a unit into *energeia* is to generate or produce it. It is through being defined in articulate perception that it comes to be at all. Time does not merely require perception to be noticed (as Verificationists would have it), it is instead produced by articulate perception. But how exactly does this happen? Aristotle develops this account in increasing detail (e.g. he uses the language of marking off at *Phys.* IV.11 220a22-24, and 221a1-4, as well as *Phys*.VI.7 237a4-5, and *Soul* III.6 430b9-14):

1. “And this <the now> bounds the change preceding and following.” (*Phys*. IV.11 220a9)
2. “…by taking a now at the extreme of <a time> (for this is what marks off [*horizon*]<time>, and what is between nows is time)…” (*Phys.* VI.7 237a4-5)
3. “We mark off [*horizomen*] change by taking them [the preceding and following in change] to be different things, and some other thing between them; for whenever we conceive of the limits as other than the middle, and the soul says that the nows are two, one preceding and one following, then it is and this is what we say time is.” (*Phys.* IV.11 219a26-219b1)[[44]](#footnote-45)

The word *horizein* could be translated as ‘define,’ which would make its ontological importance more evident, or as ‘mark off,’ as here, which highlights its geometrical characteristics. Starting with a pre-numerable oriented continuity, we mark a motion off twice. These limit-marks define an extent, and are, by definition, its extremes. The separate nows mark out and differ from the extent defined between them:

now1  now2

|\_\_\_\_\_\_\_\_1\_\_\_\_\_\_\_\_| \_

In marking off any motion we have created an active now, and if we mark two of them the motion’s orientation makes one precede and the other follow. Preceding and following describe here two different now-limits, notthe extent marked off. But in every case, between them will be an extent marked out, a measure.[[45]](#footnote-46)

The two active nows define the unit: when the two nows are grasped as defining an extent, it is no longer in potency, no longer considered as part of a larger sequence, it has been separated out and is active as its own mathematical entity. Thus, a unit has come to be through definition.

Aristotle emphasizes the activity of the soul in this act (marking off or defining, taking as *hupolabein*, conceiving as, *noein*, and saying that, *eipon* and *phēmi*). He uses the phrase “when the soul should say [*eipē*],” in a way parallel to *horizein*,divide, define, or mark off. The simplest way to make sense of this is to assert the following: the act of articulating is part of the act that generates time as a number. Marking off change is an act of making distinctions and marking joints or turning points, which is, paradigmatically, something we do in *logos,* speech or reason. It is the reason Aristotle often uses *logos* rather than *horismos* to mean definition: here the two are fused concepts. The word ‘articulation’ clearly expresses both terms at once, and just means the act to marking off or defining something in *logos*.

In sum: the way time comes to be is through defining, i.e. producing, a unit. As the soul adds now-marks to the continuum of movement, the creation of a unit from out of motion becomes possible, and when the soul grasps two now-marks as defining a unit, time comes to be. If time comes to be through being defined or marked off, it is not something existing independently alongside motion. Since the claim that time depends on motion for it to be means that time is ontologically dependent on motion or change even in the field of perception, time is also not merely an internal experience.

### Time is Abstracted From Motion

Aristotle closes passage (20)-(21) with the assertion that

1. “What is marked off by the now is thought to be time: *let this be taken as true*” (*Phys.* IV.11 219b1).

He is emphatic: what is marked off is *time*, not motion. This is a remarkable assertion. If the preceding and following is *in* change, and, change is what makes the ‘now’ what it is (once the soul posits it), we would expect marking off ‘nows’ would demarcate *change*. That Aristotle does *not* say this gives us insight into what it is to generate a number. Instead of saying that the now demarcates a quantity of *change*, he says it demarcates *time*. This is not a sloppy statement. Not only does Aristotle take the unusual step of exhorting us to accept this as the truth, he also repeats himself, saying:

1. “it is the now that, *as* preceding and following, marks off[[46]](#footnote-47) time” (*Phys.* IV.11 219b11-2).

Insofar as a now is taken in its character of being the preceding and following,[[47]](#footnote-48) it marks off *time*. What sense does it make to say this? Nows are (6)-(8) not parts of time or motion or, for that matter, of any continuity. They mark off the pre-numeric oriented continuity of motion, but insofar as the ‘nows’ are limits (as the extremities of a line), we see here that they are not limits of motion but instead of time. That nows mark off time and *not* motion indicates the ontological difference between motion and the temporal unit they generate. To be time is to be a continuous unit produced by separating a unit from its basis through delimitation, whose orientation and continuity is inherited from the precedence-structure of a motion.

If nows are not grasped together in their unity with the extent they define, then there is no unit. If, however, we perceive this unit of measure as one indivisible whole we have used now-marks to define a unit or number. To do *this* is to generate the number of time. Again, time is the number of motion, an extent measured out by two nows that limit and define it—an extent taken as though it were indivisible.[[48]](#footnote-49)

1. “Hence time is a number… in the way in which the extremes <are> *of* the same thing <viz. the unit defined by the extremes>—and not as the parts” (*Phys.* IV.11 220a13-16).[[49]](#footnote-50)

Aristotle can claim this because he holds that limits adhere to that which they *define*, not to that which makes them what *they* are (we shall return to this idea below). Thus motion is what makes nows what they are, but nows are what makes time what *it* is, and they therefore belong to it.

1. “For limits are of that alone of which they are limits, but the number of these horses, the ten, is elsewhere too.” (*Phys.* IV.11 220a23, cf. VI.3 233b32-a4).[[50]](#footnote-51)

Time, however, as a number, is abstracted from particulars.[[51]](#footnote-52) Since the preceding and following, and therefore the now, differs in its being from the motion, the unit that two nows define is different in being from the motion. The nows split a unit off from the motion, and belong properly to the unit they define. Like a length this separated unit can be applied elsewhere to other motions. We shall return to this issue in a moment.

To summarize the process: time is related to motion the way length is related to a body. Experiencing motion we mark off nows, which are not motion, but *in* them. The number-unit arising from marking off two nows is *a time*, which depends on motion for its appearance and continuity. But because its being is different from motion, defined *not* by the telic structure of a motion, but by its now-limits, it is separate from and literally abstracted from motion. This means it has some independence, and can apply to other motions as well. If time is the number that *is* counted, the now is that non-temporal limit *with which* we count, and the motion is that *of*, *from* or *according to which* we count.[[52]](#footnote-53)

The relationship between articulating and perceiving in (17)-(26) shows that for Aristotle time is a mode of the experience of motion: to the extent that we perceive motion thoughtfully, we are articulating it, which means we are already marking it off with nows. But grasping these nows as themselves defining an extent is a further act of abstraction, which generates the unit of time. There are several gradations of temporal experience: animals, who can make distinctions, have an experience of the now even if they do not have the further grasp of a unit of time, and animals who can perceive temporal unities might not use them comparatively to measure off other motions.[[53]](#footnote-54)

Marking off reveals something new about the motion, and when the soul generates something separate out of it, this is inseparable from movement. Because time inherits properties of the motion, it is not merely a subjective or ideal form imposed on motion. First, the possibility of marking something off depends on motion having an articulable structure (see Section Five, below), second, positing a mark reveals a precedence structure independent of the soul, third, it is the ongoing continuity of the movement that makes it possible for there to be two nows, and fourth, once two marks have been introduced it is not up to us that the extent between them becomes visible as a definite quantity, and for the same reason, it is not up to us that this extent is comparable to others (cf. Section Five). In a word, the act of defining does not manufacture a unit by imposing an independent ideal entity (a number, diagram, blueprint), it is an act of co-creation, in which the soul’s marking off precipitates the generation of a possible unit, which, in grasping it and drawing it into activity, makes the extent into an independent entity, a time.

## IV: The Relationships Between Now and Number in General

I argued in the first section that according to Aristotle, insofar as we are counting time, we are *not* counting nows. If nows are that by which we mark out a number, i.e. that by which we number motion, then we satisfy Aristotle’s claim that time, rather than motion or nows, must be what is counted.

But since the most prevalent reading of Aristotle holds that counting time is the same as counting nows, perhaps we should say more to clear up the problem. Ross claims that the now is the unit that by repetition constitutes time (Ross 1936, 603). Annas worries that the now plays both the role of limit and counted unit, which, if true would conflict both with Aristotle’s account of measurement and his explicit claims that the now is a point in (5)-(8).[[54]](#footnote-55) Coope says “for Aristotle, time is what we count by counting nows as they pass” (Coope 2005, 171, cf. 86, 169). They each maintain a version of the Counted-Now hypothesis.[[55]](#footnote-56)

While the preceding reconstruction should be sufficient to show that Aristotle does not hold the Counted-Now view, that view is based on a vague sense that if the now can also be counted, counting nows must be associated with counting time. My claim in response to this is straightforward: the now has several determinations, and several ways of being related to number, but only one of them relates it to the temporal number. Distinguishing the ways the now is related to number will provide another rebuttal of the Counted-Now view, as we shall see.

Three distinctions are required to clarify the possible relationships between nows and number: first, like any limit the ‘now’ can be taken either as uniting or as dividing, so which of these is related to the temporal unit, and how? Second, the now is used to form numbers, but can the now itself be counted, even if it is a point? And what makes it countable? In other words, can it be a number? If so, is one of these the same as the temporal unit? Third, in what way is the now ‘in Time’, and, on the same question, in what way is motion ‘in Time’? Aristotle claims that the now is in time the way that a limit is in number, and motion is in time in the way that there is always a number of it, but these need to be explained.

### The Two Functions of Limits

The now, like all limits, has two functions:

1. “the point, too, both a) makes the length continuous and b) bounds it, being the beginning of one and the end of another.” (*Phys.* IV.11 220a10-13).
2. “The now is a link of time… it links together past and future time, and is a limit of time, since it is a beginning of one and an end of another… The now is on the one hand a *division* of time, in potency, and on the other hand, the *limit and union* of both [times]. The division and the unification are the same thing and in respect of the same thing, but their being is not the same.” (*Phys.* IV.13 222a10-12, 13-15, 18-20, emphases added).[[56]](#footnote-57)

On the one hand the now-point separates a continuity-line into two, ending one and beginning the next, and on the other hand it unites two lines into one: \_\_1\_\_|\_\_2\_\_ and \_\_\_\_\_|\_\_\_\_\_. As dividing, we saw, it distinguishes two things and thereby makes evident a relation of priority. As uniting, it joins two lengths into one continuous extent. It is the boundary that joins (*sunechei*)the future to the past.[[57]](#footnote-58) What the point is, its being, differs depending on what its relevant function is:

1. “It divides potentially, and as such, the now is always different, but as binding together it is always the same, just as in the case of mathematical lines… if one divides the line it is different in different cases, but inasmuch as [the line] is one, [the point] is the same everywhere.” (*Phys.* IV.13 222a13-15)[[58]](#footnote-59)

Aristotle’s claim seems to be this: if the point is viewed as dividing a continuity, then the two lines it defines change depending on where it is placed. Since the point belongs to the line it defines, its being will be different depending on where you place it. But if a point is taken as uniting two lines then no matter where you put it, the result is always the same unified line, so its being will be the same, because it belongs to the same line.

This fits the description of the present now between 219b9-220a4. There Aristotle argues that the now corresponds with the moving thing, while time corresponds with the motion. Both the moved body and the now are in one respect always the same, and in another respect always different:

1. “The moving thing is, in respect of what makes it what it is, the same… but in *logos* it is different, in the way in which… being Corsicus-in-the-Lyceum is different from Corsicus-in-the-marketplace… Here too, then, whatever it is that makes it the now is the same: it is the preceding and following in change. But its being is different: it is the preceding and following, considered as countable… So the now is in a way the same always, and in a way not the same, since the moving thing too [is so].” (*Phys.* IV.11 219b18-28)[[59]](#footnote-60)

What is responsible for its being is always the same: Corsicus is himself no matter how he is moving, the now is always a precedence point in change. In this respect its being is always the same. The way it is different is more difficult to grasp. In articulation, or insofar as it is countable, the thing is different: Corsicus’ attributes differ, the precedence point considered as countable is always different.[[60]](#footnote-61)

Putting together (28)-(31), we can make sense of the claim: the uniting function of a point is the same because in uniting it is considered in view of the underlying being responsible for it being what it is. On the other hand, the dividing function of a point means it is ever different: it is possible to divide a continuity anywhere, and *as* a division a point is always potential, since once the division is made actual, what is there is no longer a division, but two lines that have a beginning and end at the same point. The point of division generates two lines. Thus, it is not as uniting, but as dividing that the now is ‘countable,’ and it is as countable that a now generates mathematical objects.

The present now, then, insofar as it is always the same, holds together past and future insofar as its being is anchored in the being of the moved body responsible for it, e.g. mine, yours, the sun’s. The ever-differing now distinguishes past from future, preceding from following, because its being is anchored in the particular things it marks off, in the unities generated by articulation. It is in its function of dividing that the now is related to time.

### A Countable Now

The now is motion-precedence insofar as it is *countable* (14) and it belongs to number (27), but can it also be counted? Can the now *itself* be counted and have its own number? Apart from claim (14) that the now is the preceding and following as countable, the primary evidence that it can occurs in a corrupt passage, and no solid conclusions can be drawn from it.[[61]](#footnote-62) But it seems reasonable to say that if nows can be distinguished, we could number them.[[62]](#footnote-63) This means the now could relate to number in two ways, either to be that by which numbers are generated, or that which is numbered.

If so, the now would only be related to time in one of these ways, for in the first case, when it is used as a limit to define time as an extended unit, as we have seen, the now is that by which time is counted, so that it is not nows but *time* that is counted. When the now is used as a limit, what it marks off is what is counted, i.e. time. The now is not time because it belongs to that which it marks off, i.e. time, without being part of it. As a point-like limit, it is therefore not time, just attached to and accompanying it.

In the other case, if a now could itself be what is counted, in this respect it would be used neither to define nor to count time, because what is being counted is the now. If the now was counted, it would be a number, but this would not be the number of motion, i.e. time, it would instead be the number of the preceding and following, as noted in (14), above (*Phys.* IV.11 219b25-6, cf. b28, b12, and 220a14-17). The now in this case is not time because the number being counted is not the number of a motion, i.e. time, but of the now as a limit with a precedence structure. It therefore differs in its being from time. Thus, in neither of these ways is the now time.

Aristotle uses this account of limits to mount an argument at 220a4-24 that rejects the claim that time is the number of a now. Recall that the now has two functions: one of uniting, one of separating. The function of separating is itself split into two aspects. Because (27) the limits belong to what they mark off, the now is the limit of two different extents. But the limit can only belong to one whole at a time, as Aristotle says, continuing (28), above:

1. “But when one takes it in this way, treating the one [point] as two, one must come to a halt [*histasthai*], if the same point is to be both beginning and end.” (*Physics* IV.11 220a13).

Aristotle is pointing out the phenomenon that produces multistable optical illusions like Rubin’s vase (see Figure 1). First, the boundary is not a third thing in-between the white and black. It does not hover between them, it is always resolved in one way or the other, attached to the item in the foreground.

Second, the outline either forms a vase or two faces, but not both at once. While the limit accomplishes both the function of beginning one thing and ending another, these functions are different in their being. We cannot give the limit a single number: we must come to a halt between grasping the first (being the end of one extent) and the second (being the beginning of another extent). Considered abstractly in this way, the now is two. The now as dividing implies both discontinuous functions. It is split in its being into these functions in relation to the continuities it marks off. There is no unit, no continuity or extent marked out by these two nows.

1 In Rubin's Vase, we see either a face or a vase. We do not grasp an independent limit between them. The boundary between white and black belongs to what it defines.

If we called time *this* number, i.e. the number of the now as dividing, time would not be the number of motion at all, but of a halt, of discontinuity, since there is no continuity between the functions of the now. Clearly, this is not the way to define time, and if we counted the now in its function of dividing, we would not be counting a unit of time, but the conceptual halt between two incongruous functions.

Whereas the now in this respect would be immobile, unchanging, Aristotle continues, the now insofar as it is related to time has to be related to motion:

1. “But the now is always different, because the moving thing changes” (*Physics* IV.11 220a13-14).[[63]](#footnote-64)

Because the now as related to motion is always different, because it tracks the moving body, Aristotle concludes, the temporal number is not the number of the now, but the number generated by limits:

1. “Hence time is a number, not as being of the same point, in being <both> beginning and end, but in the way in which the extremes <are> of the same thing <viz. the unit defined by the extremes>—and not as the parts” (*Phys*. IV.11 220a13-16).

At face value it might seem as though there are two possible readings of (34): *either* the number or quantity of time just is the number of nows, counted in series, *or* attending to the continuously differing now, we mark off two different points, which define a line-unit, i.e. time. But the arguments leading up to the passage mean that insofar as the now is numbered, it is taken as multiply functional, i.e. as the beginning of one line and end of the next, as dividing and unifying. As so numbered, its functions imply discontinuity rather than motion. Therefore, insofar as they are counted, nows do not relate to motion. So if time was counted by counting nows, time would not follow motion or be the number of motion, but of the discontinuity of now-functions. So since time is an extent, not a point or composed of points, and since it is a number of motion, not of now-functions, the only possible reading is that time is not made by counting nows, but by counting the units generated by nows. This argument, then, shows that the now is not time, and that to count it is not to count time.

It follows from this that insofar as the now is related to time, it is not considered as such a two-function dividing limit, but only as a one-function limit, either a beginning or an end of an extent. When we count time, we are not counting nows, we are using nows as extremes that define the temporal unit. The way that the nows are *two* in defining the temporal number is by being opposite ends of an extent, not by one now having two functions. Its use in defining time is as extremes belonging to a line, and *not* as a single dividing point in the middle of a line. The now’s own numerability is not used; only its character as a one-function limit of an extent is used. This means that language of the now being a number does not (as Annas and Ross have it) imply that it is a unit.

The argument has a dilemmatic structure: either the temporal number is just the number of nows, in which case it has no relation to motion, or time is the number of motion, in which case it is not the number of nows. Aristotle chooses the latter. He could hardly reject the Counted-Now hypothesis more forcefully.

To summarize, the same point or now has two different definitions, two sorts of functions, one of which is split into two:

|  |  |  |  |
| --- | --- | --- | --- |
| Now | | | |
| Dividing segments | | Unifying segments | |
| Beginning | End |  |  |

Since these functions are different in definition, i.e. in being, the now is therefore multistable in its function. In none of these functions can the now play the role of a unit. Although these functions can be counted, so that the now can be counted in its own right as a limit, counting them is not to count time. Thus Aristotle’s argument provides the strongest possible rejection of the idea that counting time consists of counting nows.

One might protest that the claim was not that the now was time, but that by counting one thing (nows), we can count another (time). If this were the case, could not time be counted by counting nows in sequence? But this account is unnecessary. And Aristotle argues that things (5) are counted by something that is the same in kind (cf. *Phys*. IV.14 223b13-15).

But there is a further function that a now can perform, but not on its own: two nows can define an entity that is different in kind, namely a unit. This function is how the now gives rise to time.

### How are the Now and Motion ‘in Time’?

The now in motion is related to the number of time, then, by dividing off a unit-extent that differs in its being from motion, making this unit what is counted. But if the now is *in* time, must not time be prior to it? If this is the case, my thesis that for Aristotle time is generated by marking off motion must be false. Similarly, if motion is in time, should not time be prior to it?

The question gets going from passages like this:

1. “for a motion the being in time is the being measured by time both of the motion itself and of its being…” (*Phys*. IV.12 221a4-5)[[64]](#footnote-65)

This worry is based on the assumption that being *in* means being *prior*.But this is an assumption Aristotle does not share.[[65]](#footnote-66) The objection is based on a misunderstanding of what the word ‘in’ means, for Aristotle. He responds to the worry by distinguishing its meanings as follows:

1. “to be in time is one or other of two things:
2. *either,* to be when time is,
3. *or*, [to be in it] in the way in which we say some things are ‘in number’, which means that [something is in number]

(B1) *either* as a part or property of number, and in general, that it is some aspect of number,

(B2) *or* that there is a number of it.

(B1) And since time is a number, the now and the preceding and everything of *that* kind [i.e. divisions] are in time in the way in which the limit and the odd and the even are in number (they are aspects of number as the others are of time).

(B2) But *objects* are [in time] as they are in number. If so, they are surrounded by time [i.e. they are not aspects of time] just as the things in number are by number and the things in place by place.

1. It is manifest, too, that *to be in time is not to be when time is*… If this is what ‘in something’ is to mean, then all objects will be in anything whatever….
2. For a thing to be in number is for there to be some number of the object, and for its being to be measured by the number in which it is, and so, if it is in time, by time.” (*Phys*. IV.12 221a9-23, 221b14-17)[[66]](#footnote-67)

Aristotle rules out option (A) that to be in time is to be when time is. For the now and motion to be in time, then is (B) to be in number, in one of two ways: (B1) some things are aspects of number, as the now is, but (B2) things that are not aspects of number are in number only insofar as number surrounds them, i.e. insofar as they and the things around them can be numbered. Since time is dependent on motion, and more specifically, since according to passage (1) time is motion insofar as motion has a number, clearly (B2) motion is in time only insofar as there is a number of motion. As Annas argues, according to Aristotle the phrase ‘to be in number’ does not imply that numbers are there in advance: “’in number’ means only, of a term, that its definition presupposes mention of number, and of a thing, that ‘its being is measured by the number that it is in’”.[[67]](#footnote-68) Thus, clearly, being in time does *not* mean that time is *prior* to nows or to motion.[[68]](#footnote-69)

But there is another way to pose the same objection: since Aristotle clearly says that time measures motion and motion measures time, someone might object that it cannot be the case that time is generated by and ontologically dependent on motion. This is the same objection as above, but let us address it on its terms.

The worry gets going based on passages like this:

1. “Not only do we measure motion by time, but time by motion also, because they are defined by one another.” (*Phys.* IV.11 220b14-15)[[69]](#footnote-70)

The objection is based on the assumption that the two ways of being defined are the same, or at least equiprimordial. The continuation of this passage (37) shows that this assumption is false: the way motion and time define one another differently allows time to depend ontologically on motion.

1. (A) “The time defines the motion, being its number, and
2. the motion [defines] the time. We speak of ‘much time’ and ‘little time’, measuring it by motion, just as we measure the number by what is countable, e.g. by the one horse we measure the number of the horses,
3. for it is by number that we become acquainted with the multiplicity of the horses,
4. and, conversely, by the one horse that we become acquainted with the number of horses itself.” (*Phys.* IV.11 220b15-23)[[70]](#footnote-71)

The one horse / motion lets us know the number itself, and then the number lets us know the multiplicity of horses / motions. A foot-length is created by marking off an actual foot, after which we can use this length to mark off other things, including other feet:

1. “Since time is a measure of motion and of being-in-motion, and since it [time] measures motion by defining some motion which will measure out the whole motion (just as the cubit measures length by defining some magnitude which will measure off the whole magnitude)…” (*Phys.* IV.12 220b32-221a4)[[71]](#footnote-72)

Aristotle describes the same relation of priority in the *Metaphysics*:

1. “a measure is that by which the amount of something is known; and it is either by a one or by a number that an amount is known… while every number is known by a one” (*Met.* X.1 1052b20-3)[[72]](#footnote-73)

Since in definition the one is primary, and motion defines the temporal unit, clearly motion is prior to time. Even though they define one another, they define one another differently; motion defines time by being what generates the unit of time, while time, thereby constituted, can in a second step then mark off motion.

In sum, there is no indication in the text that time is prior to or even equiprimordial with motion. The fact that motion is in time means only that there is a number of it, while the fact that motion and time measure one another just means that once the unit of time is generated from measuring motion, it can, thereafter, mark off other motions. Thus, the principal objections to my proposal fail: if we understand the role of the now in Aristotle, we can see time is ontologically dependent on motion.

## V: Further Questions

Two important questions remain: a) if the now is a mark in a particular motion, but defines temporal units, how can these temporal units be universal? Then, b) if nows are simply arbitrary cuts in motions, then isn’t the real basis for the temporal unit in the soul rather than in motion? And if this is true, might we be drawing on an experience of time independent of (external) motions?

### The Universality of Time

How can Aristotle get from the activity of marking off individual motions to a universal temporal continuity? We have seen that the now is a fundamentally different kind of being than the motion it marks off, and also different than the stretch time it defines. The stretch of time and motion are kept ontologically distinct by this function of the now, i.e. by the difference that the now introduces. The now splits an abstract unit off of a concrete motion.

But at *Phys*. IV.14 223a29-b3, Aristotle formulates a problem: since time “is a number of each change, insofar as it is change” it is conceivable that the result would be simply an irreducible plurality of times—one for each motion. How exactly can different temporal numbers join together and become part of others? What is responsible for the universality of time?

There are two possible responses: first, if we grant that the temporal unit does remain tied to the individual motion, nevertheless, for Aristotle there is a motion that encompasses all others:

1. “…time is thought to be the motion of the [celestial] sphere, because the other changes are measured by this one, and time by this change.” (*Phys*.IV.14 223b22-24)[[73]](#footnote-74)

The motion of the heavens encompasses and measures all others, and the other changes, including changes different in kind, such as qualitative, quantitative, and substantial changes, can be mapped or marked onto it. Thus the greatest motion provides us with a temporal continuity that encompasses and relates all possible generated time units. But Aristotle’s language is tentative throughout this passage, which is attempting to explain why people think of time as a cycle (*Phys*. IV.14 223b28-34). The governing assumption here, that the temporal unit is tied to the moving body, has the philosophical disadvantage that it seems, at first, difficult to adapt Aristotle’s account of time to our current understanding of the universe. But while it might not fit a Newtonian universe, it might relate in an interesting way with the general theory of relativity, for which individual moving bodies shape space-time.

Second, we might instead argue that the kind of split that the now introduces between the motion and the temporal unit is more radical, and that it amounts to a distinction between a concrete continuity and an abstract one that is already universal or can be assembled into a universal continuity. This is closer to Aristotle’s position. He makes two related arguments at 223a30-b12: times that are equal and together or coincident are the same, the way the number seven is the same whether it is of a number of dogs or horses. Here the abstract character of the number appears to do the work of anchoring the universal. He bolsters this claim at 224a2-15 by arguing the following: though ten dogs and ten horses are different groups of ten, the tens do not differ insofar as they are numbers. Since numbers do not, as numbers,differ from one another, the relevant difference that would tie them to particular motions vanishes. So, insofar as time is a number, all individual time-units are in principle the same and commensurate.

But this commensurability does not imply that all times are reducible to a single continuous dimension of time. There is no necessity for there to be a single measure. As Stein shows, all that is necessary for things to be in time together is for something to happen before and something after the time of any particular being. Being in time means that individual beings surround one another temporally, so that “all times are parts of some greater time without… [implying] that the greater time is independent of the things and events in time, or …that these times must ultimately compose a single whole… there is no collection of parts that compose to form the whole of time in the way parts compose wholes as standardly conceived” (Stein 2016, 510).

But if the now is responsible for both the relation and the separation of number from the motion it is ‘of,’ we would expect Aristotle to claim that it is by the ‘now’ that different times are related. He does just this at 223b6-12: when the limits of two changes coincide, he argues, even when the changes are different in kind, the time is the same. He concludes that it is because of the coincidence of their limits that the numbers are equal, despite being marked out from different motions (223b10-12). It is the limits of the temporal unit that make the equivalence possible. Much as marks on a ruler can measure out the same length on different objects, nows can mark out the same time though they are in different motions.[[74]](#footnote-75) That now-points are different in kind from both motions and time allows them to mark off either one without making time the same as motion. That nows belong to the temporal unit they define, and not to the motion (24)-(27).

But how is it possible to take a point from one motion and mark off a different motion? It is possible in much the same way that we can take a ruler and mark off a different body by using its length: the fact that the two are in the same world allows me to pivot from one to the other and keep both in view. The common world, ultimately, underlies the comparison of motions.

### Grasping Articulate Motion

It might seem as though dependence on things and dependence on the soul are mutually exclusive. Section Three, above, aimed to show that they are not, and that time depends on both soul and motion, but there is more to say about why. If the being of the now depends on the motion of beings in the world, and motion is an ontological ground of time (10)-(15), then in what way does time depend on the soul, and in what way on motion?

Concerning what the soul must be like for this to be the case, it should suffice for our purposes to say that, perception or imagination, and based on motions, we can reconstruct nows in the past (“we did not notice until later that the sun had set while we were inside,”) and anticipate nows in the future (“the moon will be full in three days”).[[75]](#footnote-76) This is why Aristotle is comfortable with the expressions “he will come now” and “he has come now” and “just now” and “right away” (*Phys*. IV.13 222a21-25, b8-15). While we are sleeping, we do not mark off motions, but when we wake, we recognize that something changed while we were asleep (“the sun rose,” “the rain stopped,” “my friends arrived”), and mark them off retrospectively.[[76]](#footnote-77) One can have in mind a past or future now when one marks off a unit of time.

Let us, finally, turn to the question: what does motion have to be like for this account of time to be possible? Does the soul use the ‘now’ to arbitrarily mark off motions, or do motions contain or imply marking-off points, or are both positions possible?

If (a) a person marks off motions arbitrarily, the soul would seem to be the real source of time, but if (b) motions contain, imply, or suggest their own articulations, then time is either (b1) structured solely by the motion of things, or (b2) it is generated by both motion and the soul that marks it off. I shall argue briefly for the latter position (b2).

For motion you need at minimum two things: a coherent stretch or extent, and a difference, i.e. a preceding and following. For a motion to be both coherent and have a preceding and following, it must be organized by a principle, i.e. (12)-(13) by a body insofar as it is in motion, and have a ‘for which’, *heneka*,or *telos*. To mark off a magnitude of motion, and not just to mark a point along a magnitude, it is necessary to grasp the principle or end that unifies it as a motion and makes it continuous. This principle is apparent once the motion is already underway:

1. “something of what comes into being has always already come into being, and in general something of what is in motion has always already been moved” (*Met.* IX.8 1049b34-5, cf. *Phys*. VI.6 236a10-15)[[77]](#footnote-78)

Therefore, articulating a motion will always be in some way retrospective and prospective, an articulation accomplished in the perception or grasp of its principle. If this is so, it is only because motion is principled that its differentiation and articulation are possible.

If this is right, the capacity for articulation arises in the motion of things, and the articulateness of motion is thereby what makes time possible. When something changes, that is, when motion differentiates the moving thing, these differentiations are possible nows that the soul could articulate and grasp.[[78]](#footnote-79) By (16) drawing them into activity, the soul thereby generates the temporal number. In other words, by having definite articulate differences and unity, motion lays out ‘nows’ that we grasp, and the soul, perceiving and distinguishing them, grasps and thereby generates time.

## Conclusion

Through a reconstruction of the relationship between the now and number, I have argued that Aristotle’s account of time contains a strong claim about the relationship between time and motion, namely that the now is instrumental in generating the temporal number through abstraction.

I first set up the problem with Aristotle’s distinctions between each of the principal terms involved in time. Motion, time, and the now all differ by definition, that is, in what they are, their being: a number (time) is by definition not the same as what it numbers (motion), a limit (a now) is by definition different than a continuity (both motion and time). The question then was how the temporal number is defined.

To understand how the now could define time, we needed first to examine its relationship with motion. The structure of motion makes both the now and time what they are. The moving thing unfolds an oriented continuity independently, without presupposing time or nows. Dividing (marking a limit in) an oriented continuity into parts produces the phenomenon of one part preceding another part. Because the orientation was implicit in the continuity that the limit marked off, the limit (a now) is intrinsically oriented. The unit (time) will, in turn, inherit this orientation from the limit (a now), not directly from motion, which means that the now is the proximate source of both the orientation and the continuity of time.

To understand how a continuous motion could give rise to a temporal unit, we then turned to an examination of how the now is related to time. A limit (a now) in a continuity (motion) has two functions, either dividing it into two, or joining two into one. In pairs, limits (nows) that divide a continuity define a unit (time). The unit (the number of time) comes to be through being defined, and did not pre-exist its definition.

Following this, we examined the relationships between the now and number. We saw that a limit (a now) taken as joining two things (e.g. past and future) establishes a continuity, but we also saw that this is not the respect in which the now marks off time. Then we saw that insofar as a now could itself be numbered, it would have two incompatible functions. This number would not be time, nor would time be constituted by numbering it. Thus, it is as one-function limits (i.e. a beginning or an end) of an extent that nows define time. Then we saw that by being in time, neither motion nor the now is subordinate to or presupposes time: motion is in time insofar as there is a number of it, and it generates the temporal number, while the now is in time the way limits, the odd and the even are in number, namely that they are aspects of it without being numbers.

We then turned to two further questions related to the thesis. In the first, I showed that the abstract character of the temporal number, along with the ability of ‘nows’ to mark off other motions, accounts for the universality of time. Then, I argued that the soul is not able to articulate motions without in some way grasping their principles. Thus time depends both on the soul and on the orientation implied in the structure of moving beings.

Time is related to motion the way length is related to a body: the unit of length is generated by marking off the body, while the points with which we mark it off are neither the length nor the body, but create a unit separate from the body, which can be taken away or abstracted for use elsewhere. Because the body is already articulate, it has such units of length in potency. A length is generated by marking these off.

It will be useful to summarize the whole process. Time comes to be as follows: each motion occurs along an oriented continuity. Marking off this continuity creates a point-like limit, a now, which inherits the structure of precedence from the oriented continuity of motion. When two nows are marked off, the act of grasping or perceiving the nows as defining an extent generates a temporal unit of measure by drawing it into activity. This is the generation of time as a number. If we taking this measure as though it were indivisible, we are taking it as a kind of being separate from and ontologically distinct from motion, even though it is generated from and arises from it. Thus by articulating and perceiving one thing (motion) we generate a new being (number, time) through abstraction, i.e. through separation. This can then be used to measure or mark off other motions, again using now-marks.

For Aristotle, time is an epiphenomenon of motion, and ontologically dependent upon it. Marking off or articulation of motion sets us up to grasp nows as units, and to grasp these is already to generate time. Because of this, complex articulations of motion will tend to overflow into a generative definition of time, for which reason it is difficult for us to think of motion and time as separate.

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1. The author wishes to thank the reviewers for their thoughtful and thorough comments. [↑](#footnote-ref-2)
2. The influential verificationist reading takes the priority to be merely epistemological: time is always running off in parallel to motion, but we only notice it or grasp it by marking off motion. On this view, time is ontologically independent of motion but epistemologically dependent on it (See Shoemaker 1969, Sorabji 1983, Hussey 1983. Coope 2001 gives an overview of the debate). But it has been made clear that this position does not fit the text (e.g. in Coope 2001, 2005, Roark 2011). Recently there have been studies of the objectivity of time (e.g. Stein 2016, and Loughlin 2011), and several scholars have argued that motion and soul co-constitute time (e.g. McGinness 2003, Roark 2011, Harry 2015), but (except for Roark 2011) they concentrate more on the soul than on motion, so too little attention has been given to the ontological priority of motion over time. The debate about whether for Aristotle time is static or dynamic points to the same perplexity about the relationship between time and motion (cf. McGinnis 2003, 151-5, 165, and Roark 2011, 179–210). As the debate indicates, the problem is not yet settled. A systematic account of the now, which I undertake here, can anchor a robust co-constitutivist account of the priority of motion over time. [↑](#footnote-ref-3)
3. Aristotle does not, in my view, accept authoritative opinion as sufficient ground for truth, notwithstanding the passage at *Nicomachean Ethics* 1172b36-1173a2. Instead, he accepts that there is *something* true in it and does considerable dialectical work to discover what the problem is that these opinions are attempting to answer, and what is at stake in this answer. In other words, before he agrees with the *endoxa*, he does a lot of work to uncover something to agree with. This is why his interlocutors, and with them modern readers, have good reasons to accuse Aristotle of distortion, because they disagree with his assessment of what the positions are really about. I take a middle position between Coope and Roark: against Coope, I agree with Roark that Aristotle is not philosophically naïve, and that he has thought carefully about the path his argument will take, but I agree with Coope (against Roark) that Aristotle might not know the answer in advance. As Roark notes, Aristotle does not make every step of the argument gradually: he gives the definition of motion immediately after his opening arguments in IV.11, for example (Roark 2008, 78). This indicates that he has a clear direction he wishes to go in the argument, and shows that what comes earlier in an argument is not necessarily replaced by or abandoned in what follows. Moreover, he will often defend a position he disagrees with in order to set up a conclusion that its proponents would disagree with (cf. his treatment of Parmenides in *Phys.* I.2-3, 8, and of Plato in *Met.* VII.6). Meanwhile what comes later can sometimes be rejected because an earlier argument becomes relevant again. For example, when in IV.13 Aristotle brings up the claims that time depends on the soul, but motion exists without time, the issue is discussed with severe brevity and summarily dispatched. This is possible because the preceding argument (in IV.11) established an answer that needed merely to be stated explicitly. This view of Aristotle’s dialectical writing just means we need to examine his actual arguments to discover which he holds and which he does not. [↑](#footnote-ref-4)
4. Roark 2011 rightly resists the view that Aristotle is a philosopher of common sense (Roark 2011, 78-9). Bostock 1980 and Heidegger 1982 both claim that Aristotle is explaining the common-sense view of time, but the claim ends up being something of a Trojan horse in both cases. [↑](#footnote-ref-5)
5. Pickering (1978) argues, on the basis of Aristotle’s response to Zeno, that the now is a point, which means it is not a part of motion, but his argument does not examine its role in constituting time. G.E.L. Owen (1981) argues that Aristotle’s account is centered on the concept of an instantaneous present, and that other senses of present derive from this, but does not examine how the temporal number is produced, while Broadie (1984) argues for Aristotle’s concept of the now as instantaneous and she reconstructs the way it joins future to past, but only devotes two pages to its relationship to motion and the constitution of number (Broadie 1984, 113–14). Roark (2011) argues that the material of time is motion, while the form is perception. In so doing he offers a non-temporal account of precedence, in which the now is a kinetic cut in a spatial continuity oriented by motion. But while articulate perception precipitates the generation of number, the form of time is number. Thus, Roark does not give an adequate account of how the now is involved in the constitution of the temporal number. [↑](#footnote-ref-6)
6. Although Annas (1975) argues that Aristotle’s account of time depends on his account of the generation of number, she also claims that the now is sometimes a unit and sometimes a point—a position I will argue conflates two ways the now relates to number. Similarly, Coope (2005) claims that to count time is to count nows. [↑](#footnote-ref-7)
7. See, for example, Broadie’s examination of the flowing now (Broadie, 1984). Similarly, her 2005 aims to show that it is the now, not the events themselves, that constitutes the relations of events to one another, and thereby that it is not part of the temporal series (Broadie 2005, 86-93). On the other hand, McGinness holds that the now does not flow, but sticks to events it marks off (McGinniss 2003, 165-7). Bowin argues, counter-intuitively, that in Aristotle’s usage the total object insofar as it changes amounts to a complex predicate, so that ‘Corsicus-in-the-Lyceum’ (where ‘Corsicus-in-the-Lyceum’ is a being addressed as identical with all its changing attributes) and ‘Corsicus-in-the-Agora’ are two mutually exclusive entities, whereas the object insofar as it stays the same is grasped only by intellect because it distinguishes between the underlying thing (Corsicus) and its attributes (Bowin 2008, 74-6, 83-4). This interpretation leads, Stein argues, to the conclusion that the type of non-being belonging to past and future events is superficial: since the underlying subject always persists through a change, all change amounts to a temporal specification of predicates. Instead of saying that (S) the underlying material of the world *is not now* (P)Socrates, Stein argues, (S) *is* (P) not-now-Socrates(Stein 2016, 511-8). [↑](#footnote-ref-8)
8. In *Met.* XIII.7 Aristotle criticizes the Platonists not because they suggest that numbers come to be, but because the descriptions they offer of how this happens all lead to absurdities (see esp. 1093b24-9, and 1081b16-18, 1082b30, 1083b34, 1084a2, 1084a26-34, and XIV.5 1092b2). In Aristotle’s description, numbers are generated by abstraction (cf. Annas 1976, 30-34). [↑](#footnote-ref-9)
9. The reason Annas gives is that in *On the Heavens* I.10 279b32-280a10, Aristotle appears to say that the construction of geometrical forms is not a process that takes time, on the assumption that constructivists argue that it does. On the one hand, it seems possible to put forward a case that geometrical construction does not take time, e.g. if positing a point or a line instantly produces new properties and relations. On the other hand, the passage she refers to seems not to say what she claims it does. Aristotle’s argument appears to turn on the difference between the results of two types of generation: some claim that the generation of the universe and the generation of a diagram are alike, in that they both produce something indestructible. Aristotle answers that, while generating a diagram does just that, when the universe is generated, its contradictory states imply that change and time inhere in what is produced, and since change and time allow for something to be destroyed, what is generated cannot be indestructible, and the likeness is illusory in this respect. If this is the correct reading of the passage, then Annas could comfortably call Aristotle a constructivist about mathematical objects. [↑](#footnote-ref-10)
10. Sachs, trans. Modified: ‘thinghood’ replaced with ‘ousia.’ [↑](#footnote-ref-11)
11. *hōsper to diagramma gignomenon theasmenous… en men gar tē poiēsei tōn diagrammatōn pantōn tethentōn einai hama to auto sumbainei* (*On the Heavens*, 280a1-4). [↑](#footnote-ref-12)
12. Aristotle 2005, Sachs, trans. [↑](#footnote-ref-13)
13. Aristotle 1983, Hussey, trans. Modified. Hussey has “that which is counted and countable”. [↑](#footnote-ref-14)
14. Sachs, trans. [↑](#footnote-ref-15)
15. Translations are my own unless otherwise noted. [↑](#footnote-ref-16)
16. Sachs, trans. [↑](#footnote-ref-17)
17. Sachs, trans. [↑](#footnote-ref-18)
18. Sachs, trans. [↑](#footnote-ref-19)
19. Coope translates “there it is in position” (Coope 2005, 60). [↑](#footnote-ref-20)
20. The senses of precedence in *Met.* V. 11 include: i) nearness in place, ii) in time, iii) in motion, iii) in power, iv) in knowledge due to perception, v) in knowledge due to *logos*, and in the governing sense, vi) in nature and being (*ousia*). [↑](#footnote-ref-21)
21. Continuity, and therefore precedence as well, extends from the magnitude marked out by the poles of a change (e.g. white to black, Athens to Thebes) through motion, to time. Aristotle claims “it is because the magnitude is continuous that the change is too. And it is because the change is that the time is” (219a10-14). Hussey, trans. In the formation of the temporal number, change must have a characteristic that plays a role similar to magnitude. Motion, Aristotle says, “follows” spatial magnitude, while time “follows” motion: “it is because the magnitude is continuous that the change is too. And it is because the change is that the time is” (219a10-14). Hussey, trans. Roark and Hussey both argue that this is indicated by the word follow, *akolouthei*, in the claim that motion follows magnitude, while time follows motion. Hussey calls it “structure-preserving mapping” (Hussey, 144, cf. Roark, 82). [↑](#footnote-ref-22)
22. Bowin also answers the objection that if time is based on individual motions, time could not have a general coherent direction, by appealing to the simultaneity of motions. I propose a solution below in V: The Universality of Time. [↑](#footnote-ref-23)
23. Aristotle repeats this assertion at *Phys.* IV.11 219b24-5: “it is by the moving thing that we know the preceding and following in motion.” [↑](#footnote-ref-24)
24. It may be that a magnitude is itself only continuous insofar as it is articulated through *kinoumena*: if there is no sequence, there is no continuity, but sequence is grounded in the motion of a being. Imagine there is an indifferent quantity of space north of Athens. We begin to count it as a *distance* between Athens and Thebes when we define it as a continuity of a motion. This means that if, without a principle of unification, somehow the magnitude has continuity, this continuity nevertheless has no orientation. Without the orientation implied in a motion, a magnitude is not yet a distance from and to, and therefore there is no preceding or following in it. It is motion that arranges it into an oriented continuity, makes point X farther or closer than point Y. The *direction* or line within the magnitude is laid out by the concrete motion between the two cities. For there to be an oriented magnitude, i.e. a distance, it is not necessary for the distance to actually be traversed, only for there to be a body considered insofar as it is traversing it. Thus, what establishes the orientation of a magnitude, namely the body in motion, is what sets the preceding and following first of all into place. [↑](#footnote-ref-25)
25. The whole of the movement is prior to its division into parts. If this were not so, Zeno’s refutation of the possibility of movement would be successful. Parts of motions, for Aristotle, are not independent: their being depends on and points to the whole movement. Only by reference to the *telos* can Aristotle say that motion has occurred, because something of the end has come to be (*Met.* IX.8 1049b35-1050a2). [↑](#footnote-ref-26)
26. *hē d’arithmēton to proteron kai husteron, to nun estin.* “The preceding and following are in motion, and time is these as countable.” (*Phys.* IV.14 223a28) [↑](#footnote-ref-27)
27. Pascal Massie, by contrast, thinks that the now is a kind of motor that makes things perish, and thereby the source of the orientation of movements. This conflicts with the order of precedence indicated by *akolouthein* (Massie, 2009). [↑](#footnote-ref-28)
28. Cf. Hussey’s translation: “the now is the before and after [in change], considered as countable.” Bowin argues for this translation over that of Coope (“it is insofar as the before and after [in change] is countable that the now is [what it is],” Coope, 128) because it solves the problem of simultaneous times by relating them ultimately to movement. (Bowin. 2009). [↑](#footnote-ref-29)
29. When this oriented directionality is marked off by a limit, however, the division inherits the orientation of the line it marks off, and this—the now—can be counted. What does it mean to number it or count it? But which organized continuity does the now belong to? As I shall argue in the next section, Aristotle’s claim is that it belongs not to motion but to the newly constituted unit of time. See (19)-(21) and discussion, below. [↑](#footnote-ref-30)
30. Aristotle approaches this point from several starting places: i) the before and after are in time because time follows motion, which follows magnitude: “But since the preceding and following is in magnitude, it must also be in change, by analogy with what there is there (*analogon tois ekei*) [i.e. the oriented, moved body in the magnitude]. But in time, too, the preceding and following is present, because the one always follows the other of them” (*Phys.* IV.11 219a16-20). Furthermore, ii) the before and after are in time because the now is in time: “So since the nows are in time, the before and after will also be in time; for the distance from the now will be in that in which the now is” (*Phys.* IV.14 223a5-9), and so on. Hussey, trans. emended. McGinnis argues persuasively against the claim (in Annas, 1974, 110, Ross 1936, 67, and Hussey, 1993, 152-8) that *akolouthein*, ‘to follow’ means ‘be analogous to’ (McGinnis 2003, 157-8). [↑](#footnote-ref-31)
31. Cf. the section “For Time To Be Countable, It Must Be Counted” in Coope 2007, 169-170. [↑](#footnote-ref-32)
32. Aristotle. 1985. *Metaphysics: Books Zeta, Eta, Theta, Iota* (VII-X). Trans. and notes Furth, Montgomery. Indianapolis: Hackett. [↑](#footnote-ref-33)
33. Euclid, *Euclidis Elementa*, ed. J. L Heiberg (Leipzig: Teubner, 1883-1888). In 12.17, the example is the generation of spheres using arcs rather than diameters. [↑](#footnote-ref-34)
34. Thanks to an anonymous reviewer for pressing this point. [↑](#footnote-ref-35)
35. Removing the comma after *hēmin*. [↑](#footnote-ref-36)
36. The implicit claim suggested by these terms is that something must already *be* in order to happen, occur, or elapse. If this was granted, it would weaken the claim, since time would necessarily pre-exist being marked off. But this claim about the metaphysics implied by the word ‘happen’ is probably idiomatic to the semantic range of the Germanic word ‘hap’ (to occur, to find or come across by chance, to experience). But ‘happen’ also means ‘to ensue or result from,’ which seems to imply that what happens did not already exist. ‘To occur,’ from the latin ob-currere, ‘to run toward, to manifest’ means ‘to arise, manifest or turn up,’ but in English it tends to suggest that what occurs is not essential change, not by design, but by accident. The metaphysical connotations of these words are too subtle to be reliably attributed to the Greek. We should refer to the Greek rather than the English or Latin or Germanic to decide the case. [↑](#footnote-ref-37)
37. To argue that time must pre-exist the act of marking off, we would have to supply a Verificationist gloss on the phrase ‘is not without,’ *oux estin aneu*, e.g. ‘is not noticed or perceived without,’ that amounts to a much greater modification to the text than reading *gignesthai* as ‘to generate or produce.’ The reading I propose is more natural. [↑](#footnote-ref-38)
38. Sachs, trans. Accepting Harry’s argument that the meaning of *nous* in *Phys*. IV is not strictly the faculty of intellect: “rather, “nous” here means broadly the working together of sense and intellection in that, as we see in *De anima*, the faculties of intellect require sensation.” (Harry 2015, 52, cf. 60). [↑](#footnote-ref-39)
39. By the time we get to IV.14, we already have grounds to believe that time depends on soul. The argument of IV.11-12 has gradually prepared Aristotle to answer this question, notably in (36)-(39) his argument that although motion is ‘in’ time, it does not thereby depend on time for its being. He takes up the problem in IV.14 to deal directly with the worry that without time, motion could not exist, which he has not yet done. [↑](#footnote-ref-40)
40. Sachs, trans. [↑](#footnote-ref-41)
41. In the final clause Aristotle does not abandon the point, he raises the question about whether motion can exist without soul, not whether it can exist without time. Motion depends on souls to the extent that souls originate them. If there are other sources of motion apart from souls that can count, then motion can exist without time. Since souls that do not count nevertheless initiate motions, motion can exist without time. Add to this claim Aristotle’s multiple arguments that motion never ceases (e.g. *Met.* IX.8 1050b7-1050b28), and the claim that time is not, unless the soul counts it, clearly indicates that motion is a reality independent of time. [↑](#footnote-ref-42)
42. Cf. Harry 2015, 57-61. [↑](#footnote-ref-43)
43. Loughlin argues that time is where countable motions are. He makes the argument based on interpreting ‘the number that is counted’ as something concrete, and ‘that by which we count’ as the abstract number. His reading thus forces him to assert that what is marked off by the now is change, which conflicts explicitly with Aristotle’s assertion that “What is marked off by the now is thought to be time,” which I address in III.3, below (Loughlin, Tim. 2011. “Souls and the Location of Time in Physics IV 14, 223a16-223a29.” *Apeiron: A Journal for Ancient Philosophy and Science* 44:4, 310). This also makes him present Aristotle as appealing to abstract numbers to mark concrete ones, which conflicts with Aristotle’s anti-Platonic number theory. Certainly, the capacity to be counted is in things, but it is constituted in a relation to the soul capable of counting. My claim, by contrast, is that Aristotle takes the abstracted number to be ‘that which is counted,’ and ‘that by which we count’ to be the now (i.e. the number of the preceding and following, which follows the moved thing). [↑](#footnote-ref-44)
44. Hussey, trans. emended. [↑](#footnote-ref-45)
45. This is why Aristotle can say “the preceding and following is in motion, and time is *these* [i.e. the preceding and following taken as *two*] as countable” at *Phys.* IV.14 223a28-9. Since the ‘now’ is the mark that distinguishes preceding and following, insofar as it is countable, taking *two* of them together as different, i.e. taking them as plural, establishes the temporal unit. [↑](#footnote-ref-46)
46. Reading *horizei* with EV (which preserve *horizei* after *husteron*), Ross, and Prantl. The other MSSread *metrei*. [↑](#footnote-ref-47)
47. As we shall see below, this is not the only character of the now: it can also be independently counted, although no longer as preceding and following. The qualification ‘as’ indicates that there is another way to consider the now. I argue below that this is because the now has a numerical character different than its role in time: a now-point dividing a motion-line has two functions, namely uniting and separating two lines. These two functions are two different beings of the same point, and this difference allows us to give the now a number independently of its role in generating time. [↑](#footnote-ref-48)
48. While “a measure is that by which the amount of something is known; and it is either by a one or by a number that an amount is known… while every number is known by a one” (*Met.* X.1 1052b20-3) and “In all these cases, the measure and source is something one and indivisible, since even among lines, one uses the foot as though it were indivisible.” (*Met.* X.1 1052b32-4), therefore “it is clear that being one, for someone defining it most strictly in its literal sense, is being a certain kind of measure… what is one is what is indivisible, either simply or in the respect in which it is one.” (*Met.* X.1 1053b4-8). Sachs, trans. [↑](#footnote-ref-49)
49. Reading *tēs autēs* with EFGHJP. [↑](#footnote-ref-50)
50. Hussey, trans. [↑](#footnote-ref-51)
51. As we shall see, below, this abstraction is how there can be one comprehensive time, instead of an irreducible multiplicity of times. Motion, however, is particular, and its multiplicity cannot be reduced except through such abstractions. [↑](#footnote-ref-52)
52. John Thorp argued that *arithmos* is a hybrid of a count noun and a mass noun (Thorp 2017). This fits the argument of this paper, in which a measure (a length) generates a number (a count noun). [↑](#footnote-ref-53)
53. Chelsea Harry argues that any grasp of time requires a body: animals mark time by perceiving beings, while the noetic act of counting time actualizes the potential of *kinēsis* and makes it precise (Harry 2015, esp. 59-61). Bowin, 2017, keeps a sharp distinction between perception and thinking, but argues that the latter changes the former, but does so by arguing that perceiving nows is perceiving time (which I aim to reject in part IV, since nows correspond to the moving thing, not to movement, while time is the number of motion). [↑](#footnote-ref-54)
54. A key passage for her is the following: “Time is the number of the motion, and the now is, as the moving thing is, like a unit of number” (*Phys.* IV.11 220a2-3). Hussey, trans. This passage occurs in the midst of repeated descriptions of the ‘now’ as a limit or extensionless point, instead of as a unit. The solution to her difficulty is to specify exactly how the now is *like* a unit of number. To begin with, it is clear from the above discussion that the now is not a unit of time, since units are of the same type as what they measure, it is no part of time, but instead like a point to a line. The way that it is *like* a unit of number is that it plays the role in the following proportion: as the moving thing is to the expressed continuity of motion, so the now is to time. The first allows us to become aware of the second (*Phys.* IV.11 219 b24), and in addition the first also makes the second continuous and unified (220a4-6), and generates the second, causing it to come about. It is not necessary to take Aristotle’s claim here to be that the now *is* a unit, nor that it is a unit of time. [↑](#footnote-ref-55)
55. Others hold this position as well: Bowin (2017) claims that perceiving nows is perceiving time, while Massie (2009) appears to take the now as an extended indivisible structure, claiming based on *Phys.* 234a14-24 that part of the now is in the past and part in the future, and that it is marked off by limits (320). But this passage is a *reductio*, so the claims Massie concentrates on are not obviously Aristotle’s. [↑](#footnote-ref-56)
56. Hussey, trans. *Qua* replaced by ‘as.’ [↑](#footnote-ref-57)
57. On the meaning of *sunechei* as “holding”: “…the continuous is that which is next to something, but I call them continuous only when the limits at which they are touching become one and the same, and, as the name implies, hold together” (*Phys*. V.3 227a10-11). [↑](#footnote-ref-58)
58. Hussey, trans. Emended: ‘qua’ replaced with ‘as.’ [↑](#footnote-ref-59)
59. Hussey, trans. Emended: ‘definition’ replaced with ‘*logos,*’‘before and after’ replaced by ‘preceding and following,’ and ‘—‘ replaced by ‘:’. [↑](#footnote-ref-60)
60. Coope takes the identity in question to be an account of the identity of temporally dispersed nows (Coope 2005, 125-139). My account here instead concentrates only what the now is related to, and the structure of this relation. [↑](#footnote-ref-61)
61. The evidence consists of the word *arithmos* at the end of the following passage:“as a limit, therefore, the now is not time but has come along <with it>, while, as numbering, <it is a> number.” (*Phys.* IV.11 220a21-22, cf. VI.3 233b32-a4). The *hēi d’ arithmei, arithmos*, which Ross provides as a best guess for the concluding phrase, is problematic. Ross deems the text irretrievable (Ross 1936, 603). Annas defends keeping it as it is on the ground that we do not have a better solution. Themistius, Philoponus and Simplicius did not have *arithmos*, which meant the principal clause is omitted. Torstrik deems *arithmei, arithmos* a corruption. Firm conclusions cannot be drawn from it. [↑](#footnote-ref-62)
62. It might be that the irreducible two-ness of limits, which I discuss below, is what makes them numerable. A number, we saw in (4), is a multitude measured by the one. Therefore “The smallest number, simply, is two” (*Phys*. IV.12 220a27). The now, then, would have to be a multitude for it to be numerable. If it is a limit, what sort of multitude could a ‘now’ be? Because the now as a limit has multiple functions, it could be numerable in its own right. As a limit, the now genuinely has its own being, and is not reducible to the extent that it marks off. [↑](#footnote-ref-63)
63. Hussey, trans. [↑](#footnote-ref-64)
64. Hussey, trans. [↑](#footnote-ref-65)
65. Cf. Coope 2005, 150-3. [↑](#footnote-ref-66)
66. Hussey, trans. emended. Cf. the discussion of being-in, in the chapters on place: *Phys.* IV.3 210a14-25. [↑](#footnote-ref-67)
67. Annas 1976, 35 n39. For example, the panels and the triptych are in or measured by different numbers. Saying there is one is referring to the triptych, etc. [↑](#footnote-ref-68)
68. In *Phys.* IV.3, Aristotle distinguishes eight ways something can be in another. 1-2, the part in the whole and vis-versa, 3-4, parts of the form in the whole genus or definition and vis-versa, 5, as form in material, 6, as things are in the *archē* of change, 7, as things are in their *telos*, and as things are in a container. Things are in time as in a container, by which they have a number. [↑](#footnote-ref-69)
69. Hussey, trans. Emended: ‘change’ replaced by ‘motion.’ [↑](#footnote-ref-70)
70. Hussey, trans. Emended: ‘change’ replaced by ‘motion,’ ‘countable:’ replaced by ‘countable,’. [↑](#footnote-ref-71)
71. Hussey, trans. [↑](#footnote-ref-72)
72. Sachs, trans. [↑](#footnote-ref-73)
73. Hussey, trans. [↑](#footnote-ref-74)
74. See the discussion in Coope 2005, 113-124, and Bowin 2009, particularly 57-62. Bowin’s result works whether a now is a “stage,” as he calls it, or an extensionless limit, as I maintain. [↑](#footnote-ref-75)
75. See Roark 2011, 133-148 on the role of imagination. Kelly argues that *Met.* IX.6 distinguishes a ‘past in the present’ from a remembered past (Kelly 2005, 254-8) Bowin distinguishes between the act of perceiving indefinite temporal quantities and counting definite quantities (Bowin 2017). Yet he argues that whether it is done in perception or cognition, to grasp nows is to grasp time – a position that is untenable, we saw above, since a now is the number not of motion but of the moving thing. [↑](#footnote-ref-76)
76. If I ask “how long was I asleep?” to get an answer we generate a unit (e.g. an hour) by marking off a motion we have access to, and work backwards by tracing and imagining what happened, i.e. motions, and mark them off with the unit until we reach the moment I fell asleep. If there are no motions at all, then we say no time has passed (*Phys.* IV.11218b21-219a6). It is not time that we mark off, but motions. The division of time follows the motion: when one is thinking something indivisible, the time also is indivisible “a time is divided and undivided in the same way as length. So it is not possible to say what one thought in each half of the time, since there are no halves when it has not been divided, other than potentially. But by thinking separately during each of the halves, one also divides the time along with it, and then it is as if there were separate lengths; but if one thinks in a way that is made out of the two halves, one also thinks in a time that applies to both” (*Soul* III.6 430b9-14. Sachs, trans. Modified: ‘duration’ replaced by ‘length’.) [↑](#footnote-ref-77)
77. Sachs, trans. Consider also the way that judging whether a life was happy or good (*Nicomachean Ethics* I.10), or whether a body had the ability to be healthy (*Metaphysics* IX.7) is also judging retrospectively in light of a principle. [↑](#footnote-ref-78)
78. If this account is accepted, what does it mean for the now to correspond to the moved body, the *kinoumenon*? The now is always other; how is this related to its role as dividing and also unifying? The *kinoumenon* must not only be continuously other, it must also be continuously, actively being the same. [↑](#footnote-ref-79)