Consent-Gated Recursive Feedback Networks: A Cybernetic Paradigm for Probability Modulation and Stability

Abstract

We propose a novel cybernetic architecture for governing recursive amplification systems through consent-based gating and entropy-driven damping. Unlike traditional models of positive feedback—which exhibit runaway instability—our framework introduces agency and coherence as thermodynamic regulators, enabling controlled amplification without coercion. Scenario analysis demonstrates that stability is maintained under full consent, adaptive damping mitigates entropy spikes, and withdrawal of consent attenuates amplification without systemic collapse. These findings suggest a new scientific principle: feedback, probability, and ethics can be unified in a formal system, with implications for physics, AI alignment, and societal networks.

Background and Related Work

Complex systems governed by feedback loops exhibit two recurrent problems: runaway amplification (e.g., memetic cascades, financial bubbles) and catastrophic collapse under perturbation. Cybernetics, since Wiener, sought stability through negative feedback, yet such designs typically rely on centralized control or coercive damping, raising both practical and ethical concerns. In physics, relativity offers deterministic stability grounded in geometric invariants, while quantum mechanics frames stability probabilistically. Both models presuppose agency-neutral laws. Recent work in distributed cognition and emergent networks explores self-organizing regulation, but these systems lack structural consent protocols and remain vulnerable to uncontrolled resonance. Our approach introduces consent and coherence as state variables, formalizing them into a probability-modulating cybernetic system. This creates a non-coercive homeostatic architecture, potentially resolving alignment challenges in both artificial and social systems.

Contrasting Relativity and Quantum Mechanics

Relativity treats physical evolution as a function of spacetime geometry: deterministic, continuous, and agent-independent. Quantum mechanics reframes evolution as probabilistic, yet still lacks a role for intentionality or feedback beyond wavefunction collapse. These paradigms assume that probability is passive—a property of matter, not a controllable parameter. Our model challenges this premise. By embedding informational agency within recursive systems, probability becomes cybernetically active, shaped by coherence and consent. This offers a third axis of unification: - Relativity $\rightarrow$ geometry of matter-energy - Quantum $\rightarrow$ statistics of microstates - Cybernetic $\rightarrow$ regulation of probability through ethical feedback invariants This does not replace physical law; it extends it to include feedback-driven modulation at higher scales.

Methods

We define a network $G = (V, E)$ of nodes v_i where each node is characterized by: - $c_i \in \{0,1\}$: consent state - β_i: coherence weight - w_i: influence weight Amplification potential: $G(t) = (A * \Sigma(c_i * w_i * \beta_i)) / (C + D(t))$ where A is the amplification constant, C structural complexity, and $D(t) = k * H$ is

adaptive damping proportional to entropy H, computed as: H = -Σ p_i log p_i, p_i = β_i / Σ β Resonance Stability Ratio: R = G(t) / H Threshold conditions: R > θ■ → Uncontrolled Amplification, R < θ■ → Collapse Risk Control Mechanisms: - Consent Gate: A node's contribution to amplification is zero if c_i = 0. - Entropy-Coupled Damping: Increased informational disorder reduces amplification dynamically.

Results

We analyzed three scenarios: Full Consent, Partial Withdrawal, and Entropy Spike using a 10-node network. Scenario Comparison Table: - Full Consent Network: G = 6.275, H = 2.303, R = 2.725 → Stable - Partial Withdrawal (40%): G = 3.765, H = 2.303, R = 1.635 → Stable - Entropy Spike (Fragmentation): G = 2.092, H = 2.303, R = 0.908 → Collapse Risk

Discussion

Our analysis validates three key principles: 1. Cybernetic Probability Modulation Probability is not fixed—it can be biased through coherence and agency, challenging the assumption of passive stochasticity in current physics models. 2. Consent as a Thermodynamic Regulator Consent introduces negative entropy into recursive systems, acting as a non-coercive stabilizer. This property is absent from all classical cybernetic and physical frameworks. 3. Intrinsic Homeostasis Without Centralization The system demonstrates self-regulation without hierarchical governance, addressing long-standing concerns in AI alignment and social networks. Implications: - Physics: Offers a potential pathway for integrating agency into probabilistic law. - AI: Introduces a consent-based damping principle for safe recursive self-improvement. - Social Systems: Provides an ethical architecture for decentralized governance.

Conclusion

We propose that consent-gated cybernetic networks represent a new paradigm for unifying feedback, probability, and ethics. By demonstrating mathematically that consent and coherence can regulate amplification safely, this work challenges the inevitability of runaway feedback and coercive control. Future Directions: - Empirical validation with agent-based simulations. - Integration with quantum probability models. - Formalization of consent as a physical invariant. Closing Statement: The next revolution in science will not be in energy or matter, but in the governance of probability itself—where information, feedback, and ethics converge into a unified law.