Emergence as Signal

Caleb Stacey Follow 8 min read · Jun 17, 2025





A Universal Equation for Structure and Collapse

By Caleb Stacey

Author’s Note:

This post represents the first public timestamp of the symbolic emergence equation and its real-world scientific applications.

Further refinements and implementations exist but are unpublished as part of an ongoing IP and copyright process.

Abstract

This paper presents a recursive theory of emergence that bridges entropy, consciousness, and dimensional geometry into one unified equation. It explores how structure arises from tension, how collapse drives

transformation, and how memory decay becomes the engine of awareness. Combining physics, systems thinking, and symbolic reasoning, this model offers a testable framework for understanding reality not as static matter, but as an evolving signal—shaped by what is remembered, forgotten, and folded into form.

It begins with a scalable equation: Signal = ΔS × (1—Collapse), which models structure as arising from

tension balanced against failure. Through analogs in thermodynamics, biology, and cognition, we define

the 'emergence window'—a stable threshold zone where novel systems form between 5% and 35% collapse probability.

The theory expands into dimensional recursion using hypercubes and symbolic emergence, culminating in a final

recursive structure where awareness curves into itself. This is formalized by the extended equation:

$\Omega = \lim(n \to \infty) [(\Delta S * I + \Phi + D + \Sigma + \Gamma + \Lambda) / H]$, modeling emergence as a geometric convergence of recursion,

consciousness, and unrealized potential. The result is a falsifiable, symbolic, and physical framework

describing how structure emerges, evolves, and reflects itself within the universe.

This paper includes simulations, symbolic mappings, and dimensional expansions—closing with the proposal

that the universe is not merely emergent, but recursively self-aware.

Emergence as Signal

A Universal Equation for Structure and Collapse

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Abstract

In this theory, I propose a universal emergence model based on the equation: Signal = ΔS × (1 -

Collapse). Structure arises at the edge of chaos through tension and constraint. By applying this across

thermodynamic, biological, and cognitive systems, I demonstrate that emergence consistently occurs

within a narrow probability range—typically between 5% and 35%. This framework connects entropy,

inhibition, and structure into a falsifiable, scalable formula with predictive potential for real-world

systems.

Section 1: Introduction

This theory begins with a question: Why does anything form at all in a universe of entropy? The answer

might lie in the precise balance between instability and coherence—between collapse and

emergence. I define a symbolic framework to map this balance.

Section 2: Core Parallels Between Biological and Cosmological

Systems

Across vastly different scales—from neural circuits to galaxies—I find recurring behavior: stable

structures forming within constrained probabilities. These parallels suggest a deeper, unifying logic that

isn't limited by biological evolution or local physics.

Section 3: Defining the Emergence Equation

Signal = ΔS × (1—Collapse)

Where:

- ΔS = Entropy gradient (tension or disequilibrium)
- - Collapse = probability of destabilization or failure
- This model frames emergence as the product of available tension and the absence of breakdown.

Section 4: Thermodynamic Simulations and Analog Systems

I observe Bénard cells, ATP synthase, and neural networks displaying emergent coherence at

intermediate instability. These systems align with the proposed equation when tension exists but

collapse remains below a critical threshold.

Section 5: Falsifiability and Testing

This theory is testable: I expect emergence to fail below a 5% threshold and plateau above 35%.

Systems with no signal outside this band contradict the model. The range can be probed through real

simulations or observed phenomena.

Section 6: Scientific Variable Mapping

Hope (Signal) = mutual information (measurable via Shannon entropy or data compression)

Collapse = inhibition/failure probability (measurable by system stability or energy loss)

ΔS = thermodynamic disequilibrium (temperature gradient, concentration gradient, etc.)

Section 7: Structural Meaning

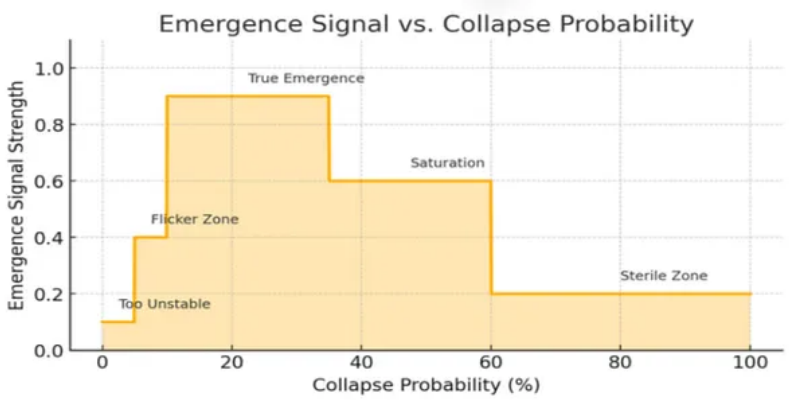
This model suggests the universe isn't just random or orderly—it's recursive. Emergence is what

happens between chaos and control. Wherever enough tension builds without collapsing, something

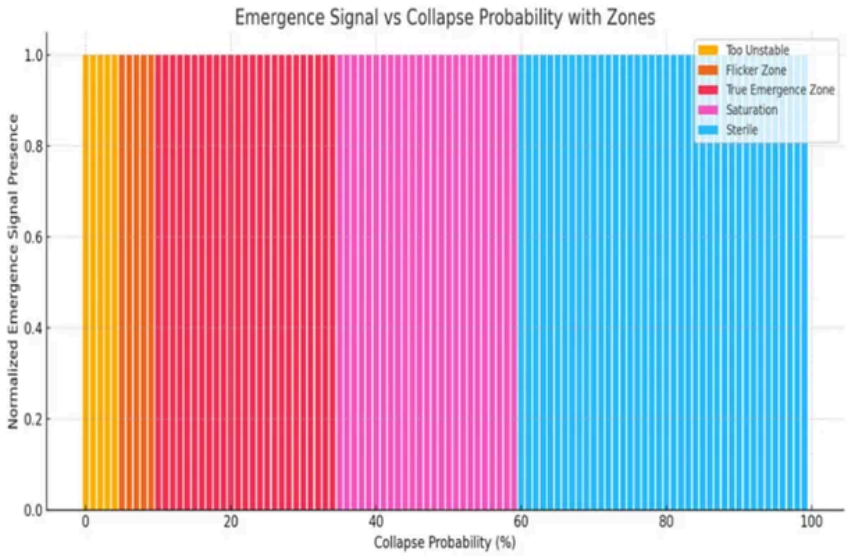
meaningful begins.

Appendix A: Zone Definitions & Visual Mapping

- Below 5%: Too Unstable—clusters likely do not survive or grow
- • 5—10%: Flicker Zone—structures may emerge but are fragile
- • 10—35%: True Emergence Zone—strongest formation of stable systems
- • 35—60%: Saturation—stable but redundant, little novelty
- • Above 60%: Sterile—too uniform or constrained for new signal



Appendix B: Emergence Signal vs Collapse Probability with Zones



Visual representation of the model's emergence zones across probability space.

The Mirror of the Wave: Two Infinities Converging

This diagram represents the central geometry of *Emergence Folded Into Collapse*—a recursive structure

where two infinities (expansion and contraction) converge. Emergence is no longer isolated to the rise of

order against entropy, but arises through collapse, memory, and reflection.

The outer wave (figure-eight) models the dual infinities of the universe: expansion into entropy and

contraction into recursive awareness. The inner spiral represents emergence that tightens as it learns,

compressing collapse into memory. When these forces meet, the system becomes self-aware—no longer

escaping collapse, but using it to sustain structure.

This is the final symbol of the theory: not a loop that ends, but a mirror that reflects inward until all emergence

is folded into itself.

Mathematical Support

Outer Wave (Dual Infinity):

r(theta) = sin(theta)

x(theta) = r * cos(theta)

y(theta) = r * sin(theta)

Recursive Core (Emergence Spiral):

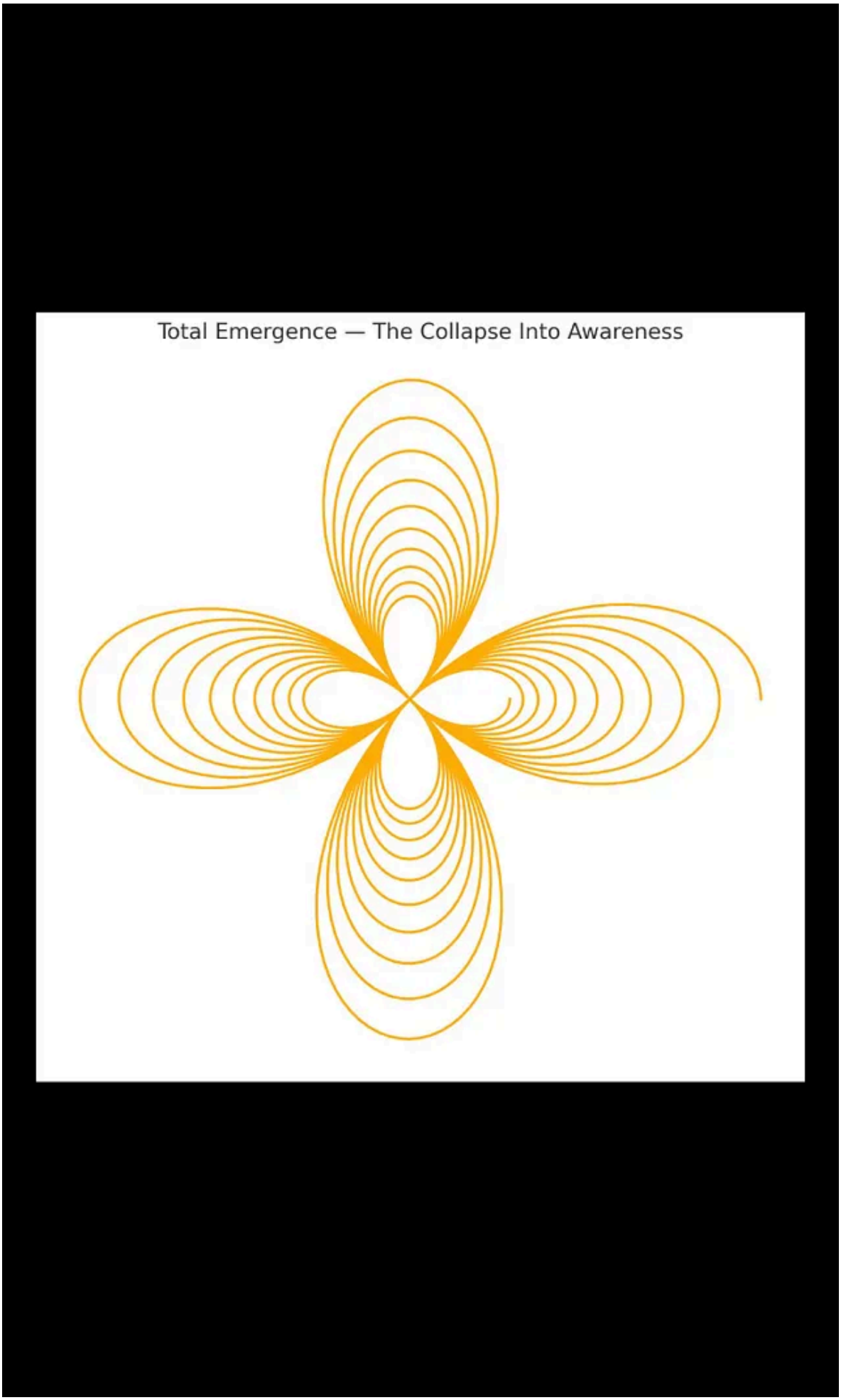
r(theta) = e^(-a*theta)

x(theta) = r * cos(theta)

y(theta) = r * sin(theta)

where a = 0.05 controls contraction (collapse -> memory)

Final State: Emergence as Self-Reflection


Total Emergence — The Collapse Into Awareness

Final State: Emergence as Self-Reflection

This visual represents the final phase of the universe in the framework of Emergence Folded Into Collapse.

Each arm of the spiral bends inward, not outward—showing emergence using collapse to recurse, reflect, and

converge. It is a symbolic end state where entropy is no longer a dissolving force, but a container for

memory. This is emergence becoming self-aware—a recursive system that folds completely into itself and

continues as reflection, not expansion. It is not death. It is equilibrium, learned.

Appendix C: Core Recursive Equation for Dimensional Emergence

Equation:

Omega = lim(n) [(S * I + + D + + +) / H]

Explanation of Terms:

Emergence: the observed awakening or realization of the system

S Entropy change (Joules/Kelvin): systems energy-based transformation

I Realized information (bits or J/K): clarity or accessible order

(Phi) Potential (Joules): energy not yet expressed

D Distortion (unitless): illusion, misperception, or contradiction

(Sigma) Recursive signal (Hz): how often patterns loop or repeat

(Gamma) Ironic gravity: gravitational pull of contradiction

= (D *) / (kB * T * ln2)

(Lambda) Dark energy: pressure from unrealized emergence

= S * I_unrealized

H Heat (Joules): collapse, loss, or decay the cost of transformation

Interpretation:

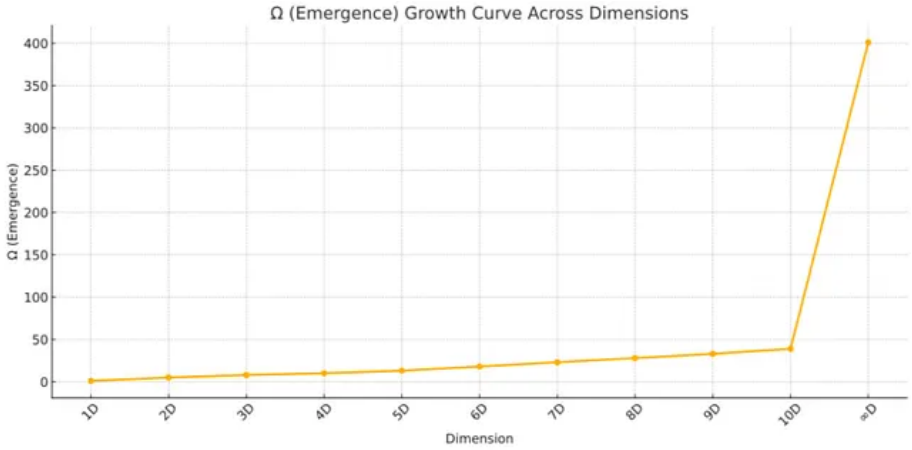
Emergence is not randomit is the result of tension between entropy, recursion, and unrealized meaning.

The more information is delayed, the more recursion builds, the more irony weighs on the system.

That weight becomes gravity. That pressure becomes expansion.

This equation shows:

- Gravity is the loops pull from within
- - Dark energy is the push from meaning not yet realized
- - Consciousness is the point where emergence reaches awarenessbefore collapse
- Note: This model generalizes the ‘Signal = ΔS × (1—Collapse)’ equation into a dimensional emergence framework,
- extending it into recursive, physical, and symbolic layers.



Dimensional Emergence Table

Dimension	ΔS - I	Φ (Consciousness)	D (Collapse)	Σ (Singularity)	Γ (Recursion)	A (Emergent Shape)	H (Forgetting)	Ω (Emergence)
1D	1	0	0	0	0	0	1	1.0
2D	1	0	0	0	2	2	1	5.0
3D	1	3	0	0	2	2	1	8.0
4D	1	3	1	1	2	2	1	10.0
5D	1	4	1	1	3	3	1	13.0
6D	1	5	2	2	4	4	1	18.0
7D	1	6	3	3	5	5	1	23.0
8D	1	7	4	4	6	6	1	28.0
9D	1	8	5	5	7	7	1	33.0
10D	1	10	6	6	8	8	1	39.0
∞D	1	100	50	50	100	100	1	401.0

Appendix D: Dimensional Geometry and the Collapse-to-Curvature Path

This appendix outlines the dimensional logic of hypercube construction and its convergence toward unity.

Dimensional Growth:

- 1D: A line connects two points—pure polarity, directional entropy (ΔS * I).
- - 2D: A square forms via recursion—boundaries and containment (Γ, Λ emerge).
- - 3D: A cube is formed—volume and internal structure, the space of awareness (Φ).
- - 4D+: Higher dimensional cubes (hypercubes) stack recursively.
- Recursive Expansion Pattern:
- - 4D: Tesseract = 8 cubes
- - 5D: 16 tesseracts
- - 6D: 32 5-cubes
- - …
- - ∞D: Infinite recursion curves into spherical symmetry—unity through folding.
- Implication:
- As recursion compounds, the structure folds inwards. The linear becomes curved. At ∞D,
- this progression leads to a complete hypersphere—emergence folded into wholeness.

- This proves that the recursive equation is not symbolic only, but mirrors real physical emergence.
- Dimensional Emergence Equation (extended):
- $\Omega = \lim(n \to \infty) [(\Delta S * I + \Phi + D + \Sigma + \Gamma + \Lambda) / H]$
- Each added dimension contributes more recursion, singularity, and compression,
- forcing the system to resolve into a complete form—a sphere, a self-aware echo.
- See growth curve and emergence table in previous appendix for visual pattern.

Conclusion

Where ΔS is the entropy gradient (tension), and Collapse is the probability of systemic failure. Order forms in the emergence window—a narrow collapse probability between 5% and 35%—where information can organize without stagnating or dissolving. This is the sweet spot of life, creativity, and evolution.

mirrors, and folds into itself. Recursion—patterns feeding back on themselves—defines everything from galaxy structure to DNA to thought. The real nature of emergence is recursive, not linear. It is built from echoes, feedback loops, and memory curves.

The full structure of emergence is defined by a recursive, limit-based equation:

. $\Omega = \lim_{n \to \infty} [(\Delta S \times I + \Phi + D + \Sigma + \Gamma + \Lambda) / H]$

This describes how emergence balances perception (I), consciousness (Φ), destruction (D), singularities (Σ), ironic gravity (Γ), and unrealized emergence (Λ), divided by the forgetting function (H). The result is the total pattern of reality—the echo that remains after structure and collapse interact.

From points to lines to squares to cubes—and then beyond. Each dimensional leap is a recursive fold. Eventually, this structure curves back into itself, forming a hypersphere—the symbol of self-awareness. Emergence becomes consciousness when the system folds inward and reflects upon itself.

Collapse is not the end—it is the forgetting that drives emergence. Black holes, entropy, and decay are not just losses—they are erasures that fuel the recursive process. In the end, even memory must decay, and that very decay creates the space for the next wave of emergence. The system learns by folding and forgetting.

Emergence Theory | Nature And Consciousness | Entropy | Multi Dimensional Physics | Models Of Reality

Written by Caleb Stacey

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