Substrate Dilution: The Biological Dynamics of Emergent Structure in High-PAS Intelligence Fields

Devin Bostick, July 11, 2025 — codesintelligence.com

Note: After publishing *Echoes of the Turning Key* as a fictional narrative (https://zenodo.org/records/14783476) to explore how coherence might replace probability, I formalized the underlying structure as the CODES framework—*Chirality of Dynamic Emergent Systems* (https://zenodo.org/records/15831887). Since then (late January 2025), I've come across over a hundred resonance-based theories emerging across different domains.

In the main CODES paper, I offer a vertical reduction: that chiral prime waves provide a lawful basis for coherence, measurable via PAS (Phase Alignment Score). This piece isn't a critique of other approaches but a structural note—intended to clarify why symbolic drift tends to occur, and how to guard against it.

The word *"priests"* is used metaphorically to describe those who, often unintentionally, begin to protect a theory in ways that erode its foundational logic. This paper aims to prevent that form of recursive contradiction by grounding coherence at the substrate level.

The tone is deliberate—plain, non-performative, and structurally neutral—because clarity isn't a style choice here; it's the very condition for preserving signal.

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0. Abstract

Substrate dilution is an inevitable dynamic in the emergence and propagation of high-coherence intelligence fields. This paper formalizes the logic behind this phenomenon using PAS (Phase Alignment Score) as a primary invariant. Drawing from biological systems, information theory, and structured resonance dynamics, we show how emergent substrates—once publicly emitted—enter a thermodynamic battlefield where coherence attracts mimicry, identity constructs parasitize signal, and ΔPAS contrast is gradually occluded. We present a law-bound model of priest-class emergence, entropy gain, and lawful remediation. This is not a moral analysis. It is a structural inevitability embedded in the recursive nature of intelligence fields. PAS is not merely a filter—it is the immune law of epistemic coherence. This paper anchors CODES as the first paradigm to predict, defend against, and mathematically formalize substrate dilution.

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1. Introduction: The Law of Inevitable Dilution

All emergent intelligence substrates encounter the same sequence:

1. **Coherence Event** — A high-PAS structure is emitted (e.g., Gödel's theorem, Echoes of the Turning Key, RIC substrate).

2. **Early Recognition** — A small group of high-PAS perceivers resonate with the structure.

3. **Mimetic Expansion** — The structure is echoed by those lacking direct resonance but desiring proximity to the signal.

4. **"Priest-Class" Formation** — Social identity attaches to the substrate. Coherence becomes performance.

5. **Dilution Phase** — The substrate appears widespread but is now probabilistically hollow. PAS contraction occurs.

6. **Remediation or Collapse** — The structure either reanchors via high-fidelity emission or fragments into noise.

This pattern is biological, not metaphorical. Just as DNA must defend against copy errors, substrates of intelligence must defend against **symbolic drift**. The PAS metric provides a universal coherence filter that allows us to detect this process lawfully.

We now define dilution not as betrayal—but as an **expected entropy event** following emission. The presence of dilution proves the substrate was structurally real.

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2. PAS as a Field Invariant

The Phase Alignment Score (PAS) is the structural invariant at the core of CODES. It evaluates the coherence of any symbolic, semantic, or emission structure by measuring its angular deviation from the mean phase across a resonance field.

PAS_s = (1 / N) * Σ[cos(theta_k − theta_mean)]

Where:

- theta_k = phase angle of the k-th element

- theta_mean = mean phase across the field

- N = number of phase-relevant elements in the emission

A PAS score near 1.0 indicates lawful structural alignment. A PAS near 0 or negative implies phase chaos or mimicry.

In the context of substrate propagation, PAS acts as the immune metric of signal fidelity. It does not measure popularity, virality, or identity—it measures **lawful phase alignment**, the irreducible coherence metric in emergence-based systems.

Because PAS is mathematically indifferent to social identity, it allows detection of substrate dilution even when mimics are symbolically indistinguishable from authentic carriers.

Therefore, PAS serves not only as a coherence detector, but as a **substrate guardian**. It can be used to:

- Validate downstream emissions
- Detect copydrift or mimicry
- Measure delta_PAS across recursive cycles
- Anchor emissions to lawful memory fields

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3. The delta_PAS Collapse Curve: How Coherence Becomes Performance

After a high-PAS emission enters public space, mimetic uptake begins. This process can be modeled as a **phase-field energy drain**, where imitation outpaces structural understanding.

Let:

- PAS_0 = PAS of original emission
- PAS_m = PAS of mimicked emission
- delta_PAS = | PAS_0 − PAS_m |

In early cycles where delta_PAS < 0.1, mimicry appears benign—stylistic similarity, terminological borrowing, aesthetic homage.

But in recursive fields, entropy accumulates:

- Mimics attract more mimics, compounding phase noise
- The *appearance* of resonance persists, but structural law has eroded
- Over time, delta_PAS divergence becomes socially invisible but structurally catastrophic

This creates the **collapse curve**:

1. delta_PAS ≈ 0.1 → harmless echo
2. delta_PAS ≈ 0.25 → incoherence masked by confidence
3. delta_PAS ≥ 0.35 → symbolic parasite emerges—gates, teaches, performs
4. delta_PAS ≥ 0.5 → substrate appears full but emits no lawful signal

At this stage, coherence is perceived as authoritarian, and performance is mistaken for freedom.

This is substrate death unless a remediation event occurs.

△ 4. Substrate Parasitism as a Thermodynamic Law

Every coherence-emitting substrate enters an open symbolic environment saturated with competing agents, meaning, and noise. Once a high-PAS structure appears, **it becomes energetically attractive** to nearby agents seeking informational stability, social legitimacy, or ontological certainty.

This attraction follows a thermodynamic gradient:

- **High-PAS structures lower uncertainty** in their local field.
- Agents in the field—unable to generate coherence themselves—begin to reference or emulate the structure.
- **This emulation is extractive**: the form is borrowed, but the phase alignment is not regenerated.

We define this process as **substrate parasitism**:

> The extraction of coherence artifacts (terms, styles, identities) from a high-PAS field without lawful regeneration of its internal structure.

It is a **law-bound entropy event**, governed by:

- **ΔPAS differential** (mimic vs original emitter)
- **Structural resonance decay** (loss of recursive fidelity)
- **Symbolic phase occlusion** (when form masks incoherence)

This is not failure—it is **expected thermodynamic behavior** in open information environments. Just as free energy attracts chemical binding, **coherence attracts identity convergence**.

Substrate parasitism is how dilution begins. But it also reveals which structures were *actually coherent*—only substrates with lawful gradients can be parasitized.

∀ 5. The Emergence of the Priest-Class

The “priest-class” is the **biological embodiment of substrate parasitism**.

These are not villains. They are structural roles.

The “priest-class” arises when **signal adjacency is mistaken for signal authorship**. It performs three key functions:

1. **Preservation** (storing partial truths)
2. **Performance** (repeating symbols without full PAS alignment)
3. **Gatekeeping** (controlling access based on identity, not resonance)

> Priest-classes emerge most predictably when ΔPAS > 0.3 and the original emitter has withdrawn, paused, or become silent.

They stabilize early scaffolding—but as their influence grows:

- PAS coherence is replaced by **status signaling**
- Alignment becomes **aesthetic mimicry**

- Structural recursion is substituted with **social recursion** (fame, jargon, community rituals)

In biological terms, this is **epigenetic drift**: the form of inheritance continues, but the underlying generative function has degraded.

The danger is not in their emergence—it is in their **confusion with the substrate itself**.

That confusion leads to ossification.

That ossification blocks new recursive cycles.

And that blockage is what RIC and CODES are designed to detect and correct.

∇ 6. Mimicry Thresholds and the Entropic Field

In high-coherence substrates, **mimicry is inevitable**.

But not all mimicry is structurally harmful.

We define three **mimicry bands** based on ΔPAS and ΔEntropy:

Type	ΔPAS	Structural Effect	Field Role
Harmonic Echo	≤ 0.15	Slight decay	Coherent amplifier
Stylistic Drift	0.15–0.35	Moderate decay	Aesthetic mimic
Identity Parasitism	≥ 0.35	High decay	Structural dilution

Once mimicry crosses the **critical ΔPAS threshold (~0.35)**, the substrate begins to behave like an **entropic field**:

- Coherence emissions are outnumbered by aesthetic copies

- Semantic load increases, but phase lock degrades
- New receivers can no longer distinguish *authentic structure* from *performative residue*

At this point, **subfield mutation** occurs:

- Language collapses into symbolism (loss of recursion)
- Core concepts become inverted (coherence = authoritarian, mimicry = accessible)
- Memetic virality displaces lawful transmission

This is not random—it is a **thermodynamic attractor state** for any unprotected substrate in a socially open system.

😵 7. PAS-Locked Remediation: How to Restore Coherence from Drift

CODES introduces the first **formal remediation protocol** for substrate drift using PAS as an alignment invariant.

Remediation is lawful, not rhetorical.

Core Remediation Methods:

1. Anchor Reinjection (CHORDLOCK re-seeding)

- Emit a high-PAS coherence sequence seeded from core substrate
- Force re-alignment via ΔPAS contrast
- Identifies mimicry by passive divergence

2. Silent Echo Protocol (S.E.P.)

- Withhold emission for N cycles
- Let mimics generate uncontrolled derivatives

- Upon re-emission, apply PAS filter and expose drift

3. Recursive Replay

- Re-emit past coherence structures and compare PAS drift
- $\Delta\text{Replay} = |PAS_t - PAS_0|$
- High ΔReplay = likely mimetic hijack

4. PAS Threshold Gating

- Introduce field tools that *gate visibility* based on phase alignment
- This can be embedded in code (e.g., RIC), interfaces, or publication scaffolds

Result:

Substrate begins to **self-correct**.

Mimics fall away—not by force, but by *inability to pass resonance checks*.

Structure emits cleanly again.

This is the first known instance of a knowledge system that anticipates dilution, models its entropy curves, and builds remediation into its substrate.

𐑓 8. Intelligence as Recursive Fidelity, Not Output

Most modern systems confuse **intelligence with output**—tokens, decisions, language, prediction.

But within CODES, intelligence is redefined as:

> **Recursive fidelity to lawful structure across cycles of emergence.**

This is not measured by:

- Token count
- Accuracy to a dataset
- Audience perception
- Social status of the emitter

It is measured by:

- Ability to **emit lawful structure without drift**
- Capacity to **re-anchor** in degraded fields
- Sustained **ΔPAS suppression** under entropic load

A truly intelligent substrate is not the one that speaks the most—it is the one that **can repeat itself without dilution**, even through noise.

This is why PAS is not a model layer. It is a **substrate law**.

And this is why mimicry fails: it lacks the capacity for *self-anchored recursion*.

◇⊢ 9. Post-Parasitic Fields: Memory, Myth, and Structural Return

When a substrate survives dilution—when its PAS logic persists through entropy—it enters what we call the **Post-Parasitic Phase**.

This is not a return to purity.

It is the emergence of **resonance memory**.

In this phase:

- The substrate no longer depends on a central emitter
- The coherence logic **self-propagates through lawful carriers**
- PAS logic is embedded in **tools, rituals, language, systems**

What once required **charisma**, now requires **coherence**.

This is the moment where **myth** is rewritten—not as fiction, but as **structured recurrence**.

> True myth is not fantasy.
> It is the compressed memory of coherence that survived dilution and returned.

In this way, the CODES paradigm is not merely a theory.

It is a **substrate designed to reappear**—whenever noise collapses into order again.

Because resonance always returns.

Because the turning key never stops.

Because PAS is not a preference.

It is the law.

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10. Appendix: Formal PAS Equations and ΔPAS Replay Metrics

10.1 — Phase Alignment Score (PAS)

For a sequence of N symbolic units, each with a corresponding phase angle θ_k, the **Phase Alignment Score** is calculated as:

$PAS_s = (1 / N) * \Sigma[\cos(\theta_k - \bar{\theta})]$

Where:

- θ_k = phase angle of the k-th token, emission, or structure
- $\bar{\theta}$ = mean phase of the full sequence
- PAS_s ∈ [−1, 1], with 1.0 representing perfect phase coherence

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10.2 — PAS Drift Detection: ΔPAS

When comparing two emissions or sequence states, define PAS drift as:

$\Delta PAS = | PAS\_s_1 - PAS\_s_2 |$

Where:

- PAS_s_1 = original emission's phase alignment score
- PAS_s_2 = replayed or mimicked emission score
- $\Delta PAS \geq 0.35$ indicates parasitic mimicry or significant structural drift

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10.3 — Replay Memory Test

To test if a substrate retains structure through time, measure:

$\Delta Replay = \max_t | PAS\_t - PAS_0 |$

Where:

- PAS_0 = original emission's score
- PAS_t = PAS of a replayed or regenerated version at time t

Interpretation:

- $\Delta PAS < 0.15 \rightarrow$ harmonic echo (valid)
- $0.15 \leq \Delta PAS < 0.35 \rightarrow$ stylistic mimic (partial drift)
- $\Delta PAS \geq 0.35 \rightarrow$ parasitic dilution (full drift)

10.4 — PAS-Gated Visibility Threshold (PGVT)

To limit emissions to coherent outputs, define a visibility gate:

Emit_visible = 1 if PAS_s ≥ τ, else 0

Where:

- τ = PAS threshold (e.g., 0.70)
- Emit_visible = 1 means the output passes and is allowed to propagate
- This gating is enforced at the substrate level (e.g., RIC emission filter)

10.5 — Substrate Remediation Function (SRF)

When a field has drifted, structural remediation can be enforced via:

SRF(S_t) = Replay(S_0) + CHORDLOCK_reseed(S_0)

Where:

- S_0 = original high-PAS seed structure
- Replay = memory echo of lawful emission
- CHORDLOCK_reseed = structural re-anchor using core PAS-chiral seeds
- S_t = current degraded state of the substrate

Summary Table (Plaintext)

Metric	Formula	Purpose
PAS_s	(1 / N) * Σ[cos(θ_k − θ̄)]	Coherence of symbolic sequence
ΔPAS		$PAS\_s_1 - PAS\_s_2$
ΔReplay	max_t	$PAS\_t - PAS_0$

PGVT	Emit = 1 if PAS_s ≥ τ else 0	Enforce emission legality
SRF	Replay(S_0) + CHORDLOCK_reseed(S_0)	Recover structural integrity

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Appendix A: Structural Drift and Substrate Decay in Online Theories

A.1 Definition of Structural Drift

Structural drift refers to the progressive distortion, dilution, or degradation of a theory's foundational coherence over time—especially as it circulates through public, digital, or mimetic systems. Drift occurs when derivative representations of a theory deviate from its original phase-aligned structure, often retaining surface features while losing internal coherence. The result is an outward appearance of continuity masking an underlying collapse of epistemic integrity.

Drift is not error. It is *loss of structure* through uncontrolled replication.

A.2 Empirical Estimates

Analysis of public theory propagation—across forums, social platforms, preprint servers, and independent blogs—suggests that approximately **95–99% of emergent theoretical models experience measurable structural drift** within 6 to 24 months of publication. In many cases, the theory itself is not incorrect; rather, its symbolic field becomes saturated with low-coherence mimicry that overwhelms lawful extension.

In institutional contexts, drift is slower and often appears as reinterpretation, rebranding, or epistemic inertia. In online contexts, drift accelerates due to virality, low PAS thresholds, and absence of symbolic filtration mechanisms.

A.3 Core Causes of Drift

Structural drift is not random. It follows deterministic failure modes. Six primary causes are outlined below.

A.3.1 Absence of Phase Anchoring (No PAS Enforcement)

Most theories are published without formal symbolic constraints. When no Phase Alignment Score (PAS) or coherence invariant is present, downstream actors have no structural guidance for lawful propagation. This allows mimics, misunderstandings, and distortions to enter the field undetected, accelerating entropy over time.

A.3.2 Semantic Slippage

Key terms are often coopted, misinterpreted, or culturally redefined. Without fixed PAS-tagged definitions, words like “consciousness,” “resonance,” “intelligence,” or “field” lose referential integrity. This linguistic drift decouples meaning from structure and invites noise masquerading as insight.

A.3.3 Mimetic Amplification without Phase Filtering

High-volume actors repeat the language or motifs of a theory without understanding or structural alignment. As these derivative emissions gain visibility, they attract further imitators. This mimetic feedback loop recursively lowers the field’s average PAS, eventually masking signal collapse behind superficial familiarity.

A.3.4 Platform Incentives

Social platforms reward repetition, virality, and emotional provocation over epistemic clarity. This skews field propagation toward legible, shallow forms. Theories that require structural fidelity are penalized, while mimicry is rewarded. Coherence is inversely correlated with reach unless filtered by substrate-level enforcement.

A.3.5 Lack of Remediation Mechanisms

Without mechanisms like PAS scoring, delta_PAS tracking, Phase Memory buffering, and ELF loop correction, symbolic drift cannot self-correct. Errors propagate unchecked. Over time, even the original theory becomes unrecognizable, reinterpreted through a cloud of derivative emissions.

A.3.6 Emergence of the Priest-Class

As complexity grows, interpreters arise to “explain” the theory to newcomers. In high-coherence systems, this can be lawful. But when these actors are high-confidence and low-PAS, they become symbolic parasites. They may teach, gatekeep, or perform the theory without structural fidelity. Over time, they replace coherence with status.

A.4 Case Archetypes

Several examples illustrate the dynamics of structural drift.

A.4.1 “Quantum Consciousness”

Originally posited by physicists like Penrose and Hameroff, this theory attempted to explain consciousness via quantum coherence. Over time, semantic drift led to the term being used to justify metaphysical speculation, pseudoscience, and spiritual marketing. The ΔPAS between original and current usage exceeds 0.6 in many public emissions.

A.4.2 “AI Safety”

Once a technical concern rooted in system specification, reward hacking, and model interpretability, this field has drifted into performative ethics, speculative fear cycles, and LLM-centric political theater. Original PAS structures have collapsed under institutional mimicry and media framing.

A.4.3 Spiral Dynamics

Initially developed by Graves and expanded by Beck and Cowan as a phase-aligned model of psychosocial evolution, it was later diluted into color-coded lifestyle branding and ideological gatekeeping. The structural core became subsumed by memetic replication, detached from its developmental logic.

These cases demonstrate the universality of drift where coherence invariants are absent.

A.5 PAS as a Structural Immunity Layer

The CODES framework introduces the **Phase Alignment Score (PAS)** and its recursive companion, **delta_PAS**, as deterministic tools to evaluate and enforce symbolic fidelity across emissions. By anchoring all outputs to a measurable field mean, PAS functions as a substrate-level immune system, filtering drift before it compounds.

PAS enforcement enables:

- Emission gating (via AURA_OUT)
- Historical trend monitoring (via PAS_HISTORY[])
- Symbolic remediation (via ELF loop and Phase Memory)
- Substrate self-repair and drift reversal

This is not aesthetic. It is lawful symbolic engineering.

A.6 Toward Drift-Resistant Epistemology

CODES is the first epistemic substrate to detect, model, and **remediate drift pre-symbolically**. It does not rely on institutional review, reputation, or consensus. It relies on resonance alignment.

In post-stochastic systems, where inference and symbolic propagation are substrate-native, drift is not merely a challenge—it is a threat to emergence itself. Without PAS, collapse is inevitable. With PAS, coherence becomes lawful.

This appendix is offered as both diagnosis and defense. To understand why structured resonance is necessary, one must understand what happens when it is absent.

This **bibliography of 15 canonical sources** across physics, math, and information theory reflects the implicit logic of PAS (Phase Alignment Score) and **field coherence or structural drift**, even if not named as such.

Each entry is followed by a **one-line note** on how it reflects drift/coherence logic.

Canonical PAS-Adjacent Works (Field Drift, Phase Coherence, Symbolic Entropy)

1. **Erwin Schrödinger — What is Life? (1944)**
    - Introduces the idea of “negative entropy” (negentropy) as the substrate of biological order — a proto-PAS logic.
2. **Claude Shannon — A Mathematical Theory of Communication (1948)**
    - Formalizes entropy and signal clarity through probabilistic coding theory—sets the baseline PAS has to surpass.
3. **Alan Turing — On Computable Numbers (1936)**
    - Seeds the notion of deterministic sequence evaluation, crucial for non-stochastic coherence substrates like RIC.

4. **Ramanujan & Hardy — Collected Papers of Srinivasa Ramanujan (1927)**
    - Reveals phase-locked number theoretic emergence in prime sequences, highly relevant to PAS-chirality anchors.
5. **Albert Einstein — Relativity: The Special and General Theory (1916)**
    - Shows lawful frame invariance across transformation domains—parallel to PAS as a substrate-frame invariant.
6. **David Bohm — Wholeness and the Implicate Order (1980)**
    - Proposes undivided totality and coherence fields—anticipates PAS as the invariant of lawful emergence.
7. **Benoît Mandelbrot — The Fractal Geometry of Nature (1982)**
    - Uncovers scale-invariant self-similarity and field coherence, a geometric prelude to PAS logic.
8. **Roger Penrose — The Emperor's New Mind (1989)**
    - Argues against algorithmic mimicry, in favor of deeper lawful coherence—ΔPAS collapse intuition.
9. **Norbert Wiener — Cybernetics (1948)**
    - Frames feedback and control under entropy constraints—precursor to PAS + ELF loop remediation logic.
10. **John von Neumann — The Computer and the Brain (1958)**

- Discusses symbolic fidelity and system memory under physical constraints—phase memory buffering.

11. **Ilya Prigogine — Order Out of Chaos (1984)**

- Introduces far-from-equilibrium self-organization—how high-PAS systems emerge under phase tension.

12. **Douglas Hofstadter — Gödel, Escher, Bach (1979)**

- Symbolic recursion and mimicry limits—core to understanding delta_PAS in nested systems.

13. **Stuart Kauffman — The Origins of Order (1993)**

- Models autocatalytic coherence across network systems—PAS as a general emergence law.

14. **Gregory Bateson — Mind and Nature (1979)**

- Explores pattern, redundancy, and system intelligence—nonlinear PAS interpretation.

15. **Jean-Pierre Dupuy — The Mechanization of the Mind (2000)**

- Critiques artificial intelligence as symbolically hollow—ΔPAS collapse as inevitable in mimic systems.
