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, directly 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, automatically gives us AdS_5.

I must assume the reader is already familiar with the theory of time proposed in the companion paper Merriam (2019).

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

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

under Lorentz transformations. The Minkowski 1+3 invariant is in terms of (t, x^3), such that, in the same convention, t → *ic*t, 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, (g_{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 g, t, and x, it would be nice if there were some kind of invariant

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

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 discussed in the companion paper and is not important right now.) *k* is the rate the position changes as it becomes from Alice's future into her present and then into her past. *c* is the rate the position changes when going from earlier to later times. These are, in this theory, not the same thing.

Consider

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

(Wu, 2016) The minus sign between t and g, 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 is therefore

(4) $g \rightarrow -ikg.$

In which case

$$(5) \quad d\tau'^2 = -k^2 dg^2 - c^2 dt^2 + \sum_{i=1}^{3} dx^2$$

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

I don't have a degree in physics. But, if I am not mistaken, (5) is the AdS_5 invariant. Let's be clear on the interpretation of (3). 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, (3) is an invariant on Alice's 'private' AB-spacetime.

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, automatically gives us AdS_5.

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