Leibnitz, Descartes, and Emergent Relational Spacetime

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https://youtu.be/OV9MnAZLmMQ&lc=UgxNOshsF6zb2TuPw8d4AaABAg

A Comment on the PBS Space Time post:
What If Space & Time Are Created By Our Brains? (Mar 15, 2023)
https://youtu.be/OV9MnAZLmMQ?t=1m16s

1:16 "Leibnitz and Descartes considered space and time as "relational," as a network of distances between objects or succession of events." Leibnitz and Descartes were correct, but with two qualifiers. The first is that only *squares* of distances, with units of time-distance, result in a non-redundant 3D (versus 4D) network compliant with the constraints of special relativity. That's just algebra since the observation loops underlying length distances always contain length compression and time dilation Lorentz factors that cancel when multiplied.

The time-length product stays invariant regardless of the velocity state of any observer. Thus the entire collection of all Lorentz area distances (LADs) for the universe produces an objective state machine in which each object has a singular present-moment state (no worldlines). The tricky part is that classical time emerges in bits and pieces *from* the dynamics of this Lorentz area state space (LASS), while our state machines *require* time. Me brain not like! The nice thing is that Schrödinger's cat — one of those object present-moment states ("objates") — always knows whether she's dead or alive, as Schrödinger intended. Causality is bottom-up in a LASS universe, with spacetime emerging in bits and pieces as an afterthought.

(Incidentally, if you think of a Lorentz area as a rectangle — and you can find this version of them in light paths of Minkowski's original figures since the complete set of R distortions of a rest-state Lorentz square reproduces his hyperbolic curve — then the R and 1/R sides of the rectangles *never* have units of "time" or "length." Duration and length instead form the diagonals of such Lorentz area rectangles and shrink or extend *together*. If you are a Clifford algebra fan, yes: Such algebras have excellent potential for describing these Lorentz areas and their diagonals analytically, as long as you don't accidentally insert classical time into your equations instead of allowing it to emerge. Finding the best units and way to interpret the R and 1/R sides of Lorentz area light-path rectangles is an intriguing problem.)

In any case, every LAD requires some variant of a full-cycle distance observation involving exchanges of bits of linear momentum at all steps. That is important. While linear momentum is as conserved as angular momentum, they differ in that it is not quantized. Thus, it can interact in ways and at scales entirely different from exciting individual electrons. This vanishingly-small option for linear momentum is why photons can impart incredibly low-energy bits of momentum to NASA solar sails without interacting historically with any *single* electron in the reflective sail. Physics models almost always represent these blurry, unquantized linear momentum interactions as "potentials." The danger of using this traditional classical term is how easy it is to forget that every interaction of a quantum particle with a "potential" is also necessarily a two-way exchange of linear momentum. There is, for example, always an excruciatingly tiny but causally significant exchange of linear momentum whenever a Schrödinger wave interacts with potentials in an "empty" branch of a quantum experiment.

(Incidentally, when the linear momentum relations between particles and large objects reach such near-invisibility regarding energy content, we have another name for them: information.)

The second qualifier is that the LASS universe lacks sufficient resolution — it does not have enough information-encoding mass energy — for every particle in the universe to maintain a precise LAD relation with every other particle. I doubt Leibnitz and Descartes considered resolution issues since they were pre-quantum, though I admit I've not looked carefully to see. That might be a fascinating question, especially for Leibnitz and his monads.

Applying this resolution constraint results in a power-law connectivity relationship similar to the one used by phone networks to connect vast numbers of users *without* requiring direct links between every pair of users in the system. The same blurring trick that allows one photon to exchange finite momentum with some vastly larger classical solar sail also enables multi-scale grouping of LAD relations by permitting momentum exchanges at the "bound objects" level.

Blurring helps. For example, while it is energetically impossible for every atom in historical (versus the amnesia-inducing "dwarf" prefix) planet Pluto to maintain a LAD relation with every atom in the Sun, it *is* feasible for Pluto "as a whole" to maintain a large-granularity LAD relation to the Sun "as a whole." In the phone network analogy, this large-granularity relation corresponds to a trunk line between two large cities. Fine-grain LAD distances at each end are measured relative to this larger-scale distance. Recursive, hierarchical use of this self-relative principle results in an astronomical (heh!) drop in the energy and information needed to express xyzt-equivalent spacetime relationships between sparsely distributed objects in space.

Since LADs are dynamic relations involving linear momentum, this large-granularity distance relation between Pluto and the Sun likely has dynamic implications. For example, it may include dynamics to conserve large-scale LAD metrics for calm periods between momentum insertions (no asteroids crashing into Pluto). Since gravity operates at these same scales and with similar levels of granularity fuzzing, an interesting little puzzle might be whether the mathematics of large-scale LAD relations replicate gravity. Such an emergent model would require framing in LxLyLz and LASS dynamics, not xyzt. Perhaps the most exciting point is that gravity would become a dense two-way concentration of LAD linear momentum exchanges.

I should call this need for energy-limited, multi-scale LAD networks *the* power law relation since its role in the profoundly fundamental emergence of spacetime is likely why power laws pop up so often in physics.

Finally, spacetime is not *just* in our brains. The natural and objective LASS breakdown into local, velocity-dependent xyzt interpretations begins before human intervention. It's just that our brain designs make the most of this super-handy shortcut for faster survival responses.

That's enough for now since I'm only 1 minute and 16 seconds into the video… :)

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PDF: https://sarxiv.org/apa.2023-03-16.1438.pdf