Re: From physical measurement to mathematics...

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Roland Franzius wrote:

> Christophe de Dinechin schrieb:
>
> > Why can we add masses together and get a mass? This question may seem stupid, but we can't do the same with time: we need to add a time and a *duration* to get another time.
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> We cannot add points in space but we can add differences of point coordinates, because the directed lines between points make up a vector space with addition and scaling by numbers and the process of addition is the process of making longer lines from short pieces.

I can certainly understand vectors as a mathematical construction. Where I have a question is why would 3−vectors represent space coordinates so well?

Let's start with something simpler: time. The usual representation of time is a real number. Why? Here is a tentative explanation. Time is measured using cyclic processes, some cosmological (the apparent movement of the sun in the sky), some mechanical (a pendulum), some piezzo−electrical (quartz oscilation), some at the atomic level (decay of Cs atoms). Why do all these processes happen line up along a common definition of time?

I think that we make them line up. We remark that N1 oscillations of the pendulum correspond approximately to N2 rotations of earth, to N3 oscillations of such and such quartz, and so on. So we can write them proportional to one another, and we call "time" the common factor. And then, a duration is a count of one or another clock, which no longer matters once we have chosen this common graduation of time.

The issue is that all these physical processes diverge from one another at large enough scale. Pendulums decay, quartz crystals need electricity or stop vibrating, etc. A very good example is the measure of time using radiocarbon. For short periods of time (think: days), this process lines up with the rotation of earth. For much longer

periods of time, it affects the population of carbon atoms, so we end up counting a ratio between two kinds of atoms that looks more like an exponential.

So the original question could be rephrased as: if one measure of time can diverge from another at large−enough scale, do we have any reason to believe that there is some "absolute" time behind all of these that we can put in equations, or do our equations implicitly depend on the measurement process we chose?

I hope the question is clearer, phrased that way.

Note that in the paper I linked to, I show that this question has a very fundamental impact on the normalization of the wave function. We cannot sum at infinity along a space or time dimension if there is no common definition of how it behaves at infinity.

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