Notes on Aristotle's *Physics*

1. IV.x
   a. The tenth chapter of the fourth book of the Physics marks a "fresh start" for Aristotle. He sets aside certain questions of motion in general in order to focus more exclusively on the problem of time, which turns out to be filled with paradoxes.
   b. The basic questions are:
      i. Is time "one of the beings?"
      ii. This is reframed by the moderns as: "does time exist?"
      iii. What is the "nature" (*physis*) of time?
      iv. How can time 'be' (in the present tense; *esti*) if it is made up entirely of the no-longer and the not yet (past and future tenses)?
      v. It would seem that the now would be the only part of time that is present, but is there such a thing as a 'now' in time? (No!)
      vi. More literally: is the now (*nyn*) a "part" of time (*meros chronou*)?
   c. Axiom: No now can be set alongside another now.
      i. Therefore, time cannot be thought of as a bunch of nows in a row.
      ii. Instead, time is a continuum, not an agglomeration of now-chunks.
      iii. This parallels what Aristotle says about lines and points in VI.i.
      iv. A point is a marker on a line which allows us to talk about line segments.
      v. But a line is not therefore 'made up' of chunk-like points.
      vi. A line, to be a proper line, must be an infinitely divisible continuum.
      vii. The same goes for time: it is an infinitely divisible continuum.
      viii. The now, then, is a 'point in time:' a marker or limit (*peras*).
      ix. As a limit, the now can demarcate time-spans.
      x. But it is not thereby a 'real part' of time.
   d. Time is not Movement.
      i. Some, possibly including Plato, affirm that time is identical with movement.
      ii. Time certainly has to do with movement.
      iii. Movement happens in time and can be temporally measured, etc.
      iv. But movement is not itself time.
      v. Depending on how we interpret it, we may therefore have to totally jettison the Timaeus definition of time as "the moving image of eternity."
      vi. That seems to identify time with the (celestial) motion of the universe.
      vii. But Aristotle wants to say that any 'slice' of that rotational motion would be just as temporal as the whole rotation considered altogether.
      viii. Because of this, he rejects any obvious 'cyclical' view of time.
      ix. His objection is less to the cycle itself, more to the overidentification of time with the movement that happens within time.
2. IV.xi
   a. Wicksteed and Cornford remind us that Aristotle is not offering abstract 'metaphysical' reflections on the nature of time, but instead trying to get straight on the confusions faced by the "plain man" when discussing time. Why is such a premium placed on removing Greek conceptions of time from the realm of philosophical speculation? A similar move is made by Momigliano.
   b. Continua
      i. Aristotle here weighs in on the great debate: atomism v. continua.
      ii. He seems to be a staunch continuum theorist.

   iii. Magnitude (cf. distance) is a continuum.
   iv. Movement (cf. speed) is a continuum.
   v. Time is a continuum.
   vi. All of these continua (S = D / T) are infinitely divisible.
   vii. Points can be posited on each continuum.
   viii. But that doesn't mean that movement or time moves in atomistic 'jerks.'
   ix. (On 'jerky' movement, see Sorabji; video games; cinema…)

 c. Now
   i. So where does the now-point come from?
   ii. The soul (psyche)!
   iii. The soul posits now-points in order to mark off time-spans.
   iv. Just like marking off segments on a line.
   v. The now is a limit (*peras*); the soul is interested in sketching limits (*horizein*).
   vi. It's difficult to posit a beginning and an end for a continuum itself.
   vii. It becomes much easier once the soul sets horizons onto the continuum.

 d. Time
   i. The definition: "But when we perceive a distinct before and after, then we speak of time; for this is just what time is, the calculable measure or dimension of motion with respect to before-and-after-ness. Time, then, is not movement, but that by which movement can be numerically estimated."
   ii. *Arithmos kineseōs kata to proteron kai husteron…*
   iii. Time is the calculable measure of motion.
   iv. Before-and-after-ness is ambiguous, but it could mean two things:
    1. Simple succession
    2. Two limit-points on a time-span (line-segment)
     a. i.e., the first limit (*proteron*) and the terminus (*husteron*)
     b. This latter might be more plausible, then harder to grasp.
   v. So: time remains a continuum.
   vi. Even a continuous flux: *aei allē kai allē…*
   vii. But it is a countable continuum.
   viii. It is not itself made up of now-units.
   ix. But it can be severed into measurable time-spans by the soul, which projects a now-limit onto the continuum.
   x. Mathematically speaking:
    1. Nows are numerators.
    2. But they are not actually part of the numerable (continuum).
   xi. It is even "obvious" that the now is not a part of time.
   xii. Nor is a point (*stigmē*) really a part of a line (*grammē*).
   xiii. The now has nothing to do with the essence (*ousia*) of time.
   xiv. It is merely an accident (*sumbebēkos*).
   xv. Whereas time remains the numerable continuum.
    1. Continuum: *sunechēs*
    2. Holding-together
    3. Cf. *Con-tineo*; holding-together

3. IV.xii
 a. Infinite (or Infinitesimal) Divisibility
   i. Any continuum is infinitely divisible.
   ii. This is true for magnitude, movement, and time.

        iii. It means that there is no smallest possible time-unit. (No minima.)
        iv. Ergo, the now cannot be defined as the smallest possible time-unit.
         v. Any attempt to find a minimum time will collapse into micro-pasts and micro-futures. (cf. Augustine)

  b. The Effect of Time
         i. Not all things are temporal.
        ii. But anything that arises and passes away is temporal.
       iii. *Genesis* and *Phthora* happen in time.
        iv. (cf. Being and Becoming in the Timaeus)
         v. But here Aristotle chooses to focus on the destructive effects in time.
        vi. He argues that time is most noticeable in the wearing-away of things (aging).
       vii. Yet why can't we think of time as both giving and taking away?
      viii. Why is time's genetic power downplayed here?
        ix. Heidegger will criticize Aristotle for this.
         x. Yet there remains a folksy truthiness to this line of thinking.
        xi. We care about time when it ages and kills us.
       xii. We care less when time brings us about in the first place.
      xiii. (cf. Epicurean comments about prior and posterior nonexistence)

  c. Nonexistence
         i. What is in time?
        ii. Everything that sometimes is, sometimes isn't.
       iii. That is: everything that is generated and destroyed.
        iv. Nonexistence can be said in many ways:
             1. Temporal Nonexistence: what was and will be, but 'is' not
                 a. Present-tense bias is decisive here
             2. Eternal Nonexistence: what could never be
                 a. Modal impossibility is the criterion here

4. IV.xiii
  a. Now Redux: the now is both a uniter and a divider. It can be seen as chopping up the continuum into segments or connecting one segment with another. Its divisiveness is merely a potentiality.
  b. Is time limited? No. It's nature as a continuum implies that time is everlasting. It cannot have beginning or end points.
  c. Time-language is confusing. Our use of words to designate temporal relations is ambiguous, at best. Aristotle lets this thread dangle…
  d. Conclusions:
         i. Time is.
        ii. It can be defined as the number of motion with regard to before and after.
       iii. Yet our language about time continues to confound us.
        iv. The value of time is ambivalent: it is both creator and destroyer.
             1. That is why the poets might call time both a wise life-giver and an ignorant destroyer.
             2. And yet it is not so much time as change that is destructive.
             3. Change is not time, but is again what happens in time.
             4. Kinesis covers both movement and change.
             5. Perhaps, then, time remains neutral.
             6. Whereas change always involves passing-away.
             7. Change is ek-static.

5. Sorabji
    a. Richard Sorabji has helpfully characterized the relationship between atomism and the continuum in Aristotle and his followers. In Sorabji's view, only the Epicureans (cf. Lucretius) are true atomists when it comes to time. Only they really think that there are minimal time-atoms (or time-minima) at the heart of temporality.
    b. The Stoics sometimes look like time-atomists, because they valorize the present. But this value-laden 'living in the now' should not be reduced to a crude atomism. Elsewhere, the Stoics stick to a firm commitment to infinite divisibility in their natural science.
    c. He also discusses the fraught attempts of many philosophers to map Aristotle onto McTaggart's A-Series-B-Series distinction. But what Aristotle says about the past-present-future and before-after may not map perfectly onto any of that.
    d. The big concern is whether or not Aristotle's logic has to match up with his physics when it comes to time. His logic is quite temporal: it emphasizes tense and the tensed nature of truth statements. That's a big deal. But does that mean Aristotle must make 'tense' (PPF) an integral part of his physics of time? Or can we have tense-talk and pure continuum physics as the same time?
    e. Spoiler Alert: Time-atoms will return with a vengeance in Islamic philosophy.
6. Big Questions
    a. What's the fundamental difference between the approaches to time in Plato and Aristotle?
    b. Are their definitions of time pre-conditioned by the disciplines they use to arrive at them (i.e., cosmology or kinematics)?
    c. If the now doesn't exist, why does everyone talk about the present as if it were the most intimate or secure part of time?
    d. Can we think of time without importing the concept of a now?
    e. Does thinking of time as a point-free continuum force us to think of time as everlasting, i.e., without a beginning-point and an end-point?
    f. Is Aristotle right to say that the effect of time is more about destruction than generation?