Rebecca Newberger Goldstein and the Need for New Physics Maths

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https://youtu.be/9WdRk6uvBbE&lc=Ugy-QCsaDzVz2plHZLR4AaABAg

A Comment on the Closer To Truth YouTube post:
Rebecca Newberger Goldstein - Toward a Science of Consciousness (Apr 28, 2023)
https://youtu.be/9WdRk6uvBbE?t=9m17s

9:17 *"Maybe what we're seeing [in] the tension … between relativity theory and quantum mechanics is … a different way … of [getting] at a complete description of matter. Maybe when … that breaks open into a new methodology, we'll… get properties that yield consciousness."* First, thanks to both of you for this delightfully analytical discussion. Rebecca Newberger Goldstein, we are from communities that seldom intersect. I did not know of your existence until seeing this snippet, which I gather is from two years ago. Of the many *Closer To Truth* interviews and outtakes I've watched, this snippet is among the most insightful and interesting.

Regarding the tensions between maths and physics, the question seldom asked is whether our *maths* might be the problem. It's an important question since most of our maths are, if you stop and think carefully about it, generalizations of the pre-quantum, pre-relativistic classical physics of the 1700s and 1800s. Classical physics, especially in the late 1800s, was so successful at explaining the world around us that they were considered "fundamental" and beyond the need for reexamination, even after the early 1900s.

The difficulty is that since the early 1900s, we have known that the classical view of dimensions and time is *not* a self-consistent system mathematical system. The Euclidean model of three or more perfectly orthogonal axes and point-like locations is an approximation that works well only in the classical sweet spot in which we exist and from which we make most of our observations. This sweet spot is a land of exceedingly small and deceptively point-like atoms that work hand-in-hand with slow, non-relativistic velocities to give rise to an illusory, non-relativistic separation of space and time.

Think about the implications of that. Every Hilbert space in quantum mechanics, and every manifold in general relativity, is based on an effective, but also defective, set of assumptions about physics that only works well within the narrow range of physics we now call "classical physics" — and even there, only approximately. So why have we never updated the *maths themselves* to reflect better the only formal system we *know* works without paradox, which is the experimentally accessible physical universe?

The simple answer is that our brains are survival-optimized to take maximum advantage of the easy-to-calculate classical approximation of space and time. That makes it difficult even to conceive how to break such "simple" ideas as length and time into still simpler units. The rise of computers has helped since they enable a more robust and straightforward exploration of ideas not typically encountered in everyday processes.

Here's a specific example of the dangers of using maths based on seemingly "obvious" classical concepts of what is fundament and what is not:

As you read these words on a laptop, does it strike you as plausible that light might take one billion years to travel from your face to the laptop camera, while light from the screen to your eye travels at about $9.5 \times 10^{30}\ km/s$, that is, 3.2×10^{25} times the usual "maximum" speed of light? Could such an insanely asymmetrical directional asymmetry in the universe's structure result in the same physics we know and expect?

It does, of course. The only constraint is that the asymmetry must apply universally.

Furthermore, would you be surprised to learn that Einstein was aware of this problem when he defined the speed of light in his 1905 papers? He carefully included (but did not emphasize) a round-trip definition of the speed of light due to this being a *necessary* feature of special relativity. It's necessary because, in a fast-moving object, light takes longer to travel forward than it does backward. Since one of the most profound principles of special relativity is that there is no way to prove you do *not* reside within such a fast-moving frame, this principle of *asymmetric equivalence* must apply even if you are, as best you can tell, *not* moving.

The secret sauce is that when you measure time and space in *both* directions — when you create loops from yourself to the object and back — all of these strange asymmetries cancel out, giving you back the concept of "classical" space in which all units are stable and isotropic — that is the same in all directions, at best you can tell.

Think about that. If the most fundamental units of space and time require loops of undetermined size in both space and time to implement the *illusion* of point-like classical space, then the reductionist idea that the universe chops up neatly into an infinite number of infinitesimal points begins to look dicey indeed. The illusion works fantastically in cases where matter and atoms are abundant and dense, which is why point-based, fixed-unit equations work well for any primarily classical domain.

However, if you get either too small (say, atoms) or too large (cosmic scales), trying to define everything as perfect points starts to run afoul of this "loopy" two-way nature of all measurements. Does it matter? Physics has devised some pretty good fixes, including quantum and field theory for atomic and smaller scales and the relativities for cosmic scales. However, the truth is that such issues seldom are explored due to our use of maths that *assume* perfect points and are axioms that need no further explanation.

The more straightforward approach is to recognize that the since the maths we use are idealizations of a badly incomplete classical-physics sweet spot, it's more likely that physics expressed using better maths forms a smooth continuum that extends both *below* and *above* our classical sweet spot. The conflict between quantum and relativity is more likely a problem of our own making than something inherent to physics.

Your interest is consciousness, a phenomenon many think cannot be point-like in the extreme reductionist sense. The good news for consciousness theory is that a quantum special relativity universe *cannot* have point-like metrics. If we think about it carefully, we've known that since the early 1900s. It's just taking our maths a while to catch up.