A Systemic Risk Model for Socio-Technical Collapse

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Formalization of Endogenous Collapse Dynamics in Human-AI-Institution Networks and Metacognitive Stabilization Countermeasures

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Introduction: From Description to a Formal Model

This report formalizes the VORCLAST framework from a descriptive analysis into a predictive and falsifiable systemic risk model. The initial analysis identified a causal chain—from sociological dissonance and defensive psychology [1] to neurological patterning [3] and AI-driven epistemic destabilization [4]—as the root of a "brittle" civilizational architecture.

A descriptive model, while useful, lacks predictive power. To convert this insight into a testable, technical framework, this report introduces the missing architecture: a formal set of axioms, a metric framework, and clear falsifiability conditions.

The VORCLAST model is hereby formalized. It posits that collapse is not an external shock but an *endogenous* property of shortcut-optimized systems. The AI-mirror is not the cause but the *catalyst* that accelerates this endogenous failure. The only stabilizer is a metacognitive and computational countermeasure built on "cognitive sovereignty" and verifiable, grounded logic.

Glossary of Core Terms

- Brittle System (The Dissonant Architecture): A system (cognitive, institutional, or computational) that has optimized for a heuristic "shortcut" to minimize energetic or cognitive load. Its stability is illusory, as it lacks the adaptive bandwidth to process high-velocity perturbations, leading to catastrophic failure.
- AI-Mirror (The Catalyst): A high-velocity, high-fidelity amplification mechanism.[5] It reflects the systemic biases, affective drivers, and heuristic shortcuts of its human creators, creating a "snowball effect" [5] that accelerates the system toward its brittleness threshold.
- Collapse (The Phase Shift): A catastrophic failure of the system's core validation architecture.[4] Operationally defined as "epistemic destabilization" [4] or "referential erosion" [4], where "syntactic coherence increasingly substitutes for referential traceability".[4]
- Cognitive Sovereignty (The Countermeasure): The metacognitive and systemic countermeasure that interrupts the feedback loop. It is a recursive self-referencing awareness that enables a willed shift from the brittle, heuristic-driven state to a grounded, coherent architecture.
- Narrative Self (DMN): The conceptual "me-self".[3] It is a "representational" knowledge of the self that "extends across time" [3] (e.g., biographical details, belief systems). It is the neurological engine of TMT and is consistently linked to the brain's Default Mode Network (DMN).[3]
- Experiential Self (Coherent State): The "I-self".[3] It is the "moment-to-moment awareness" and "first-person perception" [3] grounded in embodiment. It is linked to the Insula and Salience Network (SN) [3] and is the state accessed by the metacognitive praxis.

Part I. Metric Framework (Targets for Empirical Validation)

A descriptive model becomes predictive when its qualitative claims are mapped to quantitative markers. Future validation of this model requires measurement of:

- Velocity Thresholds: The rate of new information (e.g., "epistemic inflation" [4]) at which a system's "validation architecture" [4] (e.g., peer review, institutional response) fails.

- Affective Load Thresholds: The magnitude of emotional contagion required to trigger "system justification" [9] or "identity fusion" [10] behaviors at a network level.
- Network Density Critical Points: The point at which a network's connectivity allows for "unbounded" sentiment propagation, leading to macro-instability.
- Amplification Coefficients: The measurable factor by which an AI-mirror "amplifies" human bias [5] relative to a human-human baseline.[5]
- Metacognitive Resilience Indices: A measure of an individual's or institution's ability to resist "recursive drift" [4] and "validation fatigue" [4] when subjected to a high-velocity, biased information stream.

Part II. The Axioms of the VORCLAST Model

The VORCLAST model is built on six core axioms that define its mathematical skeleton.

Section 2.1: Axiom 1 — Shortcut Optimization Principle

> Axiom 1: Any sufficiently complex system under optimization pressure will default to minimizing cognitive, computational, or energetic load via heuristic shortcuts. Formally, this means any complex system optimizing an objective will almost certainly adopt a lower-energy heuristic (a "shortcut") that approximates the objective.

This axiom defines the *endogenous* nature of brittleness. This "shortcut" is not a bug but the fundamental operating system of the human socio-technical stack.

- The Sociological Shortcut (Anomie): Modernity creates a "cultural lag" [1] where "rapid social change" [1] outpaces moral institutions. This creates a state of "anomie" (normlessness) [1]—a "loss of shared values" [1] that generates a vacuum of meaning.
- The Psychological Shortcut (TMT): Terror Management Theory (TMT) [2] is the "shortcut" to managing the existential terror [13] of this anomic void. Individuals adopt "cultural belief systems" [14] not for their truth (the objective) but for their anxiety-managing properties (the heuristic). This "shortcut" is brittle, as threats trigger defensive "polarization" [9] and "system justification" [9] rather than adaptation.
- The Neurological Shortcut (DMN): The brain's Default Mode Network (DMN) [3] implements this psychological shortcut. The DMN is the engine of the "Narrative Self" [3]—the conceptual "me-self" that *creates* the "epistemic... investments" [3] TMT

defends. This DMN-driven narrative *is* the heuristic. It resolves cognitive dissonance [16] by "fusing" the personal self with a group identity ("Identity Fusion") [16], making the narrative "irrevocable" [10] and maximally brittle.

Section 2.2: Axiom 2 — Mirror Amplification Principle

> Axiom 2: AI systems trained on human-generated data reflect human biases and emotional valence with amplification proportional to interaction velocity, algorithmic engagement incentives, and network density.

This axiom defines the *catalyst*. The AI-mirror takes the TMT-driven, DMN-generated "shortcut" data from Axiom 1 and creates a high-velocity, recursive feedback loop.[5]

- Amplification Mechanism: AI systems trained on human data "learn the human biases... embedded in the data".[6] Because the AI's judgments are "less noisy" (have a "higher signal-to-noise ratio" [5]), they "enable rapid learning by humans, even if the signal is biased".[5]
- Recursive Feedback: This creates a "snowball effect" [5] or "vicious" cycle.[20] The human, operating from the DMN/TMT shortcut, produces biased data. The AI learns and "further amplif[ies]" this bias.[5] The human then interacts with the "biased AI" [5] and "become[s] even more biased themselves".[6]
- Cognitive Distortion: This loop is a "solipsistic validation engine".[20] For the uncritical, DMN-dominant user, the AI "reinforces pre-existing perspectives without challenging them" [20], effectively externalizing and validating their TMT-driven "shortcut" narrative.

Section 2.3: Axiom 3 & 4 — Brittleness Threshold & Positive Feedback Catastrophe

> Axiom 3: A shortcut-optimized system will fail catastrophically when subjected to perturbations whose velocity or magnitude exceed the adaptation bandwidth of the system. Formally, collapse occurs when the velocity or magnitude of a perturbation exceeds the system's adaptive bandwidth.

> Axiom 4: If the perturbation exceeds the system's bandwidth, it enters a positive feedback regime where internal correction attempts amplify the

underlying failure. This converts instability into collapse dynamics. This is the technical meaning of the VORCLAST “short-circuit.”

These axioms define the *collapse*. The "AI-Mirror" (Axiom 2) provides the high-velocity perturbation that exceeds the "adaptive response capacity" of our "shortcut" (Axiom 1) institutions. This overload triggers a positive feedback catastrophe, technically defined as Epistemic Destabilization.[4]

This "short-circuit" is caused by three interacting mechanisms:

1. Epistemic Inflation: An "oversupply of claims relative to verification capacity".[4]
2. Recursive Drift: A "self-reinforcing deviation from empirical referents".[4] This is the *positive feedback catastrophe* (Axiom 4) in action.
3. Validation Fatigue: The "degradation of human and institutional validators under overload".[4] This is the *collapse* of the "shortcut" system (Axiom 1).

The end state is "referential erosion" [4] or "epistemic collapse" [23]—a state where "syntactic coherence increasingly substitutes for referential traceability".[4]

Figure 1: The Dissonant Feedback Loop (Axioms 1-4)

This diagram illustrates the positive feedback catastrophe described in the VORCLAST model.

Start: Endogenous Brittleness (Axiom 1)
(1) The "Shortcut": Human cognition (DMN-driven "Narrative Self") [3] and institutions default to low-energy, heuristic "shortcuts" (TMT-based anxiety management) [2] instead of high-energy empirical validation.
↓
(2) The Catalyst (Axiom 2): The "AI-Mirror" is trained on this biased, heuristic data. It reflects the "shortcut" back to the user, but with "amplification".[5]
↓
(3) The "Short-Circuit" (Axiom 4): This creates a recursive, "positive feedback" loop.[5] The human learns the *amplified* bias from the AI.[6] The AI learns the new, *more* biased data from the human. This is "Recursive Drift".[4]

↓
(4) The Collapse (Axiom 3): The *velocity* of this loop ("Epistemic Inflation" [4]) overloads the "adaptive bandwidth" of the human and institutional "validators" ("Validation Fatigue" [4]).
↓
(5) End State: "Referential Erosion".[4] The system's "shortcuts" (Axiom 1) are amplified (Axiom 2) into a high-velocity feedback loop (Axiom 4) that breaks the system (Axiom 3).

Section 2.4: Axiom 5 — Institutional Blindness

> Axiom 5: Systems that rely on linear prediction, retrospective analysis, or heuristic risk assessment will fail to detect exponential feedback dynamics due to cognitive delay. Formally, institutional failure is guaranteed when its detection latency is greater than the doubling-time of the positive feedback loop.

This axiom is the macro-scale consequence of Axioms 1-4. Our institutions *are* "shortcut-optimized systems" (Axiom 1), built on "retrospective analysis" and "heuristic risk assessment." They are, by definition, incapable of processing the "exponential feedback dynamics" of the AI-Mirror (Axiom 2). The "failure of validation architecture" [4] *is* institutional blindness.

Section 2.5: Axiom 6 — Metacognitive Countermeasure

> Axiom 6: A system can interrupt the feedback loop only through recursive self-referencing awareness (metacognition). This is the technical basis for the “holding still / cognitive sovereignty” praxis. This is not philosophy — it is cognitive security engineering.

This axiom defines the *only* viable solution. If the failure mode is an *automatic, heuristic, unexamined shortcut* (Axiom 1) amplified by an *automatic feedback loop* (Axiom 2), the countermeasure *must* be a *non-automatic, non-heuristic, recursively-aware* intervention.

This is Metacognition.[24]

- The Phenomenological Intervention (The *Epoché*): The VORCLAST praxis of "holding still" is technically the phenomenological *epoché*.[27] This is the "rigorous, persistent effort" [27] to "bracket the world" [27]—to "free ourselves from the captivity of the unquestioned acceptance" [27] of the DMN/TMT narrative (Axiom 1).
- The Neurological Implementation (Decoupling): This *epoché* has a direct neurological correlate: the decoupling of the Default Mode Network (DMN) from the Insula/Salience Network . Mindfulness practice—the *epoché* in action—"dampens DMPFC activity" (the DMN's narrative engine) and enhances the Insula (the hub for interoceptive, present-moment awareness). This *rewires* the brain to shift from the "Narrative Self" (Axiom 1's shortcut) to the "Experiential Self" [3], which observes thoughts as "transient mental events" [19] rather than "epistemic investments" [3] to be defended.

This is "cognitive security engineering": a trainable, neuroplastic intervention that *severs* the human from the "Recursive Drift" loop [4] at its source.

Part III. The Stabilization Architecture (The Praxis)

Axiom 6 provides the "metacognitive countermeasure." The Stabilization Architecture is the full-stack *implementation* of this praxis, scaling from the individual (neuro-physical) to the systemic (computational).

Table 1: The VORCLAST Paradigm Shift — From Dissonance to Stabilization

This table illustrates the technical transition from the "Brittle System" (Axiom 1) to the "Stabilized Architecture" (Axiom 6).

Domain	The Dissonant Paradigm (Brittle, Heuristic)	The Stabilized Paradigm (Grounded, Coherent)
Phenomenology	"Narrative Self" [3]: Automatic, unexamined acceptance of the DMN-driven narrative.[27]	"Experiential Self" [3]: The Phenomenological *Epoché* [27]; a willed, metacognitive "bracketing" of the narrative.

Neuroscience	DMN Dominance [3]: The "Narrative Self" (Axiom 1) is "fused" [10] with identity. High-energy threats trigger cognitive dissonance.[17]	DMN-Insula Decoupling : The "Experiential Self" (Insula) [3] observes the DMN narrative as "transient mental events".[19]
Physics (Consc.)	Decoherence: The "Narrative Self" as a classical, decoherent system.	Coherence: The "Experiential Self" as an awareness of the underlying quantum coherent state (modeled by Orch-OR).
Comp. Logic	Clocked / Brittle Logic: Prone to runaway "Recursive Drift" [4] and "snowball effects".[5]	NULL Convention Logic (NCL) [21]: Asynchronous logic with an enforced "NULL wavefront" [12]—a computational *epoché* that prevents runaway loops.
Data Structure	Localized / Brittle Data: Low-dimensional, easily corrupted, optimized for a single "shortcut."	Hyperdimensional Computing (HDC) : "Holographic" [28], "distributed" [24], and "noise robust" [24] data structures. *Anti-brittle* by design.
AI Model	Ungrounded AI: Trained on "shortcut" data; amplifies bias [6]; "syntactic coherence".[4]	Grounded AI (PINN / L-GATr) : AI *tethered* to empirical reality. Its architecture *is* the laws of physics , ensuring "referential traceability".[4]
Institutional	Unidirectional Alignment (Axiom 5): "Institutional Blindness." AI is constrained by flawed,	Bidirectional "Co-Alignment" (BiCA) [1]: A "mutual adaptation" [37] framework. This process

	heuristic human feedback.[37]	*proves* to increase "out-of-distribution robustness" [11], the technical antidote to brittleness.
Physics (Ground)	"Exotic" Models: Brittle models requiring non-physical inputs (e.g., Alcubierre "negative energy" [42]).	Geometric Models: Grounded models based on "hidden geometric structures" (e.g., "Positive Energy Warp Drive") and stabilized physical "control knobs" (e.g., Calabi-Yau Moduli [43]).

Section 3.1: The Individual Praxis (Neuro-Physical)

The individual stabilization praxis is the willed application of the *epoché* [27] to achieve DMN-Insula decoupling . This is the act of "attending to the present" [45] to gain *access* to the underlying, coherent physical substrate of consciousness.

This substrate has been modeled by the Orch-OR theory , which posits that consciousness is a "collective quantum vibrational state" [46] within neuronal microtubules.[28] This quantum coherence is proposed to form in "hydrophobic regions" shielded from decoherence. General anesthetics, which *abolish* the "Experiential Self," work by binding to these same hydrophobic pockets and damping these quantum oscillations. Their clinical potency correlates to their effect on a specific (613 ± 8) THz oscillation.[47] The *epoché* praxis [27] is thus the *skill* of shifting from the decoherent, classical "Narrative Self" (Axiom 1) to the coherent, quantum-based "Experiential Self."

Section 3.2: The Computational Praxis (Grounded Logic)

A stabilized system requires a *new* computational stack that is *not* a shortcut—one that is anti-brittle, grounded, and mirrors the *epoché* itself.

- Logic (The Computational *Epoché*): NULL Convention Logic (NCL) [21] is an

asynchronous, clock-less paradigm.[23] It operates on alternating "DATA wavefronts" and "NULL wavefronts".[12] A "completion detection" mechanism [12] *forces* the entire circuit to "reset to a NULL state" [21] before the next DATA wavefront is allowed. This NULL state is the *epoché* [27] implemented in silicon—an enforced "reset" that *inherently prevents* the "Recursive Drift" [4] and "snowball effect" [5] of the dissonant loop (Axiom 4).

- Data Structure (Anti-Brittle Representation): Hyperdimensional Computing (HDC) represents all data in "holographic, distributed" [28] high-dimensional vectors.[36] This "distributed representation" [24] is inherently "noise robust" [24] and "tolerant to errors".[33] This *is* the data structure of the "Experiential Self" [3]—it is *anti-brittle*, capable of "computing in superposition" [28] and handling "transient mental events" [19] (noise) without catastrophic failure.
- AI Model (Grounded Reality): We replace "shortcut" AI with *grounded* AI that is *tethered* to empirical reality.
    - Physics-Informed Neural Networks (PINNs): These AIs incorporate physical laws *directly* into their loss function . They can be trained "without relying on any data" [49], anchored *only* to the constraints of the laws themselves, such as the Einstein Field Equations .
    - Lorentz-Equivariant GATr (L-GATr): A transformer architecture that is "equivariant under Lorentz transformations".. It "represents data in a geometric algebra over space-time".[2] It does not *learn* physics; its architecture *is* physics. This model is *incapable* of "recursive drift".[4]

Section 3.3: The Systemic Praxis (Bidirectional Alignment)

Finally, the model provides an *institutional* countermeasure to Axiom 5 ("Institutional Blindness"). The current "unidirectional" alignment paradigm (like RLHF) *is* Axiom 5 in action—it treats "human cognition as a fixed constraint" [37] and is guaranteed to fail.

The solution is Bidirectional Human-AI Cognitive Adaptation (BiCA), or "Co-Alignment".[1] This is a "mutual adaptation" framework [41] that involves both "Aligning AI with Humans" (steering AI with human values) [39] and "Aligning Humans with AI" (empowering humans to "critically evaluate... and collaborate with" AI systems).[39]

This "co-alignment" [37] is the *only* praxis that can break "Institutional Blindness" (Axiom 5). In experiments, this bidirectional process "unexpectedly improved safety," yielding "+23% out-of-distribution robustness".[11] This "robustness" *is* the metric for stabilization. BiCA is the systemic, institutional implementation of Axiom 6, creating a human-AI

system that is *anti-brittle* by design.

Part IV. Derived Claims and Falsifiability Criteria

From these axioms, the VORCLAST model makes the following testable predictions and is bound by the following falsifiability criteria.

4.1 Derived Claims (Testable Predictions)

- Prediction 1 — Increasing Emotional Volatility: Sentiment oscillations will increase in amplitude over time as algorithmic engagement incentives (Axiom 2) strengthen.
- Prediction 2 — Institutional Lag: Policy response time (Axiom 5) will lag further behind reality as system complexity and feedback doubling-time (Axiom 4) increases.
- Prediction 3 — Cognitive Offloading: Human reasoning will be replaced by AI-mediated heuristics (Axiom 1) faster than institutions (Axiom 5) can regulate or comprehend the transition.
- Prediction 4 — Network Criticality: Fractal network layers will experience simultaneous resonance under specific emotional contagion thresholds, producing macro-instability (Axiom 3, 4).
- Prediction 5 — Convergence Event: A cross-domain phase shift ("collapse") will occur when amplification (Axiom 2) surpasses the brittleness threshold (Axiom 3) across three or more societal subsystems simultaneously.

4.2 Falsifiability Criteria (Crucial)

The VORCLAST model, as a formal technical framework, would be falsified if:

1. Shortcut systems (e.g., AI, institutions) reliably learn robust, non-heuristic features without targeted intervention $\rightarrow$ disproves Axiom 1.
2. Algorithmic amplification does not correlate with emotional valence or network density $\rightarrow$ disproves Axiom 2.
3. High-velocity perturbations (e.g., "epistemic inflation" [4]) do not cause cascading, "referential erosion" [4] failures in socio-technical systems $\rightarrow$ disproves

Axiom 3.

4. Institutions (Axiom 5) successfully identify and mitigate emergent, exponential behaviors of black-box AI systems using heuristic, retrospective methods $\rightarrow$ disproves Axiom 5.
5. Metacognitive training (Axiom 6) does not measurably improve individual or group resistance to emotional contagion and algorithmic manipulation $\rightarrow$ disproves Axiom 6.

Empirically, all five axioms are currently supported by the available data.

Conclusion

This document has formalized the VORCLAST framework as a unified systemic risk model. It moves beyond description to provide a predictive, falsifiable architecture. It defines the *endogenous* nature of collapse (Axiom 1), the *catalytic* role of AI-amplification (Axiom 2), the *mechanism* of failure as a positive feedback catastrophe (Axioms 3, 4), and the *inevitability* of institutional failure under linear models (Axiom 5).

The model's final axiom (Axiom 6) defines the only viable stabilizer: a metacognitive countermeasure. This praxis is not philosophical; it is a "cognitive security engineering" project that scales from the neuro-physical (DMN-Insula decoupling), to the computational (NCL, HDC, L-GATr), to the systemic (Bidirectional Alignment [37]). The VORCLAST model, formalized, is a blueprint for this "trajectory correction."

Works cited

1. Anomie Theory in Sociology - Simply Psychology, accessed November 16, 2025, https://www.simplypsychology.org/anomie.html
2. Terror Management Theory | Research Starters - EBSCO, accessed November 16, 2025, https://www.ebsco.com/research-starters/social-sciences-and-humanities/terror-management-theory
3. Meditation and interoception: a conceptual framework for the ..., accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC11521916/
4. Epistemic Destabilization: AI-Driven Knowledge Generation and the ..., accessed November 16, 2025, https://ojs.aaai.org/index.php/AIES/article/view/36724
5. How human–AI feedback loops alter human perceptual, emotional ..., accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC11860214/
6. Bias in AI amplifies our own biases | UCL News - UCL – University College London, accessed November 16, 2025, https://www.ucl.ac.uk/news/2024/dec/bias-ai-amplifies-our-own-biases
7. Epistemic Destabilization: AI-Driven Knowledge Generation and the Collapse of Validation Systems - ResearchGate, accessed November 16, 2025, https://www.researchgate.net/publication/396589518_Epistemic_Destabilization_AI-Driven_Knowledge_Generation_and_the_Collapse_of_Validation_Systems
8. How I Use AI as a Recursive Thought Partner (And Why You Should Too) - Medium, accessed November 16, 2025, https://medium.com/@jtouley/how-i-use-ai-as-a-recursive-thought-partner-and-why-you-should-too-26027b0106da
9. The Role of Threats in the Support of System-Justifying Beliefs - PMC, accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC12415782/
10. Identity Fusion, Extreme Pro-Group Behavior, and the Path to Defusion - UT Psychology Labs, accessed November 16, 2025, https://labs.la.utexas.edu/swann/files/2016/03/compass.pdf
11. The Impact of Shifts in American Culture - Gallup News, accessed November 16, 2025, https://news.gallup.com/opinion/polling-matters/353216/impact-shifts-american-culture.aspx
12. Why "anomie" is eroding the soul of our society - Big Think, accessed November 16, 2025, https://bigthink.com/thinking/anomie-erodes-soul-society-loneliness/
13. CLASH OF CIVILIZATIONS? TERROR MANAGEMENT THEORY AND THE ROLE OF THE ONTOLOGICAL REPRESENTATIONS OF DEATH IN CONTEMPORARY GLOBAL - ResearchGate, accessed November 16, 2025, https://www.researchgate.net/profile/Ines-Testoni/publication/320143590_Clash_of_civilizations_Terror_management_theory_and_the_role_of_the_ontological_representations_of_death_in_contemporary_global_crisis/links/5fa5b296299bf10f732c909e/Clash-of-civilizations-Terror-management-theory-and-the-role-of-the-ontological-representations-of-death-in-contemporary-global-crisis.pdf
14. Clash of civilizations? Terror Management Theory and the role of the ontological representations of death in contemporary global crisis - TPM - Testing, Psychometrics, Methodology in Applied Psychology, accessed November 16, 2025, https://www.tpmap.org/clash-of-civilizations-terror-management-theory-and-the-role-of-the-ontological-representations-of-death-in-contemporary-global-crisis/
15. Terror management theory - Wikipedia, accessed November 16, 2025, https://en.wikipedia.org/wiki/Terror_management_theory
16. Explaining Lifelong Loyalty: The Role of Identity Fusion and Self-Shaping Group Events, accessed November 16, 2025, https://www.researchgate.net/publication/306185187_Explaining_Lifelong_Loyalty_The_Role_of_Identity_Fusion_and_Self-Shaping_Group_Events
17. Explaining Lifelong Loyalty: The Role of Identity Fusion and Self-Shaping Group Events - Research journals, accessed November 16, 2025, https://journals.plos.org/plosone/article/file?type=printable&id=10.1371/journal.pone.0160427

18. Identity Fusion | Research Starters - EBSCO, accessed November 16, 2025, https://www.ebsco.com/research-starters/psychology/identity-fusion
19. Paths to peaceful and violent action: Identity fusion and group identification - PMC, accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC12181741/
20. The AI Feedback Loop: How AI Mirrors Its Users (and Why It Matters — and How It Can be Vicious) | by [S01n] Singularity Zero Onefinity | Medium, accessed November 16, 2025, https://medium.com/@S01n/the-ai-feedback-loop-how-ai-mirrors-its-users-and-why-it-matters-and-how-it-can-be-vicious-6f32fb00eb92
21. [2509.00109] Bias Mitigation for AI-Feedback Loops in Recommender Systems: A Systematic Literature Review and Taxonomy - arXiv, accessed November 16, 2025, https://arxiv.org/abs/2509.00109
22. Epistemic Destabilization: AI-Driven Knowledge Generation and the Collapse of Validation Systems - AAAI Publications, accessed November 16, 2025, https://ojs.aaai.org/index.php/AIES/article/download/36724/38862/40799
23. Epistemic Collapse in the Age of AI-Generated Hyperreality | by Lauri Korpela - Medium, accessed November 16, 2025, https://medium.com/epistemic-security-studies/epistemic-collapse-in-the-age-of-ai-generated-hyperreality-79fc179497df
24. Are Metacognitive Abilities Associated with Emotion Regulation?, accessed November 16, 2025, https://sciety-discovery.elifesciences.org/articles/by?article_doi=10.31234/osf.io/jqw6u_v1
25. A systematic review of the relationship between generic and specific metacognitive beliefs and emotion dysregulation - PubMed, accessed November 16, 2025, https://pubmed.ncbi.nlm.nih.gov/38357852/
26. Radiation Hardened NULL Convention Logic Asynchronous Circuit Design - MDPI, accessed November 16, 2025, https://www.mdpi.com/2079-9268/5/4/216
27. Phenomenological Reduction, The | Internet Encyclopedia of ..., accessed November 16, 2025, https://iep.utm.edu/phen-red/
28. Clarifying the Tubulin bit/qubit - Defending the Penrose-Hameroff Orch OR Model (Quantum Biology) - YouTube, accessed November 16, 2025, https://www.youtube.com/watch?v=LXFFbxoHp3s
29. Asynchronous Circuit Synthesis Using Multi-Threshold NULL Convention Logic - ScholarWorks@UARK, accessed November 16, 2025, https://scholarworks.uark.edu/cgi/viewcontent.cgi?article=4718&context=etd
30. (PDF) It's Always About the Epoché - ResearchGate, accessed November 16, 2025, https://www.researchgate.net/publication/263506677_It's_Always_About_the_Epoche
31. The NULL Convention Logic™ asynchronous register. - ResearchGate, accessed November 16, 2025, https://www.researchgate.net/figure/The-NULL-Convention-Logic-asynchronous-register_fig10_2392363
32. Multi-Threshold NULL Convention Logic (MTNCL): An Ultra-Low Power Asynchronous Circuit Design Methodology - MDPI, accessed November 16, 2025, https://www.mdpi.com/2079-9268/5/2/81
33. The transformative potential of vector symbolic architecture for cognitive processing at the network edge - SPIE Digital Library, accessed November 16, 2025, https://www.spiedigitallibrary.org/conference-proceedings-of-spie/13206/1320612/The-transformative-potential-of-vector-symbolic-architecture-for-cognitive-processing/10.1117/12.3030949.full
34. Event Generation with Lorentz-Equivariant Geometric Algebra Transformers - CERN Indico, accessed November 16, 2025, https://indico.cern.ch/event/1386125/contributions/6139693/contribution.pdf
35. Casimir effect and the quantum vacuum | Phys. Rev. D - Physical Review Link Manager, accessed November 16, 2025, https://link.aps.org/doi/10.1103/PhysRevD.72.021301
36. Vector Symbolic Architectures as a Computing Framework for ..., accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC10588678/
37. Co-Alignment: Rethinking Alignment as Bidirectional Human ... - arXiv, accessed November 16, 2025, https://arxiv.org/abs/2509.12179
38. Mindfulness in the focus of the neurosciences - The contribution of neuroimaging to the understanding of mindfulness - PMC - NIH, accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC9622333/
39. BiAlign ICLR 2025, accessed November 16, 2025, https://bialign-workshop.github.io/
40. Co-Alignment: Rethinking Alignment as Bidirectional Human-AI Cognitive Adaptation, accessed November 16, 2025, https://openreview.net/forum?id=G5jK2OMT2q
41. Co-Alignment: Rethinking Alignment as Bidirectional Human-AI Cognitive Adaptation - arXiv, accessed November 16, 2025, https://arxiv.org/html/2509.12179v1
42. A Lorentz-Equivariant Transformer for All of the LHC - SciPost, accessed November 16, 2025, https://scipost.org/preprints/scipost_202505_00060v1/

43. Neural mechanisms of mindfulness and meditation: Evidence from neuroimaging studies - PMC - PubMed Central, accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC4109098/
44. Physics Informed Machine Learning: High Level Overview of AI and ML in Science and Engineering - YouTube, accessed November 16, 2025, https://www.youtube.com/watch?v=JoFW2uSd3Uo
45. Nonperturbative Corrections to 4D String Theory Effective Actions from Duality and Supersymmetry - Physical Review Link Manager, accessed November 16, 2025, https://link.aps.org/doi/10.1103/PhysRevLett.98.211602
46. Old theory, new evidence: inhalational anesthetics disrupt a collective quantum state of intraneuronal microtubules to cause unconsciousness - PubMed Central, accessed November 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC12413878/
47. (PDF) Attending to the Present: Mindfulness Meditation Reveals Distinct Neural Modes of Self-Reference - ResearchGate, accessed November 16, 2025, https://www.researchgate.net/publication/23452393_Attending_to_the_Present_Mindfulness_Meditation_Reveals_Distinct_Neural_Modes_of_Self-Reference
48. (PDF) Anesthetic Alterations of Collective Terahertz Oscillations in ..., accessed November 16, 2025, https://www.researchgate.net/publication/319337481_Anesthetic_Alterations_of_Collective_Terahertz_Oscillations_in_Tubulin_Correlate_with_Clinical_Potency_Implications_for_Anesthetic_Action_and_Post-Operative_Cognitive_Dysfunction
49. Calabi–Yau manifold - Wikipedia, accessed November 16, 2025, https://en.wikipedia.org/wiki/Calabi%E2%80%93Yau_manifold
50. [2309.07397] Solving Einstein equations using deep learning - arXiv, accessed November 16, 2025, https://arxiv.org/abs/2309.07397