Why is there no consensus about becoming and spacetime?

Jan Pilotti B.Sc. mathematics, theoretical physics, M.D. Sweden pilotti.jan@gmail.com
Affiliated member of Institute for Foundational Studies Hermann Minkowski

Abstract

Change, becoming and "the flow of time" are fundamental human experiences. And they are also basic in our first encounter with the physical reality, and are expressed in Newtonian mechanics, which state that time is absolute and same for all, and in GT as t=t'. But in Einstein's Special Theory of Relativity experimentally verified kinematical effects show that space and time are relative. These effects can be given a physical explanation in Minkowski's four-dimensional spacetime. [2]

But as no objective physical becoming is possible in Minkowski's 4D spacetime, because all events of spacetime exist equally, this seems to be an "… apparently insurmountable contradiction between the physical theory of relativity (and the experiments that support it) and our everyday experience." [1 p.110-111] [2, 16]

There is no consensus among philosophers about the nature of time. (see e.g. [3, 17])

Recently Stefanov in *Space and Time: Philosophical problems* [4, p. 29] comments that "The controversy between the A- and B-theorists of time has still not come to an end."

But Stefanov also presents an *elaborated-BA theory*, based on Baker's BA-theory [5] and claims "Thus, the relativistic picture of the world is reconciled with our clear experience of time flow". [4 p. 121] as

"The elaborated BA-theory of time elucidates the connection between time and consciousness by taking seriously Weyl's idea about consciousness to be crawling upward along the world-lines (or better say along the world-tubes) of our bodies." [4 p. 121]

Still my concern is that even if this elaborated BA-theory is correct and is accepted the question is if it is the only possible theory explaining all we know about time. For the temporal asymmetry and the assertion "But the only possible answer is that a continuous series of consecutive regions of three-dimensional subspaces is given to our consciousness" [4 p. 70] does not by itself give an answer to the dimensionality of the world.

And still there is no consensus about the nature of time even among physicists:

Presentism: all that is real exist in the now, "in a moment of time";
past and future do not exist; time flows. [6]

Growing block universe: past and present exist, but future does not exist it is just a potentiality, future is open and possible to influence; time flows. [7, 19]

Block universe, four-dimensional spacetime, eternalism: past, present and future exist equally, no physical objective time flow [2, 8, 9, 16]

Neither presentism nor eternalism: becoming and present real locally.[10]

The lack of consensus about the nature of time is strange and seems to me to indicate that there are some fundamental aspects of reality which are neglected. I will discuss two such neglects that seemingly are related to this dilemma of time: velocities higher than that of light and consciousness not created by brains. Reichenbach [22 p.129] admitted that arbitrary high velocities would give absolute simultaneity [23], (at least in one IS). But he rejected that possibility, referring to Einstein. But Einstein only proved that matter cannot be *accelerated* to the velocity of light, so it has been speculated to exist particles superluminal from start. These have never been found and have also been questioned as leading to paradoxes (like grandfathers' paradox), but which are arguably solved (at least in microphysics) [11]. Superluminal causal processes do make the order of cause and effect relative, which Einstein already 1907 pointed out. But he didn't see it as a logical problem but that it conflicts with all our experience so sufficiently proved impossible. [12 English p. 248] However we now arguably have such phenomena in experimentally verified entanglement.[13] But can this be used for synchronization?

Another approach to superluminality is that Einstein's postulates are not only compatible with but also suggest superluminal LT in two, four and six dimensions (three space and three timelike) [14].The possibility of extra timelike dimensions seems to me to have a possible relation to the problem of 4D spacetime vs. becoming. A possibility, which have been suggested are moving spotlight theories [4 pp.56-] and with versions with a second time dimension, supertime or metatime. Even if this is strongly criticized by Stefanov [4 p. 58] and by Dainton as leading to "… a regress that is as absurd as it is infinite:" [15 p.23] I will argue that an extra time dimension need not to be absurd, when it is realized that becoming and the flow of time is related to consciousness. [Weyl and Petkov in 16 and 2, 4] Almost all philosophers, neuroscientists [18] and even physicists [16,18, 20] assume that the brain "produces", "creates" or "emerges" consciousness. This is not proven as we only have correlates. Instead of hoping that the brain shall explain consciousness and the flow of time I think consciousness is better explained by multidimensional spacetime. And perhaps a six-dimensional Minkowskian spacetime construed as a 5D block universe, i.e. a 2D "possibility surface" of many possible 3D worlds with a 1D absolute time [21] is a way to understand becoming in spacetime as well as a better understanding of consciousness.

References

1. V. Petkov, *From Illusions to Reality: Time, Spacetime and the Nature of Reality* (Understanding Reality Series Book 1) Minkowski Institute Press. 2013
2. V. Petkov, *Relativity and the Nature of Spacetime*, Springer, 2005
3. K. Miller, "Presentism, Eternalism, and the Growing Block." In: *A Companion to the Philosophy of Time.* Edited by Heather Dyke and Adrian Bardon, John Wiley & Sons, Inc. 2013, p. 345-364
4. A. Stefanov, *Space and Time: Philosophical Problems* Minkowski Institute Press, Montreal 2020
5. L.R. Baker, "Temporal Reality." In: *Time and Identity. Topics in Contemporary Philosophy*. Edited by Joseph Keim Campbell, Michael O'Rourke, and Harry S. Silverstein. The MIT Press. 2010
6. L. Smolin, *Time Reborn. From the Crisis in Physics to the Future of the Universe*. Mifflin Harcourt. 2013
7. G.F.R. Ellis, "Physics in the Real Universe: Time and Space-Time". In [9] pp. 49-79
8. H. Minkowski, *Space and Time 1908.* New translation in *Space and Time: Minkowski's Papers on Relativity*. Ed. Petkov, V. Minkowski Institute Press Montreal 2012.
9. V. Petkov, Relativity, Dimensionality and Existence. In Petkov, V. ed. *Relativity and the Dimensionality of the World*. Fundamental Theories of Physics 153, Springer 2007
10. C. Rovelli," Neither Presentism nor Eternalism." Foundations of Physics **49**, 1325–1335 (2019).
11. E. Recami, "Tachyon Kinematics and Causality: A systematic Thorough Analysis of the Tachyon Causal Paradoxes." Foundations of Physics **17**:3, 241-296 (1987)
12. A. Einstein, "Über die vom Relativitätsprinzip geforderte Trägheit der Energie." Annalen der Physik **23**, *z.* 371-384. (1907). In English at https://einsteinpapers.press.princeton.edu/vol2-trans/252
13. R, Tumulka, "The assumptions of Bell' proof." https://arxiv.org/abs/1501.04168v1
14. J. Pilotti, "How Einstein and Minkowski missed real valued Lorentz transformations for v>c which are possible in 2D and in extended special relativity to 6D spacetime." Abstract http://www.minkowskiinstitute.org/conferences/2018/abstracts/Pilotti.pdf
    J. Pilotti, "How Minkowski could have discovered six dimensional spacetime." Abstract http://www.minkowskiinstitute.org/meetings/2019/Abstracts/Pilotti.pdf
    J. Pilotti, "How Minkowski Could Have Discovered Superluminal Lorentz Transformations and Six Dimensional Spacetime." In Spacetime 1909-2019 see [16. pp. 111-146]. Also corrected and a clearer analyze of Einstein 1905 and also of his misses 1907 and 1912(1914) published on https://www.researchgate.net/publication/377759560
15. B. Dainton, *Time and space.* 2nd ed. Routledge 2010
16. V. Petkov, "Can there be becoming in spacetime?" In Reinoud Jan Slagter and Zoltán Keresztes (Eds), *Spacetime 1909 – 2019.* (2020). pp. 71-84. https://www.minkowskiinstitute.com/mip/books/2019conf.html
17. Y. Dolev, How to Square A Non-localized Present with Special Relativity. D. Dicks, ed Philosophy and foundations of physics. The Ontology of Spacetime I. Elsevier 2006.
18. D. Buonomano & C. Rovelli Bridging the neuroscience and physics of time https://arxiv.org/abs/2110.01976 19. G. Ellis, R. Goswami, Spacetime and the Passage of Time. *Springer Handbook of Spacetime*, edited by Abhay Ashtekar, and Vesselin Petkov, Springer, 2014
20. G. Ellis, Physical time and human time. Foundations of physics. 54:1. 2024
21. W. L. Craig and Q. Smith. Eds. *Einstein, relativity, and absolute simultaneity.* Routledge 2008.
22. H. Reichenbach, *The philosophy of space and time*. Dover 1958. Deutsch orig. 1927
23. J. Cosgrove, Simultaneity without cosmology. Abstract 2019 http://www.minkowskiinstitute.org/meetings/2019/Abstracts/Cosgrove.pdf