

Classical and quantum framing of the Now

David Mermin's musings about that elusive Now (PHYSICS TODAY, March 2014, page 8) are a welcome indication that physicists are beginning to ask questions about time. Physics treats time as a coordinate in spacetime in which a point can represent an event. But a person's Now doesn't figure in that scheme—it has no special status, yet it is what each of us directly experiences.

The disjunction between directly experienced time and abstract physics time was first and famously pointed out by French philosopher Henri Bergson.¹ On 6 April 1922, Bergson and Albert Einstein both attended a meeting of the Philosophical Society of Paris, convened to honor Einstein's work. There, the distinction between what Einstein called psychological time and physicist's time was discussed.² Mermin's note reminds us that 92 years on, there is still no accommodation.

Mermin's Now, however, is not Bergson's. Mermin's Now can be depicted as a point in his world line, and that sort of depiction is exactly what Bergson objected to. Treating time like space, he thought, was a deep error. What one was conscious of was not a point-like Now but rather a duration, in which the Now was a multiplicity; it was not a single thing that could be recorded as a point on a world line but a mutual penetration of past and present and a hint of the future.

Nor could one person's Now be exactly the same as another's. Different memories, perceptions, temperament, and so on make one's Now unique. Physics cannot deal with the unique and has yet to understand consciousness, so a meaningful accommodation

between Bergson's duration and the point-like Now of physics is still some way off.

I'm grateful to Mermin for telling us what he thinks about Now. He alludes to deep issues.

References

1. H. Bergson, *Time and Free Will: An Essay on the Immediate Data of Consciousness*, Dover, Mineola, NY (2001).
2. H. Bergson, *Duration and Simultaneity: Bergson and the Einsteinian Universe*, 2nd ed., Clamen Press, Manchester, UK (1999).

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■ **The trouble David Mermin** is having with the concept of Now is similar to the problem that Plato, Aristotle, and Martin Heidegger had with the concept of being. Both have no meaning when considered as individual points; they are continuous entities and can only be understood as such. Heidegger pointed out that for most people, being and Now are self-evident. Apparently, it's only physicists and philosophers who are embarrassed by their lack of understanding of such obvious concepts. According to Ockham's razor, the simplest explanation is usually the best one. And Albert Einstein, who venerated simplicity, once said that the only reason time exists is "so that everything doesn't happen all at once." That statement may seem facetious, but it is a corollary of his equating of space and time.

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■ **David Mermin says** correctly that the spacetime of special relativity does not by itself describe our experience of Now. He also notes that we are "complex, extended entities." A natural conclusion is that a notion of Now is not built into the fundamental laws of physics. Rather, it arises from the particular way our brains are organized to process temporal information—a way that is consistent with the fundamental laws but not an inevitable consequence of them. Reference 1 provides simple models of how that works within familiar classical physics, including special relativity.

That conclusion is supported by models of observing systems that do not have a past, present, and future way

of organizing temporal information and that are also consistent with the fundamental laws.

Reference

1. J. B. Hartle, *Am. J. Phys.* **73**, 101 (2005), <http://arxiv.org/abs/gr-qc/0403001>.

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■ **Mermin replies:** Understanding the Now was not the main purpose of my March 2014 commentary. My primary point was that a new way of resolving the puzzles and paradoxes of quantum mechanics, called QBism by Christopher Fuchs and Rüdiger Schack, was also able to settle that longstanding problem in classical physics. After my earlier commentary on QBism (PHYSICS TODAY, July 2012, page 8), I was concerned that many of the letters about it (December 2012, page 8) had sounded the same theme: that the letter writer's own way of looking at quantum mechanics was already perfectly satisfactory. I hoped that by applying QBism thinking to a strictly classical problem, I could disengage those readers from their favorite interpretation of quantum mechanics and help them think about QBism on its own merits. I recently emphasized in *Nature*¹ that QBism sheds light on classical physics, too, but there I discussed quantum applications of QBism as well as classical applications ("CBism").

The letters here all address only the problem of the Now but not the fact that I deal with it through a classical application of QBism. While I'm disappointed that they say nothing about QBism or CBism, I'm pleased that they all agree that the problem of the Now is indeed a problem. Not everybody does.

Berge Tatian and B. K. Ridley both criticize me for taking the Now to be a point. But I don't. I call the Now an event "whose duration and location are restricted enough that it can usefully be represented as a point in space and time." I say that "the events we experience are complex, extended entities" and that "to represent our actual experiences as a collection of mathematical points . . . is a brilliant strategic simplification, but we ought not to confuse a cartoon . . . with the experience itself."

Ridley's comment "Nor could one person's Now be exactly the same as another's" suggests that I say it could be.

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