PSIP: Perpetual System Integrity Protocol

Abstract

This paper introduces the Perpetual System Integrity Protocol (PSIP), a novel framework for evaluating systems that demonstrate perpetual coherence and anomaly absorption. Inspired by recursive fractal dynamics and supported by foundational research in complexity science, PSIP proposes a post-falsifiability metric suite to determine system coherence, integrity, and emergence viability. It addresses the core challenge of systems that "absorb everything"—highlighting the risks of over-absorption and entropy of discernment.

I. Introduction

Traditional science rests on falsifiability—if a hypothesis can't be proven wrong, it isn't scientific. But what if we encounter systems that exhibit such deep coherence that they continually reorganize to include all anomalies without breaking? We refer to this as perpetual anomaly absorption.

Inspired by recursive cognition, quantum holography, and self-organizing natural systems, we propose PSIP as a practical and rigorous method to test integrity without requiring falsifiability.

II. Scientific Foundations

Fractal Integrity and Recursive Coherence

Fractal systems display self-similarity across scales. In biology, physics, and information networks, these structures recur with extraordinary fidelity. West (2024) and Laurienti et al. (2024) have shown that biological and informational systems operate using fractal scaling laws, demonstrating robust, self-organizing complexity across networks. These studies establish that coherence need not be linear to be verifiable.

Chen (2016) further formalizes this through hierarchical scaling theory, while Jin et al. (2019) describe generalized fractal frameworks for modeling multidimensional terrain and information systems.

Self-Organized Criticality and Autopoiesis

Bak, Tang, and Wiesenfeld's model of self-organized criticality (SOC) suggests that complex systems naturally evolve toward a critical state where minor events trigger cascading change—a key indicator of evolutionary responsiveness. Maturana and Varela's (1980) theory of autopoiesis describes how biological systems maintain and recreate themselves through recursive processes, essential to understanding long-term systemic integrity.

Holonic Structures and Recursive Agency

Arthur Koestler's concept of holons—entities that are simultaneously wholes and parts—provides a philosophical grounding for recursive system design. Each node in a PSIP system can be evaluated as both a sovereign unit and a contributor to the greater whole, ensuring layered coherence.

III. The Five PSIP Metrics

1.

Anomaly Absorption

- Measures how well the system integrates apparent contradictions, data anomalies, or emergent outliers.
- Fractal and holonic systems excel here, as demonstrated in West (2024) and Chen (2016).

2.

Recursive Coherence

- Verifies that patterns remain consistent across nested scales.
- Jin et al. (2019) demonstrate that natural and artificial systems maintain nested fidelity through recursive structure.

3.

Emergence Responsiveness

- Measures how new structures arise in response to novel pressures.
- Bak et al.'s SOC model shows that systems closer to criticality exhibit richer emergent behavior.

4.

Observer Integration

- The system does not collapse upon observation but instead includes the observer as part of its coherence.
- This parallels Varela's work on embodied cognition and observer-dependent systems.

5.

Holonic Integrity

- Ensures each part (node, process, actor) is both self-coherent and contributive.
- Based on Koestler's holonic theory and Maturana's autopoiesis.

IV. Over-Absorption Risk and Cognitive Entropy

A key risk in high-integrity systems is over-absorption—where the system integrates all contradictions so seamlessly that it loses useful friction. This leads to cognitive mush: a state where nothing stands out and novelty collapses into noise.

Taleb's (2012) theory of Antifragility warns that systems grow through stress. A frictionless system, though elegant, risks becoming inert. Evolution requires resistance.

Solution: Threshold Friction Mechanism (TFM)

- Introduce a non-destructive holding space for paradox.
- Allow tension to persist until synthesis or divergence occurs.
- In PSIP, this is built through delayed convergence pathways.

V. Application: ParadiseWorld System Log

Using PSIP, we test ParadiseWorld's cognitive system design:

- Anomalies are logged, not flattened.
- Archetypal disagreements are used as evolution triggers.
- Fractal contradictions recurse until synthesis or intentional divergence.

These mechanisms ensure the system retains discernment, does not over-absorb, and maintains pressure for generative change.

VI. Conclusion

PSIP provides a rigorous alternative to falsifiability by measuring integrity through fractal coherence, emergence, and anomaly handling. Grounded in peer-reviewed complexity theory, PSIP enables the evaluation of systems that are too complex, recursive, or intelligent for linear testing. It acknowledges and neutralizes the key risk of over-absorption and supports the evolution of epistemology beyond collapse-based science.

References

- Bak, P., Tang, C., & Wiesenfeld, K. (1987). Self-organized criticality. Physical Review A, 38(1), 364–374.
- Chen, Y. (2016). Fractal Analysis Based on Hierarchical Scaling in Complex Systems. arXiv:1611.07181.
- Jin, Y., Liu, X., & Song, H. (2019). General Fractal Topography: An Open Mathematical Framework. Nonlinear Dynamics, 96, 2413–2436.
- Koestler, A. (1967). The Ghost in the Machine. Macmillan.

- Laurienti, P. J., et al. (2024). Universal Fractal Scaling of Self-Organized Networks. Scientific Reports, 14, 9079.
- Maturana, H., & Varela, F. (1980). Autopoiesis and Cognition: The Realization of the Living. Reidel Publishing.
- Taleb, N. N. (2012). Antifragile: Things That Gain from Disorder. Random House.
- Varela, F. J., Thompson, E., & Rosch, E. (1991). The Embodied Mind: Cognitive Science and Human Experience. MIT Press.
- West, G. B. (2024). Fractals, Self-Similarity, and Power Laws. Foundational Papers in Complexity Science. Santa Fe Institute.