

Peer Review

Review of: "Observers as Agents: Relational Epistemology from Physics to Ecology"

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The author makes the case that scientific objectivity is grounded in intersubjective mechanisms for sharing individual perspectives on interactions with the world. While I accept this, I do not think that the author appreciates the radical difference between the role of the observer in quantum mechanics and the role of the observer in any other domain of knowledge.

The author claims that; "Across all domains—quantum systems, biological organisms, social networks, and ecosystems—observers function as embedded agents." Including QM in the list muddles the profound break between the quantum and classical worldviews.

I agree that insofar as we learn about the world by actively making interventions in the world, we cannot speak of a world independent of such interventions. Observers equipped with different affordances will speak of different worlds because the class of interventions they can make is different. Likewise, the kind of sensations they register.

The paper is a little vague on what constitutes an agent. The missing feature is 'learning'. Learning agents compress the correlations they find between interventions and observations to embody the rules of physics, from their perspective. The shock of quantum mechanics was the discovery of ways to intervene in the world that resulted in observations that could not be predicted by the learned relations from centuries of prior interventions. The discovery of spin-half angular momentum is a good example.

The key difference between QM and everything else is this: In QM, if we know the state of a quantum system for certain, there is at least one measurement for which the results are certain, and simultaneously at least one measurement that is completely uncertain.

Prior to the discovery of quantum intervention, complete knowledge of the state of a system made every measurement certain. In the old world of Newton, Faraday, and Einstein, we attribute all uncertainty to ignorance. The fact of the matter is independent of our knowledge of it. In QM, uncertainty is not grounded in ignorance. The world of QM is irreducibly uncertain. There are physical events that are not caused by any intervention.

The author is right to claim that objectivity must be grounded in the ability of communicating learning agents, of like kind, to cooperate through collective interventions. This adds a new element — language — to the ground of objectivity and explanation. Modern treatments of multi-agent reinforcement learning would seem to be relevant here.

The author views any interaction as informational. This is contested. I would refer interested readers to Chris Timpson's seminal book on the problem; a book that also mounts a series critique of Qubism. The author's validation of Rovelli's relational view of QM is also a little eccentric. Rovelli ignores the fatal objections of Brukner (<https://arxiv.org/abs/2107.03513>) and also Pineear (<https://arxiv.org/abs/2107.00670>). There is no getting around the irreversible act of measurement. Correlations do not fix the measurement basis.

The author claims that "From an observer-based perspective, however, entanglement reflects structured correlations in the knowledge and information available to observers rather than direct physical links between objects of observation". This is misleading. All entangled systems must have interacted prior to any observation that reveals entanglement, so the causal arrow points in the direction you would expect it to. The direction of common cause.

Declarations

Potential competing interests: No potential competing interests to declare.