Einstein, Hume, and Mathematical Creationism

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[email excerpt]

Hi Ron,

Was Einstein a Hume-inspired subjectivist or a material-world-first objectivist? That's a great question. I think the answer varies depending on whether you are talking about the young Einstein or the older Einstein.

The 1905 Einstein, who wrote the special relativity papers, was, by his statement, powerfully influenced by Hume's subjectivism. I suspect Einstein found Hume's perspective deeply attractive as a way of interpreting observations that helped cut out irrelevant data. It helped him stay focused on what was important. The surprise — somewhere there is a quote from Einstein about this — came when Einstein realized that the Hume self-first perspective was also the best and most straightforward way to interpret the data *mathematically*.

Einstein realized it makes no difference what the rest of the universe is doing or how others might interpret the same data since it is *only* the observer's me-first version of all of the rules of physics that matters. In particular, the observer "owns," entirely and uniquely, the definitions of time and space for the *entire* universe — not just the observer's local surroundings.

Thus, when this observer measures the speed of light, that value becomes the speed of light for the *entire* universe, including its farthest stars. The observer does not need to worry about how anyone interprets the speed of light, not even alien beings living on that distant star.

I think that startled him. He and others of that time were deeply aware of the seemingly paradoxical interpretations of data that arise when observers *move* in different relative to each other or even have different locations. But just as we would today, most folks looking at the problem expected the resolution would be some elaborate mathematical framework accommodating *all* such views at once.

Instead, the startlingly simple solution was to *discard* all those other views as irrelevant and instead say: "For the entire universe, *my* speed of light is the only speed of light, *my* time is the only time, and *my* space is the only space." Far from causing paradoxes, doing this made the paradoxes disappear from the math and enabled everyone to predict the future better.

Conceptually, however, the paradoxes never disappeared. While it's nice to know that for purposes of calculating the future, *my* clock, which always has the shortest seconds in the entire universe, works great for everyone else, how do I reconcile that in my mind with the fact that someone flying by at 99.5% of lightspeed sees *my* clocks as 10 times slower than his?

The contemplation of this conceptual paradox, combined with the infinite-precision-is-free formalist maths of Minkowski and (later) Hilbert, drove the early, more Hume-inspired Einstein to morph over time into a believer of the most objective of all physical interpretations, the *block universe*. That is the interpretation of physics in which all of space and time pre-exist as a stupendously large crystallized block [1].

When physicists speak of time as an illusion, they are block-universe objectivists. After all, if all of time pre-exists, it is not easy to distinguish one moment from another.

Unfortunately, Einstein later mostly abandoned the Hume-style subjectivism that gave him this initial critical insight. He grew to see the block universe as the only way to reconcile all those different, viewer-dependent interpretations of the physical world. That is unfortunate since the block universe is one of the more vacuous concepts in all physics.

The central problem is that creating a block does not explain *how* the different observer views get resolved in that block. Assuming the pre-existence of a block universe thus implies that some deity-like entity that has figured out how to resolve all those different perspectives, applied that solution to the entire universe for all of time, and kindly left us the result in the form of a giant space-time crystal.

By eventually embracing this vacuous, non-explanatory block universe concept, Einstein also destroyed any chance of him achieving a deeper integration of relativity and quantum mechanics. After all, there can be no meaningful quantum uncertainty, or even an understanding of what uncertainty is, in a predetermined universe where everything is locked up in a giant crystal.

If Einstein had stuck with his original, more subjective perspective, the next century of theoretical physics likely would have been more productive in areas still perplexing us today. In particular, theoretical physics might have avoided a century-long delay in figuring out quantum theory, relativity, and particle physics work together to provide a coherent and fully integrated understanding of how the universe works.

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[1] I must be blunt regarding the block universe: No matter how many excellent and deeply insightful physicists think the block universe is the "obvious" outcome of relativity or quantum mechanics or both, it is nothing more than an especially egregious example of mathematical creationism. In short, the block universe is a theological position, not a scientific one.

Mathematical creationism first arose from continuum-focused mathematicians developing a bad habit of assuming that because many of their equations have well-defined and convergent limits, those limits must pre-exist in a reality of their own. The problem is that this belief in infinte limits has no meaningful computational or physical interpretation.

Ordinary pi is an excellent example. Pi in an equation always represents a finite process — an algorithm — and never the infinite application of that algorithm. Like a Mandelbrot set deep-dive, the pi algorithm, which most often is a simple lookup of a previously calculated result, allows people and computers to increase the precision of pi to match available data. For example, no elaboration of the pi algorithm for circles and diameters of physical objects requires more than a handful of decimal places because the atomicity of such objects eventually makes further "deeper dive" precision meaningless.

The reason why pi always represents a finite algorithm rather than an exact number is easy to see if you consider that an exact pi would require infinitely many bits, which is more storage mass than the entire universe. Furthermore, calculating this infinite-sized result would require infinite computation time, which is incompatible with the finite age of our universe. Finally, assuming that pi is available *now*, rather than at the end of time, means the device that calculated it was infinitely large, fast, and parallel.

Pause for a moment to consider that combination of infinite data storage, infinite available time, and infinite processing capacity. What would practitioners of most religions call such an infinitely capable entity? Most would call it an omniscient deity or perhaps a demon.

Mathematical creationism thus is the intellectually sloppy and dangerous habit of inserting disproportionately or even infinitely powerful computational demons into the math used to model physical processes. It is astonishingly easy to do this with continuum or "manifold" mathematics, which assumes by default that it is acceptable to map infinitely large planes into microscopically small ones without considering resolution issues. Matrix mathematics is deep with such demons, which is one reason why resource-aware quaternion math has taken over from matrices in cases where many rotations are needed. All forms of gimbal lock are examples of mathematical creationism since they use sloppy algorithms that assume infinite bit densities and computational capacities close to rotation axes.

One of the most damaging consequences of mathematical creationism occurs when sloppy models falsely imply that the fabric of the universe is chock full of infinitely powerful computational demons, even when this message is in blatant defiance of actual experimental results. Thus when studies in the late 1800s and early 1900s showed that small entities seem to lose their ability to exhibit precise locations in space and time, theorists explicitly decided to *fill that uncertainty* with an infinite number of "superposed" perfect states. Implementing just *one* such state in the physical world, let alone an infinity of them, requires deity-level computational resources. The grubbier but more realistic algorithm-aware generative approach, advocated mainly by Schrödinger, was abandoned.

And *then* folks wonder why theoretical physics has so many problems with unwanted infinities popping up in their equations?

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