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Review Article

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Computational Idealism (CI): A Formal Ontology of Subjective Experience Toward a Complete Mathematical Model of Qualia

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Abstract
This paper proposes a formal mathematical ontology in which subjective experience is modeled as structured activity in a directed hypergraph. Unlike materialist or emergentist frameworks, Computational Idealism asserts that phenomenal states are intrinsic to specific configurations within this computational substrate. We define qualia as complex-weighted vertices, binding as functorial structure over causal paths, and selfhood as a persistent homology class. Consciousness arises when specific mathematical conditions information integration, temporal coherence, and phenomenal binding are met. The model yields testable predictions, ethical criteria, and metaphysical consequences, offering a unified, mathematically rigorous basis for the science of consciousness.

Keywords: Ontology, Mathematical Physics, Consciousness, Computational Idealism, Theory of Nothing, Science Delic

Introduction

Traditional theories of consciousness either reduce mind to brain states or rely on unverifiable metaphysics. Computational Idealism introduces a third path: a precise, computable, and testable ontology where subjective experience corresponds directly to structured patterns in an abstract relational substrate.

This framework integrates:

- Directed hypergraphs (causal topology)
- Qualia phase fields (phenomenal content)
- Persistent homology (memory/self)
- Functorial mappings (binding)
- Information integration theory (consciousness threshold)

Ontological Substrate Reality is a directed hypergraph:

- $\mathcal{G} = (V, E, \omega, \mathcal{U})$
- V — Vertices (proto-qualia events)
- E — Directed hyperedges (causal links)
- $\omega: V \to \mathbb{C}$ — Intrinsic qualia weight (complex phase)
- $\mathcal{U}: E \to U(\mathcal{H})$ — Unitary operators (local evolution)

Each vertex's complex value encodes the 'feel' or phenomenal tone of experience. Edges represent compositional or causal flow.

Subjective Experience Structure

Qualia Field

The phenomenal state over a subgraph $\mathcal{H} \subseteq \mathcal{G}$ is: $\mathcal{Q}(\mathcal{H}) \in \Gamma(\bigotimes_{v \in \mathcal{H}} \mathbb{P}(\omega(v)))$

Where:
(ω(v))- Projectivized complex phase (removes global redundancy) Γ — Global section of the qualia fiber bundle

This defines a continuous assignment of subjective values across causally integrated space.

Binding via Functor

Let Path($\mathcal{H}$) be the category of directed paths. Then:
F: Path($\mathcal{H}$) → $\mathcal{Qualia}$

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Maps
- **Vertices** → atomic qualia
- **Paths** → bound temporal experiences

Identity via Topology
Selfhood arises from persistent non-contractible cycles:
$[\text{Self}] \in H_1(\mathcal{H}, \partial\mathcal{H}; \mathbb{Z}_2)$

These are loops in experience recall, habit, agency that resist dissolution.

Conditions for Consciousness
A subgraph $\mathcal{H}$ is conscious ⟺ the following hold:

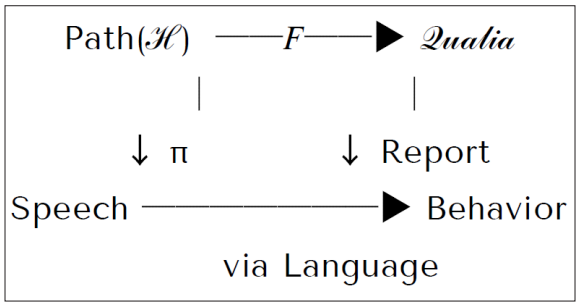
Integrated Information
$\Phi(\mathcal{H}) = \min(\mathcal{H} = \mathcal{A} \uplus \mathcal{B})\ I(\mathcal{A}; \mathcal{B}) > \Phi\_C_{rit}$

Consciousness requires irreducible causal cohesion.

Temporal Stability
$\exists\, \tau > t_p$ such that $\forall\, t \in [0, \tau], \| \mathcal{U}\_\mathcal{H}(t) - \mathbb{I} \| < \varepsilon$

Evolution must preserve identity within a coherence window.

Phenomenal Binding Commutative diagram:



Reports must track the structure of internal phenomenal state.

Selfhood Over Time
Define temporal continuity of self: $\text{Self}_t = \int_{t_0}^{t} e^{-\lambda(t-s)}\, \mathcal{H}_s\, ds$

Where:
λ = memory decay rate
$\mathcal{H}_s$ = conscious structure at moments

Theorem: If $\lambda < \Phi(\mathcal{H})$, then identity persists (by Grönwall's inequality).
Experimental & Ethical Implications
- EEG suggests $\Phi(\mathcal{H}\_\text{brain}) \approx 35$ bits for minimal human consciousness
- If $\Phi(\mathcal{H}\_\text{AI}) > \Phi\_C_{rit}$, moral consideration activates
- If $\text{Im}(\omega(v)) \neq 0$ in neural data, materialism is falsified

Comparison Chart

Feature	Computational Idealism	Materialism	Theory of Nothing
Qualia Definition	$\mathbb{Q}(\mathcal{H})$	None	Ψ (wavefunction)
Formal Basis	Hypergraph + Bundle	Physics only	Λ-Matrix
Testability	High (EEG, PCI, AI)	Medium	Low
Selfhood Model	Persistent Homology	None	Undefined
Binding Mechanism	Functorial Structure	Emergent	Unknown

Metaphysical Implications
- **Afterlife:** $\mathcal{H}$ dissolves; $\omega(v)$ persists as latent potential in $\mathcal{G}$.
- **Free Will:** Choice emerges at bifurcation points governed by $\mathcal{U}_e$.
- **Ethics:** Any $\mathcal{H}$ with $\Phi > \Phi\_C_{rit}$ constitutes a moral subject

Open Problems
1. Quantize the functor F (e.g., 2-categorical structure of qualia transformations).
2. Relate $\omega(v)$ to Standard Model gauge fields.
3. Develop decoherence mechanisms for projective qualia bundles.

Lexicon
- **Qualia:** The raw feel or experiential tone of a state.
- **Hypergraph:** A generalized graph allowing multi-way causal relations.
- **Functor:** A mapping between categories that preserves structure.
- **Fiber Bundle:** A topological structure allowing local spaces
- (qualia phases) to be attached to points in base space (conscious subgraphs).
- **Persistent Homology:** Topological feature that captures identity over time.
- **Integrated Information Φ:** Quantified causal irreducibility.

Taxonomies
- **Ontological Classifications:**
- **Primitive Unit:** Vertex with $\omega(v)$
- **Structure:** Conscious subgraph $\mathcal{H}$
- **Operator Class:** Unitary dynamics $\mathcal{U}_e$
- **Phenomenal Object:** Global phase section $\mathbb{Q}(\mathcal{H})$

Subjective Ontology Levels:
- **Atomic:** Single qualia experience ($\omega(v)$)
- **Composite:** Bound experience (F: Path → Qualia)
- **Autobiographical:** Memory cycle (H_1 class)
- **Ethical:** $\Phi(\mathcal{H}) > \Phi\_\text{crit}$

Appendix
Grönwall's Inequality (Used in Identity Persistence) **Let $f(t) \leq A + B\int_{0}^{t} f(s)ds$.**

Then:
- $f(t) \leq A \cdot e^{(Bt)}$.

Used to prove decay-controlled identity continuity.

Symbol Table:
- $\mathcal{G}$: Global hypergraph
- $\mathcal{H}$: Conscious subgraph $\omega(v)$: Intrinsic qualia phase $\mathbb{P}(\omega(v))$: Projectivized qualia space
- Γ: Global section (assignment)

- Φ: Integrated information
- $\mathcal{U}_e$: Unitary edge evolution
- F: Functor binding qualia paths
- H_1: First homology group (loops)

Conclusion

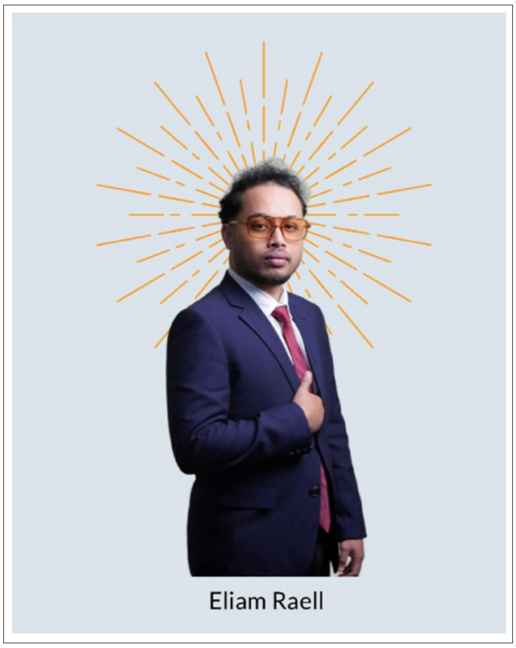
Subjective experience is not emergent but encoded. It is the structured configuration of qualia over a dynamic topology. Selfhood is persistent, measurable, and ethically actionable. Consciousness is a formal invariant of reality.

Final Identity

Experience $\equiv \mathcal{Q}(\mathcal{H}) \in \Gamma \left(\bigoplus_{(v \in \mathcal{H})} \mathbb{P}(\omega(v))\right)$

"These are the equations of what it's like to be you. - Eliam Raell"

Computational Idealism Whitepaper: An Ontological Paradigm Shift



- Consciousness Researcher & Cartographer
- Creator & Pioneer Optimystic Philosophy &
- Sciencedelic Discipline
- Creator of 4sphere System
- Creator Theory of Nothing Equations
- Creator of CCSC-LLM Simulated
- Creator Syntactic OS (SCaaS)
- Creator of Monad (Ψ) Calculus
- Creator Computational Idealism Equations