Correlation, Causation, and the Hard Problem: A Quantum-Causal Perspective

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1 Introduction

The "hard problem" of consciousness—why and how subjective experience arises from physical processes—has often been invoked to dismiss quantum interpretations of consciousness. We do not claim here that quantum mechanics *solves* the hard problem. Instead, we present a series of questions which reveal that some common objections rest on assumptions about causation that may not be justified. Recent mathematical work in quantum causal models, indefinite causal order, and counterfactual semantics provides evidence that correlation, rather than classical causation, may be the fundamental structure.

Our aim is to:

(i) List the common formulations of the hard problem in critique form.

(ii) Pose precise questions that expose where correlation has been mistaken for causation.

(iii) Cite mathematical results that imply a reframing is possible.

(iv) State explicitly what we are *not* claiming.

2 Common Conceptions and Our Questions

2.1 Conception 1: Physics Cannot Produce Phenomenology

Claim: Physics describes only structure and dynamics, not subjective qualia. Therefore, physics cannot explain consciousness.

Our Question: If physics has always described *correlations* between measurable states, on what basis do we assume that the absence of a direct causal law for qualia means they cannot emerge from those correlations?

Mathematical Insight: Quantum causal models (Allen et al., 2017) show that correlations can exist which cannot be reduced to classical causes. This suggests correlation may itself be fundamental, not derivative.

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2.2 Conception 2: Consciousness as Epiphenomenal

Claim: Even if quantum events occur in the brain, they may be causally inert with respect to subjective experience. Consciousness would be an ineffective byproduct.

Our Question: Is this claim not assuming that consciousness must exert *extra causal powers*, rather than recognizing that it may correlate with—and be identical to—the collapse dynamics already producing causal outcomes?

Mathematical Insight: Measures of quantum causal influence (Hutter et al., 2023) show that entangled states exhibit influence structures not reducible to classical cause-effect. Correlation and influence need not be separate categories.

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2.3 Conception 3: The Explanatory Gap

Claim: Even a full account of quantum brain processes would not explain "why it feels like something" to be conscious.

Our Question: When we say the explanatory gap "remains," are we confusing correlation with causation—expecting a direct causal law for subjectivity, when the consistent correlation between collapse sufficiency and experience may itself be the explanation?

Mathematical Insight: Quantum counterfactual semantics (Kooderi Suresh et al., 2023) demonstrate that counterfactual dependence does not always entail classical causation. This weakens the expectation that subjective reports require causal rather than correlational grounding.

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2.4 Conception 4: Observer Confusion

Claim: Collapse theories rely on the observer, and therefore risk circularity (consciousness causes collapse; collapse causes consciousness).

Our Question: If we reject the idea that observers cause collapse, must we not also reject the assumption that collapse is irrelevant to consciousness? Both claims exceed correlation and invoke unjustified causation.

Mathematical Insight: Results on indefinite causal order (Liu et al., 2025) show that quantum processes can violate causal inequalities. Correlation structures may persist without fixed causal narratives.

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2.5 Conception 5: Evolution Would Not Select For Consciousness

Claim: Consciousness has no causal efficacy, so evolution would not select for it.

Our Question: Is this not assuming that subjective experience must be directly *causally* efficient, rather than recognizing that systems which support collapse-sufficiency (and hence correlate with experience) may have been selected for other reasons?

Mathematical Insight: Work on non-causal explanations of quantum correlations (Felline, 2021) indicates that some correlations are fundamental and irreducible. This opens space for evolutionary "selection by correlation," not just by direct causal advantage.

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3 What We Are and Are Not Claiming

We Are Asking:

- Whether objections to quantum consciousness often assume a classical causation framework that recent mathematics has shown to be incomplete.
- Whether correlation—when formally defined in quantum contexts—may suffice for grounding aspects of consciousness without requiring extra causal postulates.

We Are Not Claiming:

- That quantum collapse *is* the solution to the hard problem.
- That subjective experience has been fully explained in physical or mathematical terms.
- That correlation replaces all need for causal analysis; rather, that correlation may carry more weight than critics often allow.

4 Conclusion

The hard problem remains open. Yet, recent mathematical results in quantum causal modelling and indefinite causal order suggest that correlation may be more fundamental than causation in quantum systems. This weakens objections which presuppose that lack of causal explanation is equivalent to impossibility. It does not prove a quantum theory of consciousness, but it shows that the ground for dismissing one is less firm than often assumed.