Notes 2 A theory of time 6 7 2019

Path-integrals in AB-theory?

Consider

(1) $$\int_{1,0}^{0,1} f(g,t)\, dtdg$$

Starting from the bottom, integrate *f* starting 1 e in the future and with indexical clock time t = 0. The top of the integral has time 0 e (which is in the center of the present) at indexical clock time t = 1 sec. later than t = 0. They're oppositely oriented because the first parameter comes out of the future while the second parameter goes into the future (later times).

In some theories (2) is different than (1),

(2) $$\int_{6,0}^{5,1} f(g,t)\, dtdg$$

given an appropriate presentism function (for example p(g) = 1 for -1 < t < 1, and p(g) = 0 everywhere else), the evolution from t = 0 to t = 1 sec. later than t = 0 in (2) is strictly in the future, from 6 e to 5 e. If the universe is branching appropriately, there are more functions in (2) than in (1), because it's further in the future. In one example the *f* in (2) are only constrained by the *f* in (1), since it is only in the present that an observation takes place. In this case the future path could be anything allowed that is consistent with the path that eventually becomes into Alice's present.

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Schrodinger's Cat in AB-theory

I will assume the reader is familiar with the Schrodinger's Cat experiment. Suppose WF (for Wigner's Friend, though I will only discuss the cat experiment here) is outside the box. He sets his indexical clock so that t = 0 seconds at the beginning of the experiment (when he closes the box) so that the experiment ends t = 10 seconds *later than* t = 0, (when he opens the box). Suppose the cat's indexical clock is set the same way. (Recall that a system, so far as this model of time is concerned, may be a person, a cat, a protozoa, or indeed on panpsychism any physical system whatsoever.)

Both WF and the cat have a private A-series parameter as well as a public B-series parameter. Their B-series parameters can be compared, their A-series parameters can not. Thus, for example, for WF at his indexical clock time t = 3 sec., he may have it that the cat is in a superposition

(1) $$\Psi = |\text{will measure it to be meowing}\rangle + |\text{will measure it to be purring}\rangle$$

For WF, his time has a private parameter and a public parameter, respectively, (*g*, *t*), and when he models the cat's public time he does it with another B-series variable as in relativity, such as (*g*, *t, t'*). However, for WF the cat's private parameter has no particular value (or in some theories doesn't even exist), and vice versa. In terms of WF's private time parameter, the measurements in (1) will happen 7 *e* in his future because it is 'now' indexical clock time t = 3 and the experiment goes until t = 10 (and there are no relativistic considerations, we'll assume). Thus for WF 'now', the future state of the cat is given at a time (7, 10). As (1) shows, there is not just one classical state of the cat, but rather a superposition of future classical states. This leads one to suspect the future is branching.

In obvious notation we have, for the cat's state as described by WF, as a function of WF's time,

(2)

$$\text{catstate}(7_{WF}, 10_{WF}) = \Psi = c_1(\text{t}_{WF})\left|\text{ will measure it to be meowing}\right\rangle + c_2(\text{t}_{WF})\left|\text{will measure it to be purring}\right\rangle$$

Apparently a future state is represented by a vector in a Hilbert space. The complex amplitudes call out for interpretation. Also, what is suggested by this picture is that the collapse of the state vector upon observation, to the extent there is one, has to do with the unification of the two system's private time variables g_{WF} and g_{cat} into one g_{WF+cat}.

And vice versa.

One hypothesis is that, for qualia, my experience of green when I look at some leaves *does not constrain*, to me, the possible qualitative values you might experience when you look at those same leaves. The related hypothesis is that it's the same way with becoming and a privileged 'now'.

The cat paradox typically comes from the fact that (what would be in our example) at the cat's indexical time t' = 3 seconds the cat finds itself to be either in state *meowing* or else in state *purring*, and not in a superposition. In the AB theory that's okay because the 'now' of WF *does not constrain*, for WF, the 'now' of the cat. So when WF's cock reads '3 seconds later than t = 0', it is not assumed that the cat's clock reads '3 seconds later than t' = 0'. Instead, when WF's clock reads '3 seconds later than t = 0', the cat's clock, for WF, could read anything between t' = 0 sec. and t' = 10 sec. (or nothing at all in some models), because the different 'nows' of the cat are associated with these different cat's-clock indexical times. Thus, during the experiment, there is no *one time* at which the cat gets ascribed different states.