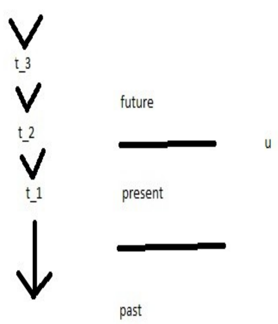
From McTaggert to AdS_5 geometry

The purpose of this note is to show how an 'AB-series' interpretation of time, given in a companion paper, leads, surprisingly, to the physicists' important AdS_5 geometry. This is *not* a theory of 2 time dimensions. Rather, it is a theory of 1 time dimension that has both A-series and B-series characteristics.

To summarize the result, a spacetime in terms of (1) the earlier-to-later aspect of time, and (2) the related future-present-past aspect of time, and (3) 3-d space, gives us the AdS_5 invariant.

I must assume the reader is already somewhat familiar with the theory of time proposed in the companion paper Merriam (2019). In that paper I called the future/present/past spectrum g, in this paper I'll call it u.

This is the model:



t_1 is earlier than t_2 which is earlier than t_3... The earlier-times to later-times timeline stays in one ordering (of one kind or another), but the whole timeline moves from future to present to past, with the present staying put. (The present does not 'move up the B-series' as in some spotlight theories because ipso facto the presents wouldn't be ontologically privileged.) As later and later B-series times become present, time goes on.

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In 1+1 spacetime, in terms of t and x, in one convention, we have the metric or invariance of

(1) $\tau^2 = -c^2 t^2 + x^2$

under Lorentz transformations. The Minkowski 1+3 invariant is in terms of (t, x^3), such that, in the same convention,

(2) $t \rightarrow ict$

for the imaginary unit *i* and the speed of light *c*. We want a generalization to a new invariant *τ*' in terms of the A-series and the B-series and x^3, (u_{system}, t, x^3) and the transformations that leave it invariant. That's because 1 dimension of time has 2 related parameters, in this theory, 1 for the A-series and 1 for the B-series. But it's not immediately obvious in what way(s) such a generalization is possible, because probability gets involved. Nevertheless we can try. (And this, also, has to do with whether the future is branching.) In what might be called 1+1+1 spacetime, in terms of u, t, and x, it would be nice if there were some kind of invariant

(3) $\tau'^2 = |c_1|^2 k^2 u^2 - c^2 t^2 + x^2$

for some complex number c_1, and some new constant *k* in units of meters per e. This is a new constant, a 'conversion factor' in meters/e, in analogy to the speed of light, which is a constant or 'conversion factor', *c*, in meters/sec. (Yes they can each be rescaled such that, in their respective units, *k* = 1, and *c* = 1, but that's not important here.) *c* is the rate the position changes when going from earlier to later times. *k* is the rate the position changes as it becomes from Alice's future into her present and then into her past. These are, in this theory, not the same thing.

Consider

(4) $d\tau'^2 = |c_1|^2 k^2 du^2 - c^2 dt^2 + \sum_{i=1}^{3} dx^2$

(Wu, 2016, Wikipedia, 2019). A minus sign between t and u, it was argued in the companion paper, comes from their opposite orientation: earlier-to-later times go into the future while future-present-past times come out of the future. Obviously other ideas are possible, but the simplest thing to try in analogy to (2) is therefore

(5) $u \rightarrow -iku$.

In which case

(6) $d\tau'^2 = -k^2 du^2 - c^2 dt^2 + \sum_{i=1}^{3} dx^2$

(Another thing to try is u → *-ih'u* for the imaginary unit *i* and some constant *h'* based on Plank's constant *h*, or Newton's constant G, but the dimensions might be off.)

If I'm not mistaken, (6) is the AdS_5 invariant. Let's be clear on the interpretation of (6). It does *not* have 2 dimensions of time. It is a proposal for an invariant on a different kind of 'spacetime'. It has 3 dimensions of space, and it has one dimension of time, but that dimension has related A-series and B-series characteristics. This might be called AB-spacetime. The A-series characteristics are, of course, 'ontologically private', as defined in the companion paper. Thus, (6) is an invariant or metric on Alice's 'private' AB-spacetime.

If 'time is going backward' in the sense of the other paper, then *u* → *iku*, since both the A-series and the B-series come out of the future in this case, and as we saw *c* → *ict*. And this gives (6) again. For the rate *r* defined in the other paper, a real number in units of seconds/e, we have u → *irk*u, and the signature of the metric is preserved.

To summarize again, a spacetime in terms of 1, the earlier-to-later aspect of time, and 2, the related future-present-past aspect of time, and 3, 3-d space, gives us the AdS_5 invariant (6).

References

Merriam, Paul (2019), *A theory of time: bringing McTaggart into physics*, https://philpapers.org/rec/MERATO-4

Wu, Yuxiao, (2016), p. 1, *A Very Introductory AdS/CFT*, http://theory.uchicago.edu/~ejm/course/JournalClub/Basic_AdS-CFT_JournalClub.pdf, and Wikipedia, *Anti-de Sitter space*, (2019), https://en.wikipedia.org/wiki/Anti-de_Sitter_space