

Peer Review

Review of: "Philosophical Aspects of Time in Modern Physics"

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I thoroughly enjoyed reading this insightful paper, which elegantly bridges Aristotelian philosophy and the profound conceptual challenges posed by modern physics. I would just like to offer a couple of comments that might further enrich the analysis and provide additional perspectives for consideration. (1) The discussion of delayed choice experiments intriguingly highlights their challenge to classical notions of causality, yet the article could benefit from a more detailed consideration of **non-local realist interpretations** of QM, like the De Broglie-Bohm theory. In this framework, particles always have well-defined positions, and their behavior is guided by a non-local pilot wave that evolves according to the Schrödinger equation. Could this remove the need to invoke retro-causality to explain delayed choice experiments? The pilot wave, by its nature, incorporates both initial and final boundary conditions, providing a consistent deterministic account of quantum phenomena. For instance, in delayed choice setups, the "choice" made at the detector could influence the trajectory retrospectively not through a temporal reversal of causality but via the continuous, non-local interaction between the particle and the guiding wave. Would the author consider exploring whether this explanation could align with experimental results without resorting to the conceptual difficulty of retroactive influences? (2) The treatment of final causality in light of delayed choice experiments is compelling, yet it raises a broader question: could the Aristotelian concept of final causality find its most natural grounding in the **block universe view** of relativity? This perspective posits that all events—past, present, and future—coexist within a four-dimensional spacetime structure. In such a framework, the future is as "real" as the past, and causal relations should not be confined to a unidirectional flow from past to future: actually, if the universe is a static block where the "now" is an observer-dependent slice of spacetime, then it is unsurprising that final states influence the behavior of quantum systems. The delayed choice experiments, often seen as evidence of retro-causality, could instead reflect the timeless interdependence of all events within the block. From this viewpoint, what appears as retro-causality might simply be the manifestation of a system's holistic nature, where boundary conditions—both past and future—constrain the behavior of particles and waves. Such an approach would integrate seamlessly with the Aristotelian analysis performed in this paper. The "now" (nunc) in the block universe can be seen as analogous to the Aristotelian nunc semper stans: a point of temporal intersection that binds the continuum. This perspective also provides a natural explanation for the apparent interplay of initial and final states in quantum mechanics without requiring a metaphysical commitment to time as a flowing entity. Would the author consider expanding the discussion to address how the block universe model might support the coexistence of Aristotelian final causality and modern physical insights? This might enhance the coherence of the proposed argument and bridge the gap between philosophy and contemporary physics.

Declarations

Potential competing interests: No potential competing interests to declare.