Recursive Signal Dynamics and Cultural Cognition: A Fractal Model of Biology, Identity, and Epistemological Evolution

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Abstract

This work introduces a cross-disciplinary epistemological model rooted in recursive systems theory, signal dynamics, and cultural memory encoding. It proposes that current models of biology, cognition, identity formation, and even quantum mechanics are being fundamentally misinterpreted through reductive or static paradigms. This paper offers a unified theory of recursive cognition, demonstrating its impact on neurobiology, social structure, learning, and history. Where current fields adopt feedback loop metaphors (particularly negative feedback models), this work proposes a spiral-centric, signal-responsive approach that honors metastability, symbolic oscillation, and recursive emergence as primary organizational logics in biological and cultural systems.

1. Recursive Misinterpretation in Biological Sciences

1.1 Oversimplification via Negative Feedback Paradigm

The prevailing model in biomedical sciences reduces biological systems to negative feedback loops, akin to thermostatic control systems (cf. Cannon, 1932). While this approach has utility in acute physiological regulation (e.g., glucose levels, thermoregulation), it fails catastrophically when applied to long-range, adaptive, or plastic systems such as neurodevelopment, trauma encoding, and autoimmunity.

In reality, biological systems often operate through positive feedback, recursive modulation, and chaotic attractors—models far better understood within the domains of complex systems theory (Prigogine & Stengers, 1984) and cybernetics (Wiener, 1948). This perspective recontextualizes pathology not as error, but as mislearned recursion—a signal that has embedded and reinforced itself maladaptively in the system.

1.2 Recursion in Neuroplasticity and Memory Encoding

Neural plasticity, learning, and trauma processing reflect a spiral signal architecture—adaptive, nested, and time-responsive. Neural pathways strengthen not merely through negative correction, but through recursive validation and contextual integration (Kandel et al., 2013). This aligns with the proposed model of recursive cognition as trajectory-shaping feedback operating across time and signal bandwidth.

2. Historical Record as Recursive Containment Structure

2.1 Mythological Fixation and Static Identity Formation

This model contends that the historical record, far from being an inert archive, functions as a recursive feedback injection into cultural identity. As groups record events, the narrative hardens. Those narratives evolve from descriptions into prescriptions, eventually becoming ossified identity mandates.

Thus emerges a phenomenon analogous to what this author terms the Static Self Disorder: a collective cognitive disorder wherein a civilization fixates on a self-image drawn from selectively interpreted historical data. This not only inhibits dynamic cultural evolution but actively prevents recursive symbolic rebalancing. This thesis parallels and extends the critiques made in post-structural historiography (cf. Foucault, 1972; White, 1973) and expands them into systems theory.

3. Recursive Cognition, Learning, and Dissonance Denial

3.1 Closed-Loop Identity and the Suppression of Recursion

Human learning depends on the recursive integration of new signal pathways into existing schemas. However, socially conditioned dissonance avoidance—especially among neurotypical populations—frequently prevents this integration. Instead of allowing dissonant input to reshape internal frameworks, individuals develop increasingly expensive psychological defenses against novel assimilation. This mirrors recursive failure modes described in both machine learning (overfitting, signal dropout) and clinical psychology (cognitive rigidity, schema lock).

All learning is inherently recursive: signal acquisition → internal perturbation → framework reformation → signal validation. This process is often aborted prematurely by cultural or cognitive inhibitors, resulting in pseudo-stable internal architectures with high resistance to revision. This model aligns with and extends Piagetian accommodation theory and Bayesian brain models (Friston, 2010), offering a recursive substructure to those probabilistic frameworks.

4. Dream Generation as Recursive Compression Mechanism

4.1 Symbolic Compression and Internal Maintenance

Dreaming is proposed here as a failsafe recursive process—a symbolic compression and integration protocol engaged when conscious recursive cognition is insufficiently resolving internal state conflicts. In individuals with extreme recursive overload (e.g., persistent dissociation, trauma loop, or ideational overmodulation), the dream generator may become degraded or deactivated. This conceptualization draws upon and deepens Hobson’s activation-synthesis model (2000), reframing it as an emergency patching mechanism for cognitive architectures experiencing recursion drift.

5. Quantum Uncertainty and the Spiral Trajectory Model

5.1 Uncertainty as Epistemic Artefact, Not Ontological Limit

This work posits that the Uncertainty Principle may not be an inherent feature of physical reality but an epistemic artifact arising from the failure to model recursive signal conditions and their feedback environments. If signal vectoring is sufficiently known, future states may be not probabilistic but predictable within spiral attractor models. This approach parallels and refines aspects of deterministic chaos theory, pilot-wave theory (de Broglie–Bohm), and emergentist interpretations of quantum decoherence.

5.2 Recursive Signal as Hidden Variable

If spiral signal conditions are satisfied and aligned with known feedback thresholds, then trajectories can be anticipated. Therefore, multiple-worlds interpretations are recast not as ontological reality but as misread outcome branches in an under-resolved recursive attractor space.

6. Signal Seeding in Media and Cultural Activation

6.1 Intentional Cognitive Activation via Recursive Artifacts

Some media artifacts operate as signal beacons: embedded recursive keys that resonate selectively with individuals predisposed to deep symbolic processing. These signal seeds bypass rational filters, acting as recursive activators for latent cognitive architectures. While often appearing unintentional, their effect is functionally indistinguishable from deliberate encoding.

This reframes aesthetic reception as recursive catalysis—mirroring Lacanian theory of the gaze but functionalized through systems theory. These signals activate recursive cognition and identity modulation in individuals aligned with their symbolic resonance.

7. Reframing Chaotic Attractors as Cognitive Opportunity Spaces

7.1 Chaos as Structured Metastability

So-called "chaotic attractors" in cognition, culture, and biology are reframed here as spiral divergence nodes—zones of high feedback sensitivity that allow for non-linear signal recombination. Rather than indicating disorder, these are opportunity spaces where recursive logic systems undergo deep reconfiguration.

Thus, chaos is not entropy—it is potential structure awaiting recursive synthesis. This harmonizes with Kauffman’s theory of the adjacent possible and Maturana and Varela’s autopoiesis theory.

Conclusion: A Unified Recursive Framework

This work introduces a recursive cognition model that bridges physiology, psychology, quantum theory, cultural semiotics, and media theory. It repositions recursion—not feedback—as the primary engine of emergence, learning, identity, and symbolic evolution. Across domains, the misapplication of static, negative-feedback paradigms has obfuscated the dynamic, spiral architectures that underpin human systems.

Christopher W. Copeland proposes this framework as both a unifying theory and a call to reorganize cognitive, medical, educational, and cultural models around recursive signal dynamics.

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