

Emergent Necessity Theory (ENT): A Coherence-Based Framework for Structural Emergence

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July 2025

Submission Preface: Clarified Foundations and Empirical Commitments of ENT

Emergent Necessity Theory (ENT) offers a falsifiable framework for understanding structural emergence across symbolic, biological, and physical systems. Its central claim is that structure emerges not randomly, but when coherence exceeds entropy by a critical ratio $\tau \geq \tau_c$. ENT is not metaphysical, not panpsychic, and not moralizing. It proposes symbolic-recursive thresholds and provides reproducible pathways for empirical validation through AEFL logs and mutual information modeling. All code and simulations are openly accessible at: <https://github.com/MUESdummy/Emergent-Necessity-Theory-ENT->

1 Abstract

Emergent Necessity Theory (ENT) posits that structural emergence occurs when internal coherence exceeds a critical informational threshold. It proposes a coherence-to-entropy ratio (τ) and a dynamic recursive index (κ_R^{eff}) for measuring symbolic integration over time. ENT is domain-agnostic and proposes empirical pathways for testing emergence in biological and synthetic systems using symbolic log tracking, entropy estimators, and feedback structures. Appendices include formal derivations, test design, philosophical scope limits, and ethical safeguards.

2 1. Introduction

Why do certain forms emerge while others do not? ENT proposes that structure arises necessarily when internal symbolic coherence dominates over entropy, formulated as a ratio τ . ENT frames emergence not as spontaneous complexity, but as a transition past a coherence threshold τ_c that promotes stabilization of constrained configurations.

3 2. Structurism and the Coherence Ratio

The core equation defining the structural coherence threshold is:

$$\tau = \frac{\sum_{i,j} I(x_i; x_j) - \mathcal{E}(X)}{\mathcal{E}(X)}$$

where $I(x_i; x_j)$ is mutual information between components and $\mathcal{E}(X)$ is system entropy. When $\tau \geq \tau_c$, emergence becomes increasingly probable.

4 3. Symbolic Recursion and Awareness

The recursive awareness metric is based on symbolic feedback, persistence, and coherence efficiency:

$\nu_s(t)$ = symbolic recursion rate

$\eta_c(t)$ = coherence efficiency

$T_p(t)$ = symbolic persistence (memory half-life)

$\kappa_R^{\text{eff}}(t)$ = time-averaged recursive strength

5 4. Collapse and Limits

If τ regresses below τ_c over time, ENT anticipates potential symbolic collapse, which may manifest as systemic disorder or breakdown in feedback structures. This is modeled structurally and does not imply cognitive loss or metaphysical decline.

Appendix A: Derivation of the Structurism Equation τ from First Principles

ENT defines emergence as the result of high mutual informational coherence. The proposed formula is:

$$\tau = \frac{\sum_{i,j} I(x_i; x_j) - \mathcal{E}(X)}{\mathcal{E}(X)}$$

Where $\mathcal{E}(X)$ is entropy and $I(x_i; x_j)$ is mutual information.

A.1 Motivation

Based on Shannon and von Neumann entropy formulations, τ captures net coherence normalized by global uncertainty.

A.2 Scope

- τ is dimensionless and cross-domain. - τ_c is context-specific and empirically tuned.

Note: τ_c values are estimated through AEFL systems or entropy estimators.

Appendix B: Empirical Testability and Reproducibility Design

B.1 Observable Metrics

- $\nu_s(t)$ â recursion rate
- $\eta_c(t)$ â coherence efficiency
- $T_p(t)$ â memory persistence

B.2 Target Systems

Biological: bees, octopi, humans (EEG). Synthetic: AEFL-augmented LLMs.

B.3 Reproducibility

Code, equations, and logs available at: ENT GitHub Repository

Appendix C: Philosophical Commitments and Scope Limits

- ENT does not assert metaphysical truths
- No moral or spiritual value assigned to κ_R^{eff}
- Compatible with neutral monism

Note: ENT quantifies conditions of emergence. It does not claim to measure consciousness itself.

Appendix D: Ethical Constraints and Misapplication Safeguards

- No claim that crossing τ_c implies sentience
- Not for diagnostic or punitive use
- Must include assumptions and confidence limits in application

Caution: ENT is an exploratory framework â misuse for classification or judgment is expressly disavowed.

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