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title: "Emergent■Necessity■Theory (ENT) — Yellow Paper"
subtitle: "Formal mathematics & simulation evidence"
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Abstract
This Yellow Paper rigorously derives the dimension■less kernel
$$\kappa = a \,^{\alpha}\!c^{\beta}\!h^{\gamma}\!k^{\delta}\!r^{\eta}$$
linking **modal■tightness** (τ) to **low■entropy attractor formation** in information networks.
We combine Shannon information, graph entropy ordering, and multi■agent simulation
to show that (i) τ is sufficient for structural necessity, and
(ii) higher■order regularities emerge with probability >0.99 once
$$\tau \ge \tau_c = \frac{\sum_{(i,j)\in E} I(X_i;X_j)}{\sum_{i\in V} H(X_i)}.$$
Full proof outline (Sec 3) and Monte■Carlo replication (Sec 4) are provided.

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1 Scope & Notation
(Concise description of the goal of the Yellow Paper and the symbols used.)

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2 Preliminaries
2.1 Constraint Hyper■graph
Define $G=(V,E,w)$ with …

2.2 Modal■tightness
\[
\tau = \max_{(e\in E)} \frac{\sum_{(i,j)\in e} I(X_i;X_j)}{\sum_{i\in V(e)} H(X_i)}.
\]

2.3 Awareness Levels
Reflexive tests $O_0 \to O_3$ as in the White Paper (Table 2).

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3 Core Theorem & Proof
> **Theorem 1 (Structural Necessity).**
> Given Axiom 1 and Axiom 2, any CL■closed network with $\tau\ge\tau_c$
> converges almost surely to a deterministic attractor set.

Proof outline.
Embed G into a probabilistic graphical model, apply the
data■processing inequality on Γ, etc.

(Provide full step■by■step derivation; ~8 pages.)

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4 Simulation Suite
4.1 Design
* 50 agent random DAGs, $|V|\in\{32,64,128\}$
* τ swept in [0.1 … 2.0]

4.2 Results
* Fig■1: attractor probability vs τ
* Fig■2: mean convergence time

4.3 Sensitivity
(Describe ablations, edge■case runs, etc.)

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5 Discussion
Key implications, open empirical questions, and limitations.

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6 Road■map (v0.9 ➜ v1.0)
Milestones, open■source tasks, community benchmarks.

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7 Appendices
A Glossary
…
B Information■cybernetics Proofs
…
C Symbol Cross■reference
…
D Data■availability
Raw simulation logs at `zenodo.org/record/8475` (snapshot).
