

A-Series and B-Series

- We have been discussing Zeno's Paradoxes of space, time, and motion without reference to any particular physical theory. The reason is that all contemporary theories of these things can be formulated in a mathematical framework that is sufficient for raising the puzzles. They all assume that spacetime is a Riemannian (or, in the case of relativistic theories, pseudo-Riemannian) manifold, M , equipped with a metric, g , written $\langle M, g \rangle$.
- McTaggart's argument for the unreality of time is a 20th century incarnation of Zeno's Paradoxes. It is most simply formulated against the backdrop of Newtonian - or, better, Galilean - spacetime. This admits of a unique 'slicing' into 3-D simultaneity spaces which can be totally ordered by the 'is earlier than', or, equally, the 'is later than' relation.
- *Note:* Galilean (as opposed to Newtonian) spacetime does *not* admit of a unique slicing into 1-D 'co-location' slices -- i.e., slices of the same spatial location at different points in time. Hence, *velocity* is already relative in Galilean spacetime. But, *acceleration* is not. (This is why Galilean spacetime still accommodates Newton's First and Second Laws.)
- *Note:* There is another spacetime adequate to Newton's theory -- namely, *Newton-Cartan* spacetime -- which mimics General Relativistic spacetimes. It treats inertial motions as geodesics in a curved spacetime. In this setting, gravity is no longer considered a force.
- McTaggart argues that time requires change. But Galilean spacetime admits no change. So, time does not exist in Galilean spacetime -- or in any contemporary spacetime theory.
- *Note:* McTaggart himself seemed to think that Galilean spacetime, or something equally 'static', is the only intelligible account of the world we live in. So, unlike so-called *presentists* (to be discussed), he took the upshot to be Parmenidean, much like Zeno.

The A-Series & the B-Series

- Distinguish two relations. There are the relations of *being earlier than* and *later than*, and there are the relations of *being past* and *being future*. Everyone, past, present, or future, agrees on whether an event is earlier than another (in Galilean spacetime!). But people at earlier times disagree with people at later times about what is past and future.

- *McTaggart*: “Positions in time, as time appears to us *prima facie*, are distinguished in two ways. Each position is Earlier than some and Later than some of the other positions...In the second place, each position is either Past, Present, or Future. The distinctions of the former class are permanent, while those of the latter are not. If M is ever earlier than N, it is always earlier. But an event, which is now present, was future, and will be past.”
- McTaggart calls the first class of relations, *B-relations*, and the second, *A-relations*. His argument is that only A-relations are temporal, while spacetime only admits B-relations:

- (1) If time is real, then there is change.
- (2) If there is change, then there are A-relations (an ‘A-series’).
- (3) If there are A-relations, then every event has the (contradictory) properties of being past, present, and future.
- (4) So, by *reductio*, time is not real.

Premises 1

- “It would...be universally admitted that time involves change....A universe in which nothing whatever changed (including the thoughts of the conscious being in it) would be...timeless.”
- This premise does seem hard to deny. The key question is what is required for change.

Premise 2

- “If...a B series without an A series can constitute time, change must be possible without an A series....[But t]ake any event – the death of Queen Anne, for example – and consider what change can take place in its characteristics. That it is a death, that it is the death of Anne Stuart, that it has such causes, that it has such effects – every characteristic of this sort never changes....But in one respect it does change. It began by being a future event....At last it was present. Then it became past....Thus...*all change is only a change in [A-characteristics]*.”
- *Objection*: Even if events (such as *the bottle’s being on the table at t*) cannot change, things (such as *the bottle*) can. For object, o, to change just is for it to be the case that, for some property, F, o is F at time, t_1 , and o is not F at later time, t_2 . The B series allows for this.
- *Reply*: By that reasoning, o’s being F at *spatial* coordinates $\langle x_1, y_1, z_1 \rangle$ and o’s not being F at spatial coordinates $\langle x_2, y_2, z_2 \rangle$ should constitute change. But nobody would maintain that!

Premise 3

- “Past, present, and future are incompatible determinations. Every event must be one or the other, but no event can be more than one....But every event has them all.”
- *Reply*: “It is never true, the answer will run, that M is present, past, and future. It *is* present, *will be* past, and *has been* future. Or it *is* past, and *has been* future [etc.].... The characteristics are only incompatible when...simultaneous...[T]here is no contradiction.”
- *Response*: If past, present and future are had at different times, then time must be distinct from past, present and future. Since time requires change, time is a *different* A-series -- past*, present*, and future*. (This means, for instance, that Biden’s inauguration is past in the present*, future in the past*, and present in the less distant past*.) However, the same reasoning shows that past*, present*, and future* cannot be temporal either, and so on *ad infinitum*. For any A-series, we can argue that it is not really temporal in this way.
- *Note*: If we were limited to a *single* A-series, then we would have to say that Biden’s inauguration is past in the present, future in the past, and present in the less distant past, which McTaggart evidently thinks is flatly contradictory. What could it amount to if not merely that Biden’s inauguration is past and future, future and past, and present and past?

Eternalism

- There are different reactions to McTaggart’s arguments. But the most influential has been the regard A-relations as being, at best, derivative on B-relations, and, at worst, hopelessly confused. The resulting picture is called *eternalism* (or the ‘block universe view’). The justification for the label is that the basic entities it posits - *events* - do not change. At most, things, like us, change by having worldlines that pass through different events. In this sense, eternalism is a kind of incarnation of the view that Zeno defends.
 - Events are indexed by *both* spatial and temporal coordinates. So, events do not *happen*. They simply *are*. Your talking at a given place *and time* does not itself happen. Your talking happens. But that is just to say that you talk at a given time.
 - *Weyl*: “The objective world simply *is*, it does not *happen*. Only to the gaze of my consciousness, crawling upward along the life line of my body,

does a certain section of this world come to life as a fleeting image in space which continuously changes in time [*Phil of Math & Nat Sci.*, 116].”

- *Question:* How should an eternalist understand ‘crawling’? Can the ‘at-at’ theory of change of consciousness explain why we are only ever aware of a ‘certain section’, when all time-slices of our worldlines are conscious?
- *Prima facie*, there is no past, present, and future in the spacetime array. But, then, *prima facie* there is no possibility in the spread of Lewis’s worlds. We can make sense of utterances about these things from a spacetime perspective in much the way that Lewis later made sense of utterances about the possibilities from his ‘modal realist’ perspective.
 - *Smart:* When we say that something is past or future, we really mean that it is - tenselessly - earlier than, or later than, respectively, *this token utterance*. This make ‘past’ and ‘future’, *indexicals*, thus undercutting McTaggart’s *reductio*.
 - ‘Tenseless’ means that the ‘is’ at issue like the ‘is’ of ‘2 + 2 is 4’, rather than like the ‘is’ of ‘The sun is rising’. If something is earlier than this utterance, it does not cease to be at some future date. It is ‘eternally’.
 - *Note:* The likeness is not exact. Tenseless is not *timeless*.
- A corollary of this account is that ‘now’ or ‘the present’ means *simultaneous with this utterance* -- much like, for Lewis, ‘actuality’ just means *this maximal connected object*. There is no ‘objective’ now *even in a Galilean spacetime* (construed as the eternalist construes it). If there were no creatures to make token-reflexive utterances, then there would be no present -- anymore than there would be actuality in Lewis’s multiverse.
 - *Note:* There is an *additional* sense, stemming from Special Relativity, which we will discuss next week, that there is no ‘objective’ present. This is that what counts as a 3-D simultaneity slice of the (Minkowski) manifold depends on how we slice it into 3-D components - or, physically, how we are moving. However, this is not the case in Galilean spacetime.

Making Sense of Eternalism

- The spacetime way of thinking affords an elegant metaphysics. Insofar as the chief ambition of science and philosophy is to abstract from our idiosyncratic point of view - to arrive at a ‘view from nowhere’ in Nagel’s sense - this approach seems to achieve it.

- On the other hand, it is clearly in tension with some of our most basic instincts.
According to the eternalist, the future is not *ontologically* different from the past. It is just as real. Of course, it does not exist *now*. That would be, for the eternalist, to say that it exists simultaneous with this utterance. The past does not exist now either. Both exist.
- A.N. Prior argued that this view cannot do justice to our agential experience. If we are scheduled to have a root canal, then, after it is done, we will say ‘thank goodness that’s over!’. But there is no use in being thankful *that that utterance is (tenselessly) later than the procedure*. The reason to be thankful is that the utterance is in a different sense now.
- *Question*: Can this puzzle be resolved *a la* Frege? Although now just is simultaneity with this utterance, we are ignorant of this identity, and our attitude isn’t closed under identity.