4-20-2007

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Tiberiu Popa
Butler University, tpopa@butler.edu

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On the (In)consistency of Aristotle's Philosophy of Time

Tiberiu Popa (Butler University)
Presented to the Society for Ancient Greek Philosophy at the Central Division meeting of the American Philosophical Association, April, 2007

I

One of the most baffling problems considered by Aristotle in his Physics is the nature of time. Does time exist in any robust sense? If it does, what is its essence? A promising, if only partial, solution to this aporia seems to be the connection between time and soul. Aristotle begins by rejecting the identification of time with notions such as movement, especially the movement of the sphere of fixed stars (218a30 ff., 223b21 ff.) and he thoroughly excludes the possibility that time is identical with the outermost celestial sphere. His resistance to theories that reify time (theories presumably cherished by the Pythagoreans and by Plato) is indeed in keeping with the privileged place he assigns to mind or intellect (nous) in his discussion of time. In modern terms, Aristotle denies that time can characterize physical events independently of conceptualizing percipients. The problem is formulated squarely in Physics Δ 14, 223a21-29, where he appeals to a counterfactual in order to show that without soul there could be no time:

Whether time would exist or not if soul did not exist (mē ousēs psuchēs), is a question that may fairly be asked; for if there cannot be someone to count (tou arithmékontos) there cannot be anything that can be counted, so that evidently there cannot be number; for number is either what has been counted or what is countable (arithmēton). But if nothing but soul, or in soul reason (psuchēs nous), is qualified to count, there would not be time unless there were soul, but only that of which time is an attribute, i.e. if movement can exist without soul, and the before and after pertain to movement, and time is these qua countable (arithmēta).1

The existence of time appears to hinge on two factors: the occurrence of changes and the possibility that those changes may be perceived by some soul. Troubled by the lines I am referring to, Ross notes that “since the discussion is very brief and Aristotle nowhere recurs to the subject, we need not suppose that he attached much importance to the answer he gives.” (1966, p. 68) Ross’ remark is the paradigmatic case for a blanket dismissal of Aristotle’s mind-dependence theory of time, as a sort of whimsical afterthought. Other commentators (Owen, for instance) prefer to tacitly avoid the difficulties raised by the incriminated Physics passage.2 Fortunately, however, more recently there has been a steady tendency to take Aristotle’s mind-dependence theory of time very much in earnest (e.g. Conen 1964, 156-68; Annas 1975, 97-113; Sorabji 1983, 84-94; Bolotin 1997, 47-62).

The chief goal of my paper is to reconsider a crucial ingredient of his theory – that figures quite prominently in that celebrated passage in Ch. 14 - namely the notion of ‘number’, and to emphasize the fact that Aristotle’s view on the relation between mind and the existence of time is far from being grounded solely on that passage.

II

Aristotle’s use of ‘number’ remains a particularly puzzling feature of his account of time. While Plato assigned independent existence to numbers, Aristotle insisted that numbers have no reality independently of mental operations like counting. As Annas convincingly demonstrates, Physics Δ, 10-14 agrees in broad lines with Metaphysics M and N (as well as with aspects of Met. I) where Aristotle thoroughly rejects Plato’s standpoint on mathematical objects. He maintains that “the objects of mathematics are not substances in a higher degree than bodies are” and that “they cannot exist somewhere apart” (1077b11 ff.; cf. 1076a38 ff., 1077b5 ff.).

Indeed these lines may indicate one of the main reasons why Aristotle chose ‘number’ (arithmos) as the key-term in his definition of time (“time is the number of change / motion with respect to the before and after”, 219b2). In the light of Metaphysics M and N, it is sensible to suppose that time was defined as ‘number’, among other reasons, in order to draw our attention to the somewhat fragile ontological condition of time, similar to that of mathematical objects. Just like numbers, time, according to Aristotle, is not to be thought of as having any existence

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1 My quotations from the Physics follow the translation made by Hardie and Gaye (in McKeon 1941), with slight modifications.
2 For a brief description of the various approaches to those lines in Ch. 14, see Conen 1964, 156-68.
apart from mental operations - or apart from the possibility of performing such operations (as well as from change, in the case of time).

Aristotle’s treatment of the concept of ‘number’ is certainly complex and intricate and, on occasion, it even appears to be slightly inconsistent (there is, for example, a certain hesitation between taking time to be numerus numeratus and considering it a numeros numeros). One crucial facet of his treatment is the connection between time and measure. Annas, more than others, draws our attention to the semantic similarity of ‘number’ and ‘measure’ in the Physics account of time and champions the thesis that ‘number’ and ‘measure’ are used by Aristotle virtually interchangeably. She ingeniously finds her argumentation on the first three chapters of Metaphysics I and notes that "whereas we regard it as natural to think of measurement as applied arithmetic, Aristotle regards counting as a kind of pure measuring." (Annas 1975, 100) true enough, the distinction between the two concepts is by no means easy to make: if we distinguish - or ‘number’ - equal temporal segments and use them as a sort of yardsticks, we can ‘measure’ the span of a certain movement.

I believe, however, that ‘number’ and ‘measure’ are at most partially synonymous in the account of time. One should be mindful of the distinction suggested by the functional distribution of the terms ‘to count’ / ‘number’ (arithmein / arithmos) and ‘to measure’ / ‘measure’ (metrein / metron) in Physics Δ. For example, it is quite seldom that one is said to ‘measure’ movements or time, rather than to ‘count’ different stages in a movement. There are somewhat more passages in the Physics in which time itself is said to ‘measure’ motion. Nevertheless, ‘measure’ is primarily and consistently used in reference to motion - to motion in general and more particularly to the circular motion of the outermost celestial sphere (whose regular and unfailing rotation provides the ultimate ‘measure’ for everything). The verb ‘to count’ is not used even once in reference to the ‘heavenly clock’, the sphere of the fixed stars, which is only said to measure time. ‘Number’, on the other hand, is always used with regard to time, to the ‘now’ or to our perception of change. For example, in 223a21-29 (the passage on mind as a prerequisite for the existence of time) there are eight occurrences of arithmos and various derivative forms, while there is no occurrence at all of metron or metrein.

The concept of ‘number’, unlike that of ‘measure’, is also employed in order to emphasize the unity of time: if we consider two groups of different beings – say ten horses and ten dogs, the same number, ten, is applicable to both groups. Similarly, several movements can occur simultaneously in the same time / ‘number’. In such contexts, ‘measure’ becomes relevant in one’s comparing a certain temporal segment (or rather a change that ‘covers’ that span) to an ongoing change, and in thus determining how much motion, for instance, has taken place. Conversely, time itself can be ‘measured’ if the unit of measurement we take into account is a given ‘amount’ of change. As I have already mentioned, the motion of the outermost celestial sphere provides the most reliable unit for measuring time. But motion is never said, not even metaphorically, to count time or anything else.

Multiple distinctions between ‘number’ and ‘measure’, ‘counting’ and ‘measuring’ emerge thus clearly. Unlike ‘measure’, ‘number’ is essential to the nature of time. ‘Counting’ often concerns an intellectual operation, namely the discernment between different moments or phases in a change – a point that I am going to further elaborate in the next section of my paper. Also, the entire Chapter 11, centered on the definition of time does show – from an empirical standpoint - that the existence of time depends on ‘counting’, not on measuring.

While this correspondence (rather than interchangeability, as Annas puts it) between number and measure, counting and measuring, is hard to deny in several passages, it is stressed by Annas to such an extent that other, equally important aspects of Aristotle’s treatment of the concept of time are almost ignored.

III

3 E.g. 220b15 – metroumen.
4 E.g. 220b3 ff., 221b7 f.
5 220b14 ff. etc.
6 E.g. 223b32 f.
7 E.g. 220a20 f.
8 224a2 ff., cf. 220a27 ff.
9 220b32-221a3.
10 When we notice some change in the sublunar world, we are at least theoretically able to compare that change with the pace of the sphere of the fixed stars. Thus we have a standard by means of which we can determine the span and speed of any movement that our senses grasp. As Thomas Aquinas puts it, “whoever perceives any motion, either existing in sensible things or in the soul, perceives the first motion from which time follows.” (257)
Aristotle spends considerable effort trying to make it clear, throughout chapter 11 for example, that our perception of change or movement is pivotal to the nature of time. The definition of time, including the reference to number, stems precisely from a long set of passages and suggesting illustrations that focus on our awareness of becoming. Initially Aristotle strives to demonstrate that there cannot be any time without change. It becomes clear, however, that a second precondition for the existence of time is intertwined with this first one: namely, the possible presence of souls able to discern the various phases of a change (in subsequent passages Aristotle will say in the same vein that time must be countable if it is to be time indeed):

(…) When the state of our minds does not change at all, or we have not noticed its changing, we do not realize that time has gone by (ou dokei hēmin gegonenai chronos), any more than those who are fabled to sleep among the heroes in Sardinia do when they are awakened; for they connect the earlier ‘now’ with the later and make them one, cutting the interval because of their failure to notice it. (…) If, then, the non-realization of the existence of time happens to us when we do not distinguish any change, but the soul seems to stay in one indivisible state, and when we perceive and distinguish we say that time has elapsed, evidently time is not independent of (ouk estin aneu) movement and change. (218b20-219a1)

In a way Ch. 11 prepares the ground for the apparently radical claim made in Ch. 14, where Aristotle contends that there cannot be time in the absence of any entity capable of perceiving change (more technically: of 'counting'). It is important to note that the references to our perception of change, made repeatedly in Ch. 11 and later on, are not simply a propaedeutic maneuver meant to lead the listener / reader from what is more knowable to us towards what is more knowable in nature (i.e. to the real nature of time). Indeed such persistent references allude rather transparently to the fact that our perception of change is constitutive to the very nature of time, to its ontological condition (and this, of course, is made thoroughly clear in Ch. 14, 223a21-29). Let me quote the passage in Ch. 11 that includes the definition of time:

When, therefore, we perceive the ‘now’ as one, and neither as before and after in a motion nor as an identity but in relation to a ‘before’ and an ‘after’, no time is thought to have elapsed, because there has been no motion either. On the other hand, when we do perceive a ‘before’ and an ‘after’, then we say that there is time. For time is just this: number in respect of ‘before’ and ‘after’ (arithmos kinesis kata to proteron kai husteron). (219a30-219b2)

From Aristotle’s formulation, it is reasonably clear that the definition of time rests firmly on the numerous remarks he made about our perception of change. It should be plausible, then, to affirm that the reality of time depends on the occurrence of change(s) in the physical world as well as on our capacity to discern various stages in any change we observe. If the definition of time, centered on the notion of ‘number’, is tightly bound up with what precedes, then ‘number’ and ‘counting’ are not always necessarily interchangeable with ‘measure’ and ‘measurement’, but are also intended to direct our attention to our awareness of becoming. Aristotle’s attention turns to ‘measure’ and ‘measuring’, underlining the ‘instrumental’ aspect of time, only after spelling out what time is essentially. And even after the enunciation of what time is Aristotle often resorts to ‘number’ and ‘counting’ in a manner that hardly evokes any measurement. (E.g. 219b28: “…It is in so far as the ‘before and after’ is countable that we get the ‘now’.

Thus number appears here to signify the multiplicity of various stages, like the various segments of a film, in contrast to the oneness of an instant (‘now’), static and comparable with a single picture, or, rather, with a point on a line. To judge by the considerations that precede the definition of time, ‘counting’ chiefly conveys our capacity to distinguish between different moments (or stages in a movement).

The notion of nun (‘now’) acquires much weight here (like several other terms belonging to what McTaggart famously called the “flowing series”). It is certainly impossible to count ‘nows’ stricio sensu, on Aristotle’s account, since there are infinitely many ‘nows’ between any two cross-sections in the flux of time, which is a continuum. In other words, since time is not a string of definite temporal items or time-atoms, we cannot properly count durationless ‘nows’. At the same time, our perception of any change (the distinction between ‘before’ and ‘after’) unavoidably entails our awareness of the immediate present. Aristotle does not explain for us in a satisfactory way what makes our awareness of the immediate present (and of our own perception of becoming - a faculty presumably requiring nous) even possible, if a ‘now’ is durationless. It may be the case that in certain passages he uses ‘now’ in a loose manner and assigns some duration to it – a point made persuasively by Bolotin in his 1997 paper.

Comparing Aristotle with contemporary thinkers is often a tempting but potentially perilous enterprise. Nonetheless, I will venture, however, to note that Aristotle’s view on time seems to agree basically with Adolf Grünbaum’s, among other contemporary philosophers. Grünbaum writes that:
My characterization of present happening or occurring now is intended to deny that belonging to the present is a physical attribute of a physical event E which is independent of any judgemental awareness of the occurrence of either E itself or of another simultaneously with it. (1971, p. 209)

The mind-dependent character of becoming has been intensely debated by contemporary thinkers. Adolf Grünbaum’s paper on The meaning of time (1971) - although of course it is not intended at all as a commentary on the Physics – shares, I believe, a few important points with Aristotle’s theory. Grünbaum notes that:

Becoming is mind-dependent because it is not an attribute of physical events per se but requires the occurrence of certain conceptualized conscious experiences of the occurrence of physical events (p. 197). (cf. Bolotin 1997 passim)

Thus it seems to me that Aristotle’s theory of time is worth pondering not only from a historical perspective, but also for the very density of its philosophical core, as it becomes clear that the aporiai Aristotle was at grips with still deserve attentive scrutiny nowadays. What I have hoped to convey today is that Aristotle’s mind-dependence theory of time does not rest on only one passage, but on relatively large sections of Physics Δ (esp. Ch. 11), and that his appeal to the notion of number (arithmos) fulfils a cluster of functions, one of them being to emphasize that our awareness of becoming (in addition to change itself) is a fundamental condition for the existence of time. In short, (contrary to what e.g. Annas notes – p. 108) the very marking off of different nows can amount to ‘counting’, even without resort to any temporal unit of measure.

IV

Now, if time depends for its existence not only on the occurrence of changes, but also on our capacity of perceiving changes and if indeed ‘counting’ is not always interchangeable with ‘measuring’ but can also signify our ability to discern between various stages in a movement or change, there remains one more point that I would like to signal here, rather than solve in any peremptory fashion. The problem that I would like to address now, at the end of my presentation, is whether, according to Physics Δ-10-14, other animals than human beings are able to perceive temporal becoming, to distinguish between different ‘nows’ and the spans delimited by them. In other words, the question has to be answered whether time is anthropocentric in any significant way in Physics Δ. In the first part of Ch. 11 Aristotle uses only examples explicitly pertaining to the human nature. At 223a21 ff. (the crucial passage in Ch. 14), however, he does not refer specifically to humans, but rather vaguely to “what (who) will count (or: is able to count)”; in Greek: tou arithmēsontos. He is convinced nonetheless that only the soul, and in soul reason, is able to count (223a25). What is the point in making this qualification?

For Aristotle, thought or reason is an attribute of man and in a peculiar way, of God. So, according to this passage, there should be only two types of beings capable of perceiving time. Yet, if God thought of whatever pertains to the sensible world, God would no longer be eternal and unchangeable in every respect. To presume that Aristotle’s God perceives time would entail serious difficulties and would conflict with Metaphysics A, in which the prime mover is considered to be the sole object of his own thought.

Does Physics Δ suggest that humans are the only beings able to perceive time? If the right answer is yes, and if it is a reasonable enterprise to contrast the Physics with De memoria in certain respects, I would like to point out a possible inconsequence in Aristotle. In several passages of De memoria, memory is said to be “a function of the primary faculty of sense-perception, i.e. of that faculty whereby we perceive time.” And also: “Hence not only human beings and the beings which possess opinion or intelligence, but also certain other animals possess memory.” Memory, just like the perception of time, is basically a function of the “primary faculty of sense-
perception”. Sense-perception is of course shared by man and the other animals (cf. *De anima* 413b3 ff.). The implication of this fact is that, in *De memoria*, Aristotle does not deny at all that other animals can perceive time. But this seems to clash with the claim, in *Physics* Δ 14, that *nous* (and implicitly the ability to count) is a prerequisite for the existence of time.

If in *Physics* Δ it is only human beings that are deemed qualified to perceive time, then time curiously becomes ‘anthropocentric’. If *Physics* Δ10-14 is to be reconciled with the account of *De memoria*, then we have to assume that time, in Aristotle’s opinion, is simply liable to be perceived in several ways. But I prefer to confine myself only to posing this problem, rather than attempting to solve it in definitive fashion.

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