Thoughts on the Sublime Subtlety of Newtonian Points and Spaces

Terry Bollinger
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Email Excerpt

Good morning Mitch!

We had a truly beautiful dry, fluffy snow here on Monday, and it's stayed below freezing every day, all day, since then. We haven't had weather like this in years, and I had forgotten how much I miss it. My oldest granddaughter has been having great fun sledding and enjoying snow days. I've always liked cold weather, so the temps are to my liking, at least for a while.

I should clarify that I think points are the greatest invention of the universe since sliced bread, which may, perhaps, be getting both the relative priorities and the order of causality a bit backward... :) It's just that I think points are *created*, not preexisting. That makes them more interesting, not less. It's similar to how I find Newtonian orbital mechanics enormously more interesting than the predecessor idea that many held that "angels push the planets around, so shut up and accept it!"

There's a complex fabric going on here: You cannot have space (metrics, distances) without points, and vice-versa, because *the two are extremes of the same underlying reality*. You also cannot have information without points and space since all forms of information eventually resolve into the ability to configure points differently in some space.

This complementary relationship applies just as fully and powerfully to math as to physics, perhaps even more so, since information-intensive math concepts cannot exist without direct support from some remarkably complicated underlying physics.

Another complementary component is time, which cannot exist without space. All of these relations are mere approximations with finite scopes, however, those being the same domains that physics calls “inertial frames,” though with the additional limit that an inertial frame is not some infinitely large abstraction but rather a decidedly and necessarily finite set of precisely cooperating material particles accelerated together to a similar velocity. When the level of participating matter gets too small, the sharp divisions become fuzzier and more approximate, and we call the resulting incomplete divisions “quantum mechanics.”

Interestingly, all of this necessarily applies just as much or more to math as to physics. But where is the quantum theory of mathematics? That huge piece is missing. Opportunity!

Points, time, and space may get fuzzy at that scale, but that does *not* mean there are no rules! The rules guiding local, multi-scale emergence of space, time, points, and information are strict but necessarily not expressible using formalisms that *assume* infinitely precise relations as zero-cost givens. A simple but pointed example of how extreme this indifference to the cost of precision and information has become is using a Bloch sphere to represent the “0” and “1” states of a qubit. Number separations at the “0” end of the Bloch sphere are finite and small, while those at the “1” end are infinitely dense and, thus, infinitely information-intensive. Saying that is a “bad” model for a concept where *barely* one bit of information exists due to insufficient local mass is an extreme understatement.

Getting all loosey-goosey freebie-jeebie (pardon the physics jargon) upon reaching the quantum level — thinking, in effect, that there are no rules at all guiding physics once space, time, points, and information begin fraying at the edges — is the fatal flaw behind a lot of non-physical ideas of the past century. I can think of no worse example than Everett’s speed-of-light-indifferent use of magically instantiated Hilbert space states to create infinite multitudes of universes. That attempt at a mathematical description of reality is so horrifyingly sloppy that there’s no need for deeper physics, just an understanding of basic electromagnetic wave encoding theory applied to matter waves.

The math challenge that intrigues me most is the existence of formalisms that don’t use certainty as a given. What *are* the strict and unforgiving rules that guide a universe that has *no* inherent concept of spaces, time, points, or information, yet enables those ideas to emerge so powerfully — Newton’s classical mechanics — that incredibly complex systems such as you and I can gain sufficient stability and persistence to be having this discussion?

That, to me, is a delightful possible future: Discovering and exploring new worlds of math and physics from which the concepts we’ve tended to take as givens instead *emerge*. Intriguing!

Thanks again for your many emails rebelling against overly simple ideas of binary simplicity. It helps to know that others are concerned that some of our math structures are too simple and too obsessed with concepts that are, at a deeper look, nothing more than approximate asymptotic limits of far more complicated underlying processes.

Cheers,
Terry