Abstract: In interpreting Aristotle, the only tenable way of thinking the relationship between time and motion is that time is not motion, but is inseparable from and belongs to motion. This paper works out what this means: what makes time both different from and dependent on motion is that it is the number of motion. But in counting time we are not counting whatever we use to count with, namely, the 'now,' we are counting time. For Aristotle, all motion is basically articulated, and when we mark off these articulations as limits or 'nows,' the number that arises from them is time. Put otherwise, movement is related to number because it generates a before and after, a 'now'. Movement itself, however, is not numerable: by marking off movement, the before and after have delimited that which we number, namely, time. That is, we mark off movement with before and after, but in doing so we do not count movement, nor do we count 'nows' with which we number, we count time. Thus Aristotle's account of time does not presuppose the existence of time, nor does it reduce time to motion. It does not assume that time is linear or composed of discrete moments. It grapples with and gives an account of the original possibility of time.

Introduction

In interpreting Aristotle there are four possible ways of thinking the relationship between time and motion. According to the first, time and motion are independent things, and time is related to motion only insofar as we become aware of it by comparing a quantity of motion with a span of time.[1] The second possibility is that time and motion are simply the same thing. The third is that time and motion have nothing to do with each another. The only remaining option is that time is not motion, but is inseparable from and dependent on motion.

Though the first two are popular interpretations of Aristotle, upon reading Aristotle's preliminary description of time, it is clear that none of the first three are tenable[2]: time and motion cannot be independent, for, he says, "time is either movement or something that belongs to movement" (219a8-9). Nor is time simply movement: "Since… it is not movement, it must be the other" (219a9). That is, the only way to understand time is the last option: "It is

[1] Bostock assumes that this is Aristotle's account of time, and this assumption leads him to argue that Aristotle's text is a hornet's nest of self-contradictions. Cf. David Bostock, "Aristotle's Account of Time" *Phronesis* 25 (1980), 148. Ursula Coope's article "Why Does Aristotle Say That There Is No Time Without Change?" in *Proceedings of the Aristotelian Society* 101 (2001) criticizes this position in her arguments against W.D. Ross and G.E.L. Owen's article "*Tithenai ta phainomena*" in *Logic, Science and Dialectic*, 1986, ed. Martha Nussbaum (Ithaca: Cornell University Press).

[2] In addition, the first and third are crippled by the presumption that we already know in advance what time is.

evident, then, that time is neither movement nor independent of movement" (219a1, cf. 219a8-9).[3] So what does this mean, and how can time be inseparable and yet different from motion?

According to Aristotle, that which makes time both different from and dependent on motion is its being-a-number. In chapters 10-14 of the *Physics* he refines his earlier description into the following definition: "time is not motion except insofar as the motion has a number… Time therefore is some sort of number" (219b3-6).[4] Immediately, he observes:

> (1) "Time obviously is what is counted, not that with which we count: these are different kinds of thing" (219b6-7).

But this distinction, though clear, seems to create more trouble than it resolves. Here Aristotle argues that in counting time we are not counting whatever we use to count with – motion, or, as we shall see, the 'now', but we are counting time. What, then, is number, if it is not what we use to count? What do we count time with? Again, how is the number related to motion?

After a short discussion of the 'now,' Aristotle specifies further that "time is 'number of movement in respect of the before and after'" (220a24). Time is 'of' the before and after in movement. So to understand time, first we must grasp what he means by before and after: if we can say how they are 'in' movement and the way that number is 'of' them, then we can grasp Aristotle's account of time. Put the other way around, any account of the 'now' must clarify the relationship between time and motion. The challenge, then, in the interpretation of Aristotle's text, is clearly to work out how the before and after ('nows') make a number (time) out of motion.

Method

Some argue that Aristotle's account of time loses its way by equating time with motion or by presupposing both time and motion, but Aristotle's argument clearly maintains that they are equal, but that time depends on movement, without being reducible to movement. His distinction between 'that with which we count' and 'that which we count' is central to

[3] Trans. R.P. Hardie and R.K. Gaye, *Physics* in *Basic Works of Aristotle*, Ed. Richard McKeon (Random House). Translations of Aristotle are from this text unless otherwise noted.
[4] Joe Sachs, *Aristotle's* Physics: *A Guided Study* (New Brunswick: Rutgers U.P., 2005), 124.

understanding this relationship between time and movement correctly. In this paper, by upholding this distinction, on the one hand, and showing how it is possible to maintain the distinction, on the other, I show how motion, time, and the now differ from one another. This paper, then, takes the distinction between 'that with which' and 'that which we count' into three readings of Aristotle: Annas, Pickering, and Coope, and attempts to learn what work it does in Aristotle's account of time.

Thus, if time *is* the number that is counted, and 'now' is that *with which* we count, the motion is that *of*, *from* or *according to which* we count. In short, looking at motions we mark off 'nows,' which are not motions. The number generated by these 'nows' is time, a different thing than motion, which depends on movement for its appearance and continuity, but which is appropriate to different movements. Time is a mode of our experience of movement.

Annas

Aristotle's account of time as number is guided by his account of the generation of number. If we omit this insight, as many commentators have, then we miss what distinguishes Aristotle's account of time, and overlook the difference between number and magnitude. Just as counting generates number, the way we use 'nows' to count generates time. The 'now' is not *what* we count, but that *with which* we count.

In the article "Aristotle, Number, and Time" Annas argues that the idea of counting and measuring in *Metaphysics* I could help to explain the meaning of number, and therefore of time. If we are to count, we must specify in advance what unit we are counting, e.g. centimetres, lettuce, cows. The unit is arbitrary, but once marked off it is the principle of counting, so that taken as a unit, "one is a measure of number" (Annas, 99) (1052b20-24). Annas argues that for Aristotle counting or numbering what forms the unit of measure, showing how number ("how many") is related to measure ("how much"). As the principle of counting the unit is arbitrary but basic and indivisible, portions of centimetres being measured in millimetre units, etc. (1052b32).

The advantages of this account, Annas says, are that things are counted by something of the same kind (Annas, 100). We can add that, unlike for Plato, the 'one' is just a thing in the world; there is no need for a separate 'number itself' or 'unit itself.' The number arises in the act of counting, and obtains only in the act itself.

Annas remarks that 'nows' are not units of time: we use them to mark off units or to form the unit of time. Aristotle says that the 'now' is that limit with which we mark off time, the way a point marks off a line. Time is not the now, but is formed by marking off 'nows':

> (2) Hence time is… number… as the extremities of a line form a number, and not as the parts of the line [or points on a line] do so. (220a13-15)

Two 'nows' form one number of time: |_____1_____|.[5] The two extremes may be arbitrary or changing but the middle is the same, a number: time (219a27).

What Annas would like to hear based on her reading of *Metaphysics* I, is that once we mark off a unit there is a second step, in which we then use it to measure other things, and she raises a difficulty based on this: the 'now,' she says, seems sometimes to be a unit, sometimes to be a point. In other words, it looks like Aristotle confuses 'now' with time, i.e. confuses 'that with which' we count and 'that which' we count.

There are a number of problems with this, but Annas's difficulty can perhaps be addressed by saying that in the first few passages of his treatment of time, Aristotle is not interested in describing how we quantify time, but interested instead in giving an account of how time is possible in the first place, that is, how we come to experience time in our experience of movement. This is to describe time as *number*, and not yet as measure. The second step of describing how we *measure* the magnitude of things, is relatively easy to explain, once we have a phenomenon of time to use as a unit, and Aristotle does discuss later how time and motion seem to measure each other.

In general, approaching the problem of time by asking 'how do we quantify time?' is very different from asking 'what makes time happen?' The first question presupposes that time

[5] Thus 'one' and 'two' imply one another. Any 'one' is already a 'two'. Thus "the smallest number, simply, is two… For example, of a line, the smallest number is two, or one, but in magnitude there is no smallest" (220a26-29). Sachs, 123-4.

exists. But Aristotle does not assume time exists already. It seems to be nothing, but we know it is comes along with motion. But the way that time comes with motion is through the 'now'. In short what generates time as number is not comparing units, but counting motion. Annas's analysis makes the act of *measuring out* more fundamental than the act of *numbering motion*: Aristotle says "time is not defined by means of time, neither by being a certain amount of it nor a certain kind" (218b15-16).[6]

The 'now' for Aristotle only ever means a limit, and according to (1) above, the *unit* of time is just a number of motion. To sort out the relationship between 'now' and time, we must introduce the term missing from Annas's analysis: motion.

Pickering as a response to Annas

In his article "Aristotle on Zeno and the now", Pickering works out the relationship between the 'now' and motion, arguing that, as a point, the 'now' cannot compose time.[7] Zeno argues that at any point an object must be at rest. Aristotle argues to the contrary, that at the 'now' there can be neither motion nor rest. In his first refutation, he says, "time is not composed of indivisible nows, any more than any other magnitude is composed of indivisibles." (*Physics* VI.*9* 239b5-9) Aristotle's second formulation again argues a related point, that Zeno is wrong to say that "that time is composed of nows" (*Physics Z*.9 239b30-33). He argues that a limit can never be a quantity, and can never compose time, rejecting Zeno's argument on every count.

We can outline the positive result of Pickering's analysis as follows: motion and rest are always through a period of time (i.e. that which rests or moves is in time). A period of time is a constituent of time, and is infinitely divisible. But insofar as it divides, a 'now' is not extended, and cannot be a constituent of time. Therefore there is neither motion nor rest in the now, and Zeno's argument is rejected. The 'now' can't belong to movement or rest because it is already something different.

[6] Sachs, 120.
[7] F.R. Pickering, "Aristotle on Zeno and the now", *Phronesis* 23 (1978), 253-257.

We conclude that the 'now', then, generates number, but is not what we number. Furthermore, it marks off movement, but differs from movement since it is a limit and not continuous. Though it is in movement and appears as an articulation of movement, it differs from movement.

The 'now' is within motion in such a way that, in remarking that this lemon has moved, we have marked off the movement with 'before, it was there' and 'after, it was here'. And looking at the before and after, we have a number laid out between them, namely time. But does this account for the dependence of time on motion, and the fact that there is no motion without time? Put otherwise, if time is the number of movement, does the 'now' give us the 'of-structure' that relates them? Two problems remain to be clarified: (i) does this account of the 'now' explain how there is no time without motion, and no motion without time? And (ii) why does Aristotle say that time is what is numbered, and not motion? We shall turn to Ursula Coope for a discussion of (i), and conclude with an answer to (ii).

Coope

In her article, "Why does Aristotle say that there is no time without change?" Ursula Coope does not discuss the 'now' but points out that the relationship between time and change is asymmetrical. The current standard reading of time in Aristotle is verificationist, as follows: "time involves change because the awareness, or realisation, that an interval of time has elapsed necessarily involves the awareness of changes occurring during that interval."[8] To be both aware of time and able to measure it, they say, we must be aware of motion.

Coope points out two weaknesses in this verificationist reading: 1) "some of Aristotle's remarks seem strangely beside the point."[9] For example, (i) there no time without change. But on the verificationist interpretation time is there already, it is only that we do not *notice* it in the absence of change. (ii) This reading is completely unable to explain why for Aristotle there is no change without time. If these failures were not crippling, verificationists must also 2) add a

[8] S.S. Shoemaker, "Time without change", *Journal of Philosophy* 66 (1969) 365-366.
[9] Coope, 361.

crucial premise that is missing from his argument, namely, that there is no undetectable passage of time.

In general we can say that the verificationist account introduces a distinction between epistemology and metaphysics that is foreign to Aristotle. Verificationism assumes that time is ontologically independent of motion, even though it is epistemologically dependent on motion. They assume an ontological symmetry, and shift the asymmetry into an epistemological framework. Yet Aristotle's assertion that "time is neither movement nor independent of movement" but belongs to movement does not distinguish between epistemology and ontology(219a1). It seems to be an 'ontological' assertion, though as Coope observes, the grounds for it lie in what we say about time.[10]

Because time is the number *of motion*, Coope says, the claims 'no time without change, and no change without time' are asymmetrical. There is no time without change because time depends on, or comes from motion. But, we can add, when it comes to the claim 'no change without time,' Aristotle's point is not that change depends on time, e.g. to be measured, but rather that to be able to say there is motion we must already mark it off with before and after: to experience motion is to articulate it into 'before' and 'after'. In a word, whenever we say there is motion, we can also say there is time. Aristotle concludes from this asymmetrical relationship that time differs from, but belongs to change.

The Asymmetrical Relationship between Time and Motion

But if in Aristotle the 'now' is what relates and distinguishes time from motion, the asymmetry between these two is part of the structure of the 'now'. It remains to us to show how the 'now' begins with motion, but gives us time. The 'now' is a great source of confusion in the

[10] Coope responds to verificationism by saying that Aristotle's account consists in working out the principles of the common opinion of time. But this is not a complete response, since it does not tell us what time is, or its relationship with change. Nevertheless, it does point us in the right direction. For it is significant that Aristotle's method involves an investigation into what people say: "whenever we do perceive and mark [change] off then *we say* that time has happened." (Sachs, 121, my italics) That *we say* it is so is enough for Aristotle to conclude that it is so. This is not a naïve move: the origin of logical analysis is precisely an investigation (Aristotle's *Categories*) into the ways that it is appropriate to say things – an argument that would be re-hashed by Wittgenstein several thousand years later. The upshot for our present purpose is that marking off time is something we do insofar as we are logical beings – living beings with speech. To mark time is already an act of speaking.

interpretation of Aristotle because readers often assume that it merely demarcates a quantity of motion. After all, Aristotle says the "'now' is the same in substratum as motion, but differs from it in definition" (219a19-20). But differing in definition means that the 'now' does not demarcate motion, it demarcates *time*. As Aristotle writes: "what is bounded by the 'now' is thought to be time" (210a29). Insofar as the 'now' is a limit (as the extremities of a line are limits), the now bounds time. So the 'now' seems to mark off motion, but though it is in motion it points us away from motion and toward *time*. It marks off motion, and in doing so, bounds *time.* We have already seen that the 'now' is in this particular motion here before me, namely as 'before' and 'after':

> whenever there is a motion, there is a before and an after in it [a limit, a now]. But surely being before-and-after is something else and not motion. [so far Pickering] But we recognize time whenever we mark off a motion, marking it off by means of a before and an after. And that is when we say that time has happened. (219a19-20)[11]

It follows that even though it marks it off, *the 'now' is not motion and does not bound motion*, i.e. it is not stuck to this motion here by which we mark out time. But if it is not motion and does not bound motion, what is it? In marking off motion the 'now' defines not motion, but time: in marking off motion, but it numbers time.

However, though the 'now' is not motion, it is not time either. For 'now' is 'that with which we count,' while time is 'that which we count.' How is the 'now' different from both motion and number? The 'now' divides motion, but bounds time. In a very difficult passage, Aristotle works out the meaning of the phrase 'in respect of before and after':

(3) …it is clear that the now is no part of time, nor is the division part of the motion, just as neither is the point any part of the line, but it is two lines that are parts of one line…. [notice Aristotle made the same argument about motion] but insofar as it numbers, it is a number. For the limits belong only to that of which they are the limits, but the ten which is the number of these horses belongs also elsewhere. (220a19-23)[12]

[11] Sachs, 121.
[12] Sachs, 123.

Aristotle says, first, that though the 'now' bounds time, it is not time, that is, not the number that we count. Furthermore, though the 'now' divides motion, it is not part of the motion. The 'now' gives rise to number from within motion without being motion.

Second, Aristotle says that because it belongs to time, the 'now' does not limit and belong to a specific *motion*, but is a number that can fit elsewhere too. Contrary to Annas, once we mark off the unit, we do not henceforth merely apply the unit to measure other things: we always measure again using the limit, the 'now,' and only then compare times using stretches of units. It is not the unit that gives us the measure of a thing, but the marking off.

Gathering these points together, we can say that it is not by counting 'nows' that we get time, it is in marking movement with 'nows' that a number appears, corresponding to the stretch between them. So we can say the 'nows' are *two* limits only insofar as they delimit time. As generating number the 'now' is not thereby what we count. In a word, the argument here is that the 'now' belongs to time, but because from movement it generates a *number*, the 'now' does *not* belong to movement, but like number belongs elsewhere also.

It can be said, then, that insofar as movements articulate and differentiate themselves, time arises in the movement of things, though it is numbered by a soul. In other words, movement lays out 'nows', and, using these to count, the soul generates time.

Conclusion

So on the one hand, the 'now' differs from movement for two reasons: it is carried in it like a body that stays the same while being carried along in a motion, and as a limit it distinguishes the 'before' of the motion from the 'after' (219b12-219a32). On the other hand, the before and after that it generates are certainly no longer motion, but something else, which, when there are two, are numerable. And this gives rise to time.

In conclusion, if we hold to Aristotle's distinction between 'what is counted' and 'that with which we count' we can sort out the relationship between time, motion, and the 'now'. In Aristotle's account, movement is related to number because it generates a before and after, a 'now'. However, movement itself, according to Aristotle, is not numerable: by marking off

movement, the before and after have delimited that which we number, namely, time. Put otherwise, we mark off movement with before and after, but in doing so we do not count movement, we count *time*. Therefore, because it is 'what is counted', time is not motion, nor is it the number of 'nows' with which we number, but only the number of motion.