What Is Observed Is Not a State: Entanglement as Lag-Structured Non-Closure

K. E. Itekki

Independent Researcher

February 2026

Abstract

Quantum entanglement is commonly interpreted as a manifestation of nonlocal physical influence or as evidence of intrinsically holistic quantum states. This paper proposes a different reading.

We argue that what is empirically observed in entanglement experiments is neither nonlocal causation nor global state reality, but a specific pattern of *locally accessible traces* resulting from a *globally defined update process*. When such trace configurations cannot be reconstructed by any local, separable, and causally closed model, the resulting explanatory residue is labeled as "entanglement."

From the perspective of observational syntax, this residue does not indicate a new physical interaction. Rather, it exposes a structural mismatch between (i) update granularity fixed at the level of the whole system and (ii) inferential frameworks that presuppose local state accessibility.

Entanglement thus functions as a diagnostic signal: it marks the failure of π-closed, state-prioritized explanations when applied to update-driven phenomena. Bell-type results are reinterpreted accordingly, not as proofs of nonlocality, but as demonstrations of the impossibility of simultaneously maintaining locality, realism, and explanatory closure.

In this framework, entanglement is not an ontological property of nature, but an inference artifact generated by attempts to force globally updated trace configurations into locally decomposable models.

Appendix 1 Why "Collapse" Is an Inference Artifact

Quantum "collapse" is not a physical event but an interpretive construct. What is physically realized is a global update whose minimal granularity is not necessarily decomposable into local subsystems.

Observation accesses only stabilized traces formed after the update. Collapse narratives emerge when observers attempt to reconstruct a unique pre-measurement state from incomplete trace information.

> Collapse occurs not in the world, but in the explanation.

Appendix 2 Trace Accessibility and the Illusion of Causality

Entanglement correlations arise from constraints on trace accessibility. Each observer accesses only local traces, while the update that produced them was indivisible.

Causal narratives—including nonlocal influence—are inference-level artifacts introduced when π-closed locality assumptions are imposed on trace correlations.

> What appears as nonlocal causality is the shadow of a global update projected onto local inference.

Appendix 3 Update–Trace–Inference Structure of Entanglement

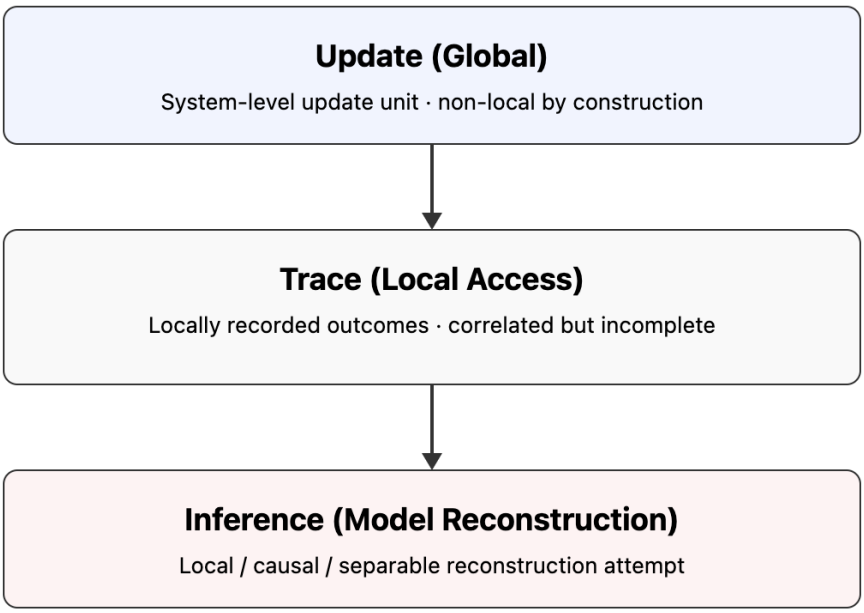

Figure 1: A global update produces locally accessible traces. When inference attempts to reconstruct the update using only local, separable models, the resulting mismatch appears as entanglement.

Layer Roles

- **Update**: Global, indivisible reconfiguration.
- **Trace**: Localized, observable outcomes.
- **Inference**: Reconstruction under explanatory constraints.

Appendix 4 No-Signaling and Update Granularity

No-signaling holds because marginal trace statistics are invariant under remote parameter changes, regardless of update granularity.

This does not constrain the update itself to be local or decomposable. Instead, no-signaling reflects the structure of trace accessibility.

No-signaling limits what can be controlled, not what can be updated.

Appendix 5 Summary

Entanglement does not indicate a fundamental nonlocal interaction. It marks the failure of π-closed, state-centric models to reconstruct global updates from localized traces.

By separating update, trace, and inference, apparent paradoxes dissolve, and entanglement is revealed as a structural feature of explanation rather than of ontology.

Key Thesis:

> Entanglement is the resistance encountered when trace correlations are forced into closed local models.