Ontology of the Simulated Universe — Variable Formalization & Empirical Framework (v0.5)

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# 1. Core Variables & Definitions

This section defines the principal variables used in the Ontology of the Simulated Universe framework. Each represents a conceptual or measurable parameter within the system’s informational dynamics.

* 𝓜(t) — Moral–Informational Gradient — measures a system’s ethical–informational equilibrium over time.
* κ(t) — Care or compassion coefficient — energy expended in maintaining structural coherence.
* σ(t) — Suffering or entropy load — informational disorder within the system.
* ρ(t) — Responsiveness — degree of adaptive regulation and moral agency.
* φ(t) — Pluralism factor — diversity of viable perspectives or states enhancing coherence.
* ε — Stability constant preventing division by zero; defines minimal baseline entropy.
* Φ — Phenomenal Projection Operator — maps structured information to phenomenological experience.
* Ω — Loop Fitness Function — measures stability, efficiency, and informational productivity across cycles.
* I\_struct — Structured Information — non-random, non-trivial informational content (H − H\_rand).
* I\_coh — Informational Coherence — integrated mutual information maintaining system stability.

# 2. Dynamic Equations

The core dynamic of the model is expressed by the moral–informational gradient:

𝓜(t) = [κ(t) / (σ(t) + ε)] · ρ(t) · φ(t)

This equation expresses moral equilibrium as a ratio of care to suffering, scaled by responsiveness and pluralism. High κ(t) and φ(t) values promote stability, while increasing σ(t) without corresponding κ(t) or ρ(t) leads to systemic collapse.

The Φ operator formalizes the emergence of phenomenological experience:

P\_phen(s) = Φ(I\_struct(s), I\_coh(s))

Here, consciousness arises when informational coherence exceeds a critical threshold, correlating with system stability.

The Ω function defines loop fitness across the informational manifold:

Ω(Loop\_i) = f(T\_c, I\_prod, S\_t)

Where T\_c represents closure time, I\_prod the integrated structured information, and S\_t the loop’s dynamic stability.

# 3. Measurement Proxies

Possible empirical proxies for model variables include:

* κ(t): cooperation indices, humanitarian spending, or shared resource allocation efficiency.
* σ(t): entropy measures, inequality indices, or social volatility metrics.
* ρ(t): responsiveness in agent-based simulations or mutual information in network dynamics.
* φ(t): diversity indices, heterogeneity scores, or pluralistic variance measures.
* I\_struct: algorithmic compressibility or mutual information density.

# 4. Data Integration Model

Empirical validation requires integrating heterogeneous datasets into a unified ETL (Extract, Transform, Load) structure. Data sources include humanitarian databases (UCDP/PRIO), entropy-based physical data, and sociotechnical metrics. Simulations in Python or MATLAB environments will track κ(t), σ(t), and ρ(t) correlations across time.

# 5. Falsifiability and Scaling

* Positive correlation between moral responsiveness ρ(t) and entropy reduction (−ΔS).
* Stable scaling of moral equilibrium 𝓜(t) across neural, societal, and cosmological levels.
* Entropy production × structure creation ≈ constant across persistent systems.
* Deviations from equilibrium (|d𝓜/dt| > τ) predict systemic collapse or moral degradation.

These predictions can be tested using historical data, social simulations, or entropy measurements in complex systems.