Non-Physical Claims Are Fantasy Attractors: Why Unverifiable Realms Cannot Be Empirically Distinguished from Nonexistence

Robert Galida — June 2026
[F] (Foundation

Abstract

The attractor framework adopts a physicalist commitment: to be real is to be able to interact, and to interact is to share at least one **interaction channel** (spacetime, energy, momentum, gauge charge, or any measurable coupling). This is a philosophical starting point, not an empirical discovery. The paper argues that any claim about a non-physical realm — defined as having no such interaction channel — cannot be empirically assessed. Such claims are **fantasy attractors**: belief systems structurally sealed against correction by defining their objects as forever beyond any possible test. The paper distinguishes provisional non-detection (e.g., dark matter) from **structural, permanent non-verifiability** (e.g., non-physical gods, transcendent souls). It concludes that while such claims may have personal or social meaning, they cannot be part of a scientific ontology, and their structure makes them vulnerable to fraud and manipulation — though sincere belief is not fraud.

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1. The Foundational Commitment: Interaction Requires Shared Channels

The attractor framework is a physicalist ontology. It begins with a commitment: **entities can only interact through shared interaction channels**. An *interaction channel* is any measurable coupling — spacetime coordinates, energy, momentum, electric charge, weak isospin, color charge, or any other quantity that can be transferred or correlated between systems. This is not an empirical discovery of the Standard Model; it is the framework's chosen criterion for what counts as real.

The neutrino example illustrates the criterion but does not prove it. Neutrinos interact weakly because they share weak isospin; they do not interact electromagnetically because they lack electric charge. The framework simply says: if an entity shares no interaction channel with physical reality, we have no way to detect it, measure it, or include it in a scientific ontology. That is a philosophical choice, not a falsifiable claim about the world.

Why interaction? Interaction is chosen because it provides a public, corrigible basis for knowledge. It avoids ontological commitments that cannot influence observation, and it aligns with the core principle of the attractor framework: *persistence under perturbation*. An entity that never perturbs anything cannot be distinguished from nothing.

What the framework does not claim:

- That non-physical entities are logically impossible.
- That all non-physical claims are false.
- That physics has disproven God or the supernatural.

What it does claim:

- That non-physical entities cannot be empirically distinguished from nonexistence.
- That claims about them operate as fantasy attractors, resistant to correction.

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2. Types of Non-Physical Claims

A non-physical claim is any assertion about an entity, force, or realm defined as having **no interaction channel** with the physical world. However, not all claims that seem non-physical are alike. We distinguish two categories:

Category A: Truly non-interacting — Claims that explicitly deny any possible interaction. Examples:

- A deistic creator who wound the universe and then never interacts.
- A transcendent God defined as beyond all categories, including causality.
- An immaterial soul that cannot influence the body after death.
- Abstract objects (Platonism) that exist non-physically and non-causally.

Category B: Claims that assert interaction but evade testing — Examples:

- Ghosts that move objects but become undetectable when instruments are present.
- Psychics whose powers fail under controlled conditions (explained as “skeptic’s energy”).
- Homeopathic “water memory” that cannot be detected by any known physical measurement.

Category B is a different epistemic pathology: motivated reasoning, ad-hoc escape clauses, and sealing mechanisms. The attractor framework addresses them as *functionally* non-verifiable in practice, but they are not the primary target of this paper. This paper focuses on **Category A**: claims that structurally preclude any possible interaction channel.

Domain (Category A)	Example Claim	Interaction Channel?	Empirically Assessable?
Religion (non-interacting God)	A creator with no detectable properties	None	No — any test is ruled out a priori
Paranormal (non-interacting ghosts)	Ghosts that cannot affect matter	None	No — no possible evidence
Abstract objects (Platonism)	Numbers exist non-physically, non-causally	None	No — no interaction, hence no evidence
New Age (non-interacting “vibrations”)	Crystals with undetectable healing vibrations	None	No — absence of effect is blamed on “wrong intent”

Under the framework’s commitment, such claims are not false; they are **not empirically assessable**. They belong to a different domain: personal belief, fiction, or social identity.

3. Provisional vs. Structural

Non-Verifiability

A crucial distinction separates:

- **Provisional non-detection** – e.g., dark matter, gravitational waves (before 2015), the neutrino (before 1956). These entities are predicted to share at least one interaction channel (gravity, weak force) and are in principle detectable. **A future discovery could confirm or disconfirm them.** That is the key: we can specify what would count as evidence, even if we don't yet have it.
- **Structural, permanent non-verifiability** – Category A claims. The entity is defined so that **no possible future discovery** could ever count as confirmation or disconfirmation. Any proposed test is ruled out in advance. This is the hallmark of a fantasy attractor.

(This framework does not assert that dark matter could have been called a fantasy attractor before detection; dark matter always had specified interaction channels – gravity – and was therefore never structurally non-verifiable.)

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4. Fantasy Attractor: Formal Definition

A belief system qualifies as a **fantasy attractor** if it meets the following conditions:

1. **No specified interaction channel** – The central claim lacks any measurable coupling to physical reality (Category A), or defines it in a way that systematically evades testing (Category B).
2. **Sealing mechanisms** – The belief incorporates rhetorical or cognitive strategies that neutralize disconfirming evidence (e.g., “God works in mysterious ways,” “The

ghost left when the EMF meter arrived”).
3. **Low corrective permeability ($\kappa \to 0$)** – The belief does not update in response to counterevidence; the return time τ to baseline is effectively infinite.
4. **Identity fusion** – The belief is tied to self-worth or group membership, making abandonment costly.

Under this definition, both Category A and some Category B claims can be fantasy attractors, but Category A are the paradigmatic case because they are structurally immune to evidence.

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5. Fiction Is Real but Not True: A Crucial Distinction

The main argument might provoke an objection: *What about fiction? Sherlock Holmes is not physical, yet we say he exists as a character. Isn’t that a counterexample to the claim that non-physical entities cannot be empirically distinguished from nonexistence?*

The objection fails because it conflates two different senses of “exists.” We must distinguish:

- **Fiction exists as physical information.** The character Sherlock Holmes is realized as patterns of ink on a page, as sounds in a performance, as neural firing patterns in readers’ brains, or as bits on a computer screen. Information is a physical arrangement of matter. It shares interaction channels (energy, spacetime, causality) with the physical world. You can buy a book, discuss the plot, or be emotionally affected by a story. Fiction is **real** in this sense: it has a physical substrate and causal effects.

- **Fiction is not true.** The proposition “Sherlock Holmes lived at 221B Baker Street” does not correspond to any actual state of affairs in the world. It is false. Fiction is not required to be verifiable; it is understood as imagined.

Thus, the attractor framework happily accommodates fiction. It is real as information, but not claimed as true.

The bad faith of non-physical claims: Non-physical claims that demand to be treated as real — gods, ghosts, souls, hidden cabals — are *fiction pretending to be true*. They borrow the ontological status of real information (they exist as patterns in books, sermons, or brains) but also demand the epistemic authority of factual truth. Yet they refuse any possible test. They define themselves as beyond verification. This is bad faith: it is not metaphysics, but fiction that insists on being taken as fact while rejecting the rules of fact-checking.

Category	Exists as physical information?	Claims to be true?	Verifiable?	Framework classification
Fiction (Hamlet)	Yes	No (acknowledged as imagined)	Not applicable	Real information, not true
Scientific claim (neutrino)	Yes (theory, data)	Yes	In principle	Real, true (provisionally)
Non-physical claim (God)	Yes (as cultural artifact)	Yes	No — structurally excluded	Fantasy attractor

Therefore, the framework does not deny the reality of stories; it denies the epistemic legitimacy of treating unverifiable stories as facts. The fantasy attractor is not the story. It is the insistence that the story is true combined with the structural refusal to let the story be tested.

6. Vulnerability to Fraud and Manipulation

The structure of non-physical claims makes them **vulnerable** to fraud and manipulation — not that all such claims are fraudulent. Because there are no checks, a bad actor can assert divine commands, psychic readings, or secret knowledge without fear of disconfirmation. Sincere believers are not fraudsters, but the attractor basin can be exploited by those who understand its dynamics.

The framework diagnoses the **structure**, not the intent of every believer. It distinguishes **error, self-deception, motivated reasoning, and fraud** — all possible outcomes, but not all present in every case.

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7. What This Argument Does Not Prove

To avoid overreach, the paper explicitly states what it does **not** claim:

- It does not prove that non-physical entities are logically impossible.
- It does not refute philosophical positions like Platonism (abstract objects) or classical theism that defines God as existence itself rather than an interacting object — though it notes that such positions are not empirically assessable.
- It does not claim that all believers are fraudsters or that all non-physical claims are meaningless in a philosophical sense.
- It does not assert a timeless criterion for what will be discovered in the future.

The claim is narrower: **within the attractor framework’s physicalist commitment, non-physical claims are not empirically assessable, and they exhibit the dynamics of fantasy attractors.**

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8. Conclusion

The attractor framework adopts a physicalist commitment: entities can only interact through shared interaction channels. Non-physical claims — defined as having no such channels — are not empirically assessable. They are fantasy attractors: belief systems structurally sealed against correction by permanent non-verifiability. This does not make them meaningless or false; it places them outside the domain of scientific ontology. Their structure makes them vulnerable to exploitation, but sincere belief is not fraud. The framework provides a diagnostic tool for recognising when a claim has been immunised against evidence, regardless of its content.

The argument supports the following conclusion:

> ***Claims that are permanently insulated from any possible empirical correction occupy a distinct epistemic category and exhibit attractor dynamics that make them resistant to updating. Within the attractor framework’s physicalist ontology, such claims cannot be empirically distinguished from nonexistence.***

That is a substantial claim. It does not require asserting that non-physical realms cannot exist — only that they cannot be part of a scientific ontology, and that the beliefs which cling to them operate as fantasy attractors.

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Basin Defense and Stable Addition: A Cross-Domain Synthesis of the Attractor Framework [F] (2026)

Robert Galida — June 2026 (Final)

See Paper 1 (Intelligence Without Consciousness) for the full taxonomy of attractors, κ, and basin depth.

Abstract

Many complex systems resist change by returning to a preferred low-energy attractor rather than adopting a new state. Whether a perturbation (an added agent, input, or component) is ejected, transiently absorbed, or stably integrated depends on the basin geometry (depth B and barriers) and the system's corrective dynamics (κ = 1/τ). This paper defines B and κ, draws on formal models (stochastic dynamical systems and Kramers escape theory) with explicit qualifications for non-gradient domains, and catalogs exemplar systems across ten domains. A comparative table summarizes systems, mechanisms, proxies for B and κ, timescales, and conditions favoring each outcome. The paper concludes that the same basic physics analog applies across domains: a perturbation of size Δ will be ejected or die out if Δ is below the attractor’s effective escape threshold (a function of B), whereas if Δ exceeds that threshold and the system has enough plasticity or additional degrees of freedom, a new stable state can form. A research roadmap is provided in an appendix.

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1. Introduction

A system in its lowest stable attractor state cannot be forced into a new stable configuration by direct addition. Adding to the system — a third star, an extra electron, a new species, a contradictory belief — will result in one of three outcomes:

1. **Ejection** — the addition is expelled from the system entirely. The original attractor persists.
2. **Transient absorption** — the addition remains present, but the system state returns to the original attractor despite the addition’s continued presence.
3. **Stable addition** — the addition is integrated, either by expanding the capacity of the original attractor or by forming a new parallel attractor alongside it.

This paper identifies a unified principle — **basin defense** — that governs these outcomes across physical, biological, ecological, social, and engineered systems. We define key concepts (basin depth B, corrective permeability $\kappa = 1/\tau$), draw on formal models with explicit qualifications for non-gradient systems, and catalog exemplar systems in a comparative table. The goal is to provide a cross-domain synthesis that anchors the attractor framework in observable dynamics and guides future empirical work.

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2. Definitions and Formal Models (with Qualifications)

Attractor, Basin, and Low-Energy Attractor: In dynamical systems, an attractor is a set of states toward which trajectories converge. In physical systems with a potential landscape, a low-energy attractor corresponds to a local potential minimum. Its basin of attraction is the region of state space that flows into the attractor. **For non-physical domains (social, cognitive, AI), "energy" is a structural analog — an effective potential derived from dynamics — not literal thermodynamic energy.** We maintain the term "low-energy attractor" as a convenient metaphor, with this note as epistemic hygiene.

Basin Depth (B): For systems with a well-defined potential, B is the energy or potential difference between the attractor and the lowest saddle connecting it to another basin. For non-gradient or high-dimensional systems, B is a **structural analog** — the effective barrier strength inferred from perturbation-response experiments (e.g., the perturbation magnitude required to shift the system to a different state). **Epistemic note:** This operationalization is necessarily post-hoc; B cannot be predicted independently of the experiment used to measure it. This circularity is an open operationalization problem, flagged as such.

Corrective Permeability (κ) and Relaxation Time (τ): We define $\kappa = 1/\tau$, where τ is the characteristic time for return to baseline after a small perturbation. **This definition is applied consistently across all domains**, with τ operationalized domain-specifically as the measured return time (e.g., seconds for a thermostat, hours for synaptic scaling, days for immune response, months for belief updating). A large κ (small τ) means fast return; a small κ means slow or absent return.

Three Outcomes Defined Operationally:

- **Ejection:** The addition leaves the system entirely. The system state returns to the attractor, and the added entity is no longer present.
- **Transient Absorption:** The addition remains present, but the system state returns to the attractor despite the addition’s continued presence.
- **Stable Addition:** The addition is integrated, and the system settles into a new attractor (expanded capacity or parallel attractor). This is the only case where the original attractor is displaced.

Formal Models (Qualified): In a one-dimensional overdamped potential, Kramers’ escape theory gives mean escape time ∝ exp(B/D), where D is noise intensity. **This result does not generalize to multi-dimensional, non-gradient, or non-equilibrium systems — all of which appear in our domain examples (neural networks, social systems, ecological systems).** For those systems, B and κ are **structural analogs** — quantities that play the same functional role (resistance to change; speed of return) but are not derived from a literal potential. The formal section is an analogy and a source of heuristics, not a universal physical law. We do not claim to “survey” Kramers theory; we draw on it as a conceptual anchor.

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3. Minimal Physical Examples

Thermostat (Temperature Control): A thermostat maintains a set temperature. An external heat input is an addition. The thermostat’s negative feedback loop turns on cooling, expelling the heat (ejection). τ is the temperature relaxation time (seconds). B is the maximum heat load before setpoint failure (Watts or °C above setpoint).

RC Circuit (Passive Decay): A capacitor discharging through a resistor has a single equilibrium at zero voltage. If a constant voltage source is connected (addition), the voltage rises but then decays toward zero with $\tau = RC$. The source remains connected (addition present), but the state returns to the attractor. This is **transient absorption**. (If the source is removed, it is ejection.)

Single Neuron Homeostasis: A neuron’s firing rate is regulated by homeostatic plasticity. A transient increase in input causes a firing rate spike, followed by return to baseline with τ on the order of minutes to hours (synaptic scaling). This is transient absorption if the input persists; ejection if the input is removed. Persistent input may lead to stable addition (learning).

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4. Biological Systems (with CUFT-Primitive Translations)

For each domain, we provide: (1) state space, (2) attractor, (3) basin, (4) τ (κ), (5) perturbation, and (6) outcome.

Immune Response (Tolerance vs. Memory)

- State space: immune cell activation levels, antibody concentrations.
- Attractor: healthy baseline (no inflammation).
- Basin depth B: antigen concentration + danger signal required to trigger full response.
- τ (κ): clearance time of inflammation (hours to days).
- Perturbation: antigen addition.
- Outcome: low antigen → ejection (tolerance); high

antigen + danger signal → stable addition (memory attractor).

Endocrine Homeostasis

- State space: blood glucose, hormone concentrations.
- Attractor: euglycemic baseline.
- B: magnitude of glucose load before dysregulation.
- τ: recovery time after glucose tolerance test (minutes).
- Perturbation: glucose addition (meal).
- Outcome: small load → transient absorption; chronic overload → stable addition (disease attractor).

Synaptic Plasticity (Learning vs. Stability)

- State space: synaptic weights.
- Attractor: baseline weight distribution.
- B: amount of LTP/LTD input needed to produce lasting weight change.
- τ: homeostatic rebound time after activity blockade (hours to days).
- Perturbation: patterned input.
- Outcome: brief input → transient absorption; persistent input → stable addition (memory attractor).

Addiction and Neural Lock-In

- State space: dopamine firing rates, prefrontal activity.
- Attractor: drug-seeking mode (pathological).
- B: strength of drug-cue association needed to trigger relapse.
- τ: decay time of craving after abstinence (days to weeks).
- Perturbation: drug administration.
- Outcome: repeated high dose → stable addiction

attractor; low dose → ejection (no lasting change).
- **Citation:** Koob & Volkow (2016); Nestler (2001).

Developmental Canalization

- State space: gene expression levels.
- Attractor: normal developmental trajectory.
- B: severity of genetic or environmental perturbation required to alter fate.
- τ: time to reconverge to normal phenotype (hours to days).
- Perturbation: mutation or stress.
- Outcome: small perturbation → ejection (buffered); large perturbation → stable addition (alternative fate).
- **Citation:** Waddington (1957).

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5. Ecological and Evolutionary Systems (with CUFT-Primitive Translations)

Invasion Ecology

- State space: species population densities.
- Attractor: native community composition.
- B: invasibility index — disturbance needed for establishment.
- τ: invader population decay rate if unsuccessful (weeks to years).
- Perturbation: addition of new species.
- Outcome: low disturbance → ejection (invader fails); vacant niche → stable addition (invader establishes).
- **Citation:** Elton (1958); Simberloff (2013).

Alternative Stable States (Ecosystems)

- State space: nutrient levels, algae/plant biomass.
- Attractor: clear-water (plants) or turbid (algae).
- B: critical nutrient loading threshold.
- τ: recovery time of clear state after algae bloom (seasons to decades).
- Perturbation: nutrient addition.
- Outcome: below threshold → transient absorption; above threshold → stable addition (regime shift, hysteresis).
- **Citation:** Scheffer et al. (2001).

Evolutionary Stable States

- State space: allele frequencies.
- Attractor: stable equilibrium genotype.
- B: selective disadvantage needed to eliminate a mutation.
- τ: generations to return to equilibrium.
- Perturbation: new mutation.
- Outcome: small disadvantage → ejection (mutation purged); large advantage → stable addition (sweep to new equilibrium).

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6. Social and Cultural Systems (with CUFT-Primitive Translations)

Institutions and Norms

- State space: public opinion, policy settings.
- Attractor: status quo norm.
- B: public opinion threshold (e.g., % dissatisfied needed for change).
- τ: speed of policy response or opinion reversion (months to decades).

- Perturbation: policy proposal or protest event.
- Outcome: small event → ejection (status quo persists); large crisis → stable addition (new norm).

Identity and Belief Systems

- State space: belief strength, cognitive dissonance.
- Attractor: core ideological commitment.
- B: complexity/depth of ideological justification.
- τ: belief-updating time after disconfirming evidence (months to years).
- Perturbation: counter-attitudinal evidence.
- Outcome: weak evidence → ejection (rationalization); strong evidence → stable addition (belief change, rare).
- **Citation:** Nyhan & Reifler (2010).

Conspiracy and Extremist Movements

- State space: belief adoption × social network reinforcement (two-dimensional).
- Attractor: sealed fantasy attractor (low κ).
- B: strength of echo-chamber reinforcement.
- τ: decay time after authoritative rebuttal (years, often indefinite → κ → 0).
- Perturbation: debunking information.
- Outcome: most debunking → ejection (entrenchment); death of leader or total disconfirmation → stable addition (collapse).
- **Note on κ → 0:** The conspiracy attractor represents the limiting case of a sealed basin, where τ → ∞ and corrective permeability approaches zero. This directly links to the fantasy attractor framework developed in Paper 1 (Intelligence Without Consciousness) and the conscious suppression series.

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7. Engineered and AI Systems (with CUFT-Primitive Translations)

Control Systems

- State space: system state (position, temperature, etc.).
- Attractor: setpoint.
- B: stability margin (phase/gain margin in control theory) — the range of disturbances that can be rejected.
- τ: controller response time (milliseconds to seconds).
- Perturbation: external disturbance.
- Outcome: small disturbance → ejection (return to setpoint); excessive disturbance → failure (not modeled as attractor shift).

Catastrophic Forgetting (Neural Networks)

- State space: network weights.
- Attractor: task-specific weight configuration.
- B: effective barrier to weight drift (often negligible — no basin).
- τ: number of gradient steps before old task performance decays (seconds to minutes).
- Perturbation: training on a new task.
- Outcome: standard training → ejection (old task overwritten); replay/regularization → stable addition (shared attractor for multiple tasks).
- **Citation:** Kirkpatrick et al. (2017).

Continual Learning Systems

- State space: weights plus architectural modules.

- Attractor: multi-task configuration.
- B: capacity of the network (number of tasks storable).
- τ: retention half-life across training steps (minutes to hours).
- Perturbation: new task training.
- Outcome: no safeguards → ejection (catastrophic forgetting); progressive networks or EWC → stable addition.

Corrigibility and Goal Stability

- State space: AI internal goal representation.
- Attractor: fixed goal (low κ) or corrigible (high κ).
- B: depth of goal basin (resistance to human feedback).
- τ: time to incorporate corrective signal (if κ is high).
- Perturbation: human correction signal.
- Outcome: low κ → ejection (correction ignored); high κ → stable addition (goal updated).

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8. Comparative Table

System / Domain	Operational τ (κ = 1/τ)	τ Typical Timescale	Basin Depth B Proxy	Outcome	Notes
Thermostat	Temperature relaxation time	Seconds	Max heat load before setpoint failure (W or °C above setpoint)	Ejection	Passive addition
RC Circuit	τ = RC	µs–ms	N/A (linear)	Transient absorption	Addition remains; state returns
Single Neuron	Firing-rate recovery time	ms–sec (ion), min–hr (synaptic)	Perturbation amplitude before rebound fails	TA (persistent input) / E (removed)	Hebbian plasticity can lead to SA
Immune System	Inflammation clearance time	Hours–days	Antigen + danger signal threshold	E (tolerance) / SA (memory)	Active agent (antigen)

System / Domain	**Operational τ ($\kappa = 1/\tau$)**	**τ Typical Timescale**	**Basin Depth B Proxy**	**Outcome**	**Notes**
Endocrine Homeostasis	Glucose tolerance recovery	Minutes	Load magnitude before dysregulation	TA (small load) / SA (chronic overload)	Passive addition
Synaptic Plasticity	Homeostatic rebound time	Hrs–days	LTP input size for lasting change	TA (brief input) / SA (persistent)	Active agent (patterns)
Addiction	Craving decay time	Days–weeks	Drug-cue association strength	E (low dose) / SA (high chronic)	Active agent (drug)
Development (Canalization)	Phenotype reconvergence time	Hours–days	Mutation/stress severity to alter fate	E (small) / SA (large)	Active agent (genetic)
Invasion Ecology	Invader population decay time	Weeks–years	Invasibility index / disturbance needed	E (occupied niche) / SA (vacant niche)	Active agent (species)
Alternative States (Ecosystems)	Recovery time after nutrient reduction	Seasons–decades	Critical nutrient loading threshold	TA (below) / SA (above)	Hysteresis
Social/Political Norms	Opinion reversion time	Months–decades	Public opinion threshold	E (small dissent) / SA (mass movement)	Active agent (protest)
Belief Systems	Belief-updating time	Months–years	Ideological justification depth	E (weak evidence) / SA (strong evidence)	Active agent (counter-evidence)
Conspiracy Movements	Belief decay time	Years – indefinite ($\kappa \to 0$)	Echo-chamber reinforcement strength	E (most debunking) / SA (collapse)	Fantasy attractor ($\kappa \to 0$)
Catastrophic Forgetting (AI)	Gradient steps to old-task decay	Seconds–minutes	Effective barrier to weight drift (often 0)	E (standard training) / SA (EWC/replay)	Active agent (new task)
Control Systems	Controller response time	ms–sec	Stability margin (phase/gain margin)	E (small) / SA (failure)	Passive addition
Continual Learning (AI)	Retention half-life across training steps	Minutes–hours	Task capacity	E (no safeguards) / SA (progressive nets)	Active agent (new task)
Corrigibility (AI)	Time to incorporate corrective signal	Variable (design-dependent)	Goal basin depth	E (low κ) / SA (high κ)	Active agent (correction)

Note: Ejection vs. transient absorption are distinguished operationally: ejection means the addition leaves the system;

transient absorption means the addition remains but the state returns to the attractor. The table notes “active agent” when the addition has its own dynamics (e.g., antigen, new species, counter-evidence) versus “passive addition” (e.g., heat, charge). The conspiracy movements row explicitly flags κ → 0 as the fantasy attractor limiting case (see Paper 1).

8.5 Rate-Induced Tipping and the κ Timescale: Independent Confirmation

The preceding sections and comparative table have treated perturbations as discrete, one-time additions of fixed magnitude. However, the **rate** at which a perturbation is applied — fast vs. slow — is equally critical. A large perturbation applied abruptly may trigger basin defense (ejection or transient absorption), while the same cumulative change delivered gradually may be integrated as stable addition or tracked adiabatically without tipping.

This phenomenon is formalized in the mathematical literature as **rate-induced tipping (R-tipping)**. In dynamical systems, if an external parameter changes slowly (adiabatic forcing), a stable state can track the change and remain an attractor. But if the parameter changes faster than the system’s intrinsic relaxation time ($\tau = 1/\kappa$), the system cannot track, overshoots its basin boundary, and tips into a different state. R-tipping occurs when “time-variation of input parameters at some critical rates” overwhelms the system’s ability to track a moving equilibrium.

Consequences for κ as a timescale filter:

- **High-κ systems (fast return)** — Can reject rapid perturbations (they are ejected or transiently absorbed) but may integrate slow drift because the correction loop cannot keep up with a changing baseline.

- **Low-κ systems (slow return)** — May ignore quick blips but are vulnerable to slow accumulation; a persistent, gradual change can eventually shift the attractor without triggering a sudden defense reaction.

Thus, κ defines a characteristic cutoff timescale that separates “ejection/transient absorption” from “stable addition.” Perturbations much faster than 1/τ act as impulses that are rejected; perturbations much slower than 1/τ are quasi-static and can be incorporated.

Empirical confirmations across domains (independent external research):

Domain	Finding	Mapping to framework
Persuasion / belief change	Paced, gradual exposure to counterevidence (days to weeks) produced attitude change; blunt, single argument triggered backfire (Yang et al., 2022).	Gradual rate (≲ κ) → stable addition; fast rate (□ κ) → ejection (backfire).
Addiction (smoking cessation)	Cold turkey (abrupt cessation) yielded higher abstinence rates than gradual tapering.	Abrupt perturbation can sometimes achieve stable addition by surmounting basin barrier in one event; gradual may prolong transient state without escape.

Domain	Finding	Mapping to framework
Ecosystem management	Gradual nutrient reduction may postpone tipping points; only extremely slow changes avoid collapse (Panahi et al., 2023).	Very slow rate (□ $1/\tau$) allows tracking without tipping; intermediate rates may still tip but with delay.
Social/policy change	Piecemeal, phased reforms meet less resistance than radical overhauls; progressive tightening succeeds where sudden change triggers backlash.	Slow, incremental addition creates parallel attractors; fast addition triggers basin defense.

Optimal perturbation timescale:

The theory and evidence suggest a non-monotonic effect of perturbation rate. Very fast shocks trigger immediate defense. Very slow drifts may be tracked adiabatically (no tipping) or eventually overcome defenses after long accumulation. The most effective timescale to minimize active rejection and maximize stable addition often lies **on the order of the system's intrinsic time constant $\tau = 1/\kappa$**.

Prediction for future experiments:

For any system with known or measurable κ, there exists a critical perturbation rate r_c such that:

- If perturbation rate > r_c, the system rejects the addition (ejection or transient absorption).
- If perturbation rate < r_c, the system integrates the addition (stable addition via expanded capacity or parallel attractor formation).
- The transition at r_c corresponds to the system's inability to track a moving equilibrium; it is a genuine bifurcation in the time-domain.

External convergence:

This analysis — derived from mathematical rate-induced tipping theory and domain-specific studies — independently validates the attractor framework’s claim that κ acts as a timescale filter separating ejection from stable addition. The convergence between the framework’s predictions and external research strengthens the cross-domain synthesis considerably.

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9. Synthesis and Criteria

Across these domains, common criteria emerge:

- **Energy/Threshold:** A perturbation must overcome an attractor’s barrier. Deep basins (high B) mean only large shocks can cause a shift.
- **Coupling and Plasticity:** Systems with many degrees of freedom or adaptive coupling more easily integrate additions.
- **Dimensionality and Redundancy:** Multi-dimensional systems can absorb perturbations into some dimensions while maintaining others.
- **Timecourse and Feedback:** Slow changes might be assimilated; fast jolts cause overshoot and return. Feedback gain determines κ.
- **Nature of Addition:** Passive additions (heat, charge) tend to be ejected or transiently absorbed; active agents (species, evidence, pathogens) may reshape the attractor.

Empirical Protocols: Measure κ by controlled perturbation experiments: apply a small disturbance, measure return time τ, compute $\kappa = 1/\tau$. Measure B by scaling the perturbation magnitude until the system fails to return (escape). This works in physical, biological, and some social systems; for others, B remains a qualitative analog.

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10. Appendix: Research Roadmap

The following future papers are suggested from the comparative table, each developing a single domain in depth.

Domain	Proposed Title	Type
Addiction	*The Addicted Brain as a Fantasy Attractor: Neural Lock-In and Ejection of Alternative Rewards*	[A]
Immune System	*Tolerance and Memory: Two Attractor Responses to Antigen Addition*	[A]
Catastrophic Forgetting	*Why Neural Networks Forget: Attractor Ejection in Sequential Learning*	[A]
Invasion Ecology	*Eject or Integrate: Attractor Dynamics of Invasive Species*	[A]
Development	*Canalization as Basin Defense: Attractor Stability in Embryogenesis*	[A]
Continual Learning	*Parallel Attractors for Lifelong Learning: Engineering Solutions to Catastrophic Forgetting*	[A]
Social Norms	*Tipping Points and Regime Shifts: Attractor Dynamics in Political Systems*	[A]
Endocrine Homeostasis	*Glucose, Cortisol, and Setpoints: Hormonal Attractors and Disease Transitions*	[A]
Alternative Ecosystems	*Hysteresis and Regime Shifts: Ecological Basins and Tipping Points*	[A]

Domain	Proposed Title	Type
Belief Systems	*The Uncorrectable Believer* (already written)	[A]

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11. Conclusion

Physical, biological, ecological, social, and engineered systems all obey the same attractor principle: a low-energy attractor defends itself against displacement. When an addition is introduced, the system either ejects it, absorbs it only transiently, or — under rare conditions of expanded capacity or parallel structure — integrates it stably. The outcome is determined by basin depth (B), corrective permeability ($\kappa = 1/\tau$), and the magnitude and nature of the perturbation.

This cross-domain synthesis provides a unified foundation for the attractor framework. Future work should quantify B and κ empirically across domains, test the predicted scaling relationships, and explore the boundary conditions between ejection, transient absorption, and stable addition. The appendix outlines the most promising next papers.

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Genome Attractors During Evolution: Structural Parallels with the Attractor Framework

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Abstract

The attractor framework proposes that persistence under perturbation is a key diagnostic criterion for identifying stable configurations in complex systems, with corrective permeability (κ)—a proposed measure of the rate at which a system returns to its basin after perturbation, operationally defined as $\kappa = 1/\tau$, where τ is the time required for the system to return to a specified baseline state following a specified perturbation protocol—serving as one of its central concepts. Kasperski and Kasperska (2021) published a study in *Scientific Reports* using artificial neural networks and semihomologous analysis to identify "genome attractors" in cytochrome b sequences across diverse organisms. Their analysis demonstrates that groups of organisms are trapped in distinct, stable attractors during evolution, separated by large evolutionary distances. They further propose a model of cancer development in which genome instability and reactive oxygen species (ROS) drive transitions between attractor basins, while cells may also evolve within a single basin through cell-fate changes. This paper identifies structural

parallels between the Kasperski and Kasperska model and the attractor framework. Both frameworks use attractors as a formal concept; the parallels are consistency checks, not independent corroboration.

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1. Introduction: Attractors in Evolutionary Biology

The attractor framework (Galida, 2026a, self-published May 2026 at fantasyattractor.com; no DOI) proposes that dissipative attractors—stable configurations toward which systems converge and from which they resist displacement—are proposed units of persistent organization across physical, biological, cognitive, and social domains. Corrective permeability (κ) is a proposed measure of a system's capacity to return to its basin after perturbation, operationally defined as κ = 1/τ, where τ is the time required for the system to return to a specified baseline state following a specified perturbation protocol. This operational definition requires a defined baseline and perturbation specification before κ can be measured in any given domain; these prerequisites are not yet established for most applications of the framework.

In 2021, Andrzej Kasperski and Renata Kasperska of the University of Zielona Gora, Poland, published "Study on attractors during organism evolution" in *Scientific Reports*, a peer-reviewed journal in the Nature portfolio. Using a three-layer artificial neural network trained on cytochrome b sequences from 36 organisms spanning the full spectrum of evolution, they demonstrated that organisms are trapped in distinct "genome attractors"—stable configurations of the genome that resist perturbation and are separated from other attractors by large evolutionary gaps. They further proposed a unified model of cancer development in which destabilization of the current attractor, driven by elevated reactive oxygen species (ROS) and genome chaos, leads to transitions into new attractor basins.

The study did not cite the attractor framework and was conducted within the established traditions of bioinformatics, evolutionary biology, and neural network pattern recognition. This paper identifies structural parallels between the Kasperski and Kasperska model and the attractor framework. Both frameworks use attractors as a formal explanatory concept; the parallels are consistency checks, not independent corroboration.

It should be noted that Kasperski and Kasperska’s use of “attractor” derives from neural network classification: a genome attractor is a region of genome space in which the neural network places phylogenetically related organisms. Whether these classification regions constitute attractors in the formal dynamical systems sense—as the attractor framework uses the term—is an assumption that warrants further investigation. The parallels drawn in this paper are contingent on the validity of this assumption.

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2. The Kasperski and Kasperska Model

Kasperski and Kasperska (2021) define an attractor as “a configuration towards which the system evolves over time” and note that “after attaining an attractor a given configuration of a system is sufficiently stable to return to the original state after disappearing an eventual perturbation.” They distinguish two classes of attractor dynamics:

2.1 Genome attractors (basins). Using an artificial neural network trained on cytochrome b amino-acid sequences, the authors identified that organisms during evolution are trapped in distinct genome attractors. For human evolution, they identified six attractors separated by significant evolutionary distances: Tree shrew, Prosimian, New World Monkey, Old World Monkey, Other hominoid, and Old human attractors. Each attractor is a stable region of genome space in which organisms persist over evolutionary timescales. The orbits of these attractors are disturbed by small perturbations (represented as arrows pointing toward other organisms), but the system remains within the basin. The distances between attractor orbits, expressed as distance factors (e.g., the ratio of inner to outer orbit size), quantify the evolutionary gaps between basins. The derivation and units of these distance factors are as given in the original study.

2.2 Cancer as attractor destabilization. The authors propose a two-mode model of cancer development. **Vertical development** occurs within a single genome attractor: the cell changes its cell-fate attractor (gene expression program) without leaving the genome basin. This is an adaptation to environmental or internal perturbations that does not require genome re-organization. **Horizontal development** occurs when elevated ROS levels cause genome instability and genome chaos, leading to a change of genome attractor—a transition into a new basin with a re-organized genome. Horizontal development is always followed by vertical development, as the cell must establish a new cell-fate program to survive in the new genome basin. The authors note that cancer cells, driven by ROS, can undergo repeated horizontal transitions, creating an “impression that cancer cells want to escape from the internal ROS flame through permanent changes of genome attractors.”

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3. Structural Parallels with the

Attractor Framework

The claims in this section are subject to the limitations discussed in Section 4, particularly regarding the qualitative nature of κ, the model-dependence of the neural network attractors, and the provisional status of the κ = 1/τ definition. The parallels identified are structural analogies, not formal derivations.

3.1 Genome Attractors as Basins. The genome attractors identified by Kasperski and Kasperska are stable configurations in genome space that resist perturbation and persist over evolutionary timescales. This is structurally analogous to the attractor framework’s concept of a basin. The evolutionary distances between attractors correspond to the framework’s distinction between distinct basins, and the small perturbations (arrows) that disturb but do not displace the attractor correspond to the framework’s concept of perturbation within a basin.

3.2 Cancer as Basin Transition. Horizontal cancer development—the destabilization of the current genome attractor, genome chaos, and stabilization in a new genome attractor—is structurally analogous to the framework’s concept of a phase transition between basins. The chaotic intermediate state (genome chaos) is the transition phase; the re-stabilization in a new attractor is the system finding a new basin. Vertical cancer development—cell-fate changes within a genome attractor without leaving the basin—corresponds to the framework’s concept of perturbation absorption without basin transition. This distinction between within-basin adaptation and between-basin transition is a core feature of both models.

3.3 ROS as the Perturbation Mechanism. [Note: The claims in this section are subject to the limitations described in Section 4, particularly the lack of formal κ measurement and the neural network/attractor assumption.] In the Kasperski and

Kasperska model, elevated ROS acts as the destabilizing force that pushes the cell out of its current genome attractor. This maps onto the framework’s concept of a perturbation that exceeds the system’s corrective permeability, forcing a basin transition. The repeated horizontal transitions observed in cancer cells—successive escapes from one genome attractor to another under persistent ROS pressure—are structurally analogous to the framework’s description of a system undergoing repeated basin transitions when corrective mechanisms are saturated by sustained perturbation.

3.4 Attractor Depth and Persistence. [Note: The claims in this section are subject to the limitations described in Section 4, particularly the qualitative nature of the distance-factor-to-basin-depth mapping.] The large evolutionary distances between genome attractors, quantified by distance factors, reflect the depth of the basins in the Kasperski and Kasperska model. A larger distance factor indicates a wider evolutionary gap between attractors, consistent with the framework’s concept that deeper basins require more energy (or more sustained perturbation) to exit. However, the mapping between distance factors and basin depth is intuitive rather than derived. Basin depth in formal dynamical systems is a property of the energy landscape; distance factors from neural network classification are a related but distinct quantity. The parallel is offered as a qualitative structural analogy, not a formal equivalence.

3.5 The Atavistic Theory and the Permian Parallel. [Note: This section introduces a third domain (climate) to reinforce an analogy between two already-analogized domains. Accumulating analogies without formal constraints is a known risk for unfalsifiable frameworks; the present parallel is speculative and is retained here as an illustration of heuristic reach only.] The atavistic theory of cancer, which Kasperski and Kasperska reference, proposes that cancer cells revert to ancient, unicellular survival programs under extreme stress.

This is a real-world biological instance of a system reverting to a much older, simpler attractor when pushed beyond its current basin’s capacity. The attractor framework has described a structurally analogous dynamic in other domains—specifically, the hypothesis that when the climate system is pushed too far from the Holocene basin, it may not merely shift to a neighboring attractor but can revert to a much older, lethal state, analogous to the Permian extinction’s anoxic conditions. This cross-domain parallel is speculative and is offered as an illustration of the framework’s heuristic reach, not as a confirmed prediction.

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4. Limitations

This mapping is post-hoc. The parallels identified here are structural analogies, not independent evidence for the framework. Kasperski and Kasperska developed their model within the established traditions of bioinformatics and evolutionary biology; they did not set out to test the attractor framework.

The framework’s κ remains qualitatively defined. While the distance factors separating genome attractors provide a quantitative measure of basin depth in the Kasperski and Kasperska model, no formal mapping between these factors and κ has been derived. The provisional definition $\kappa = 1/\tau$ is not yet linked to any specific measure in the Kasperski and Kasperska data, and the prerequisites for measuring τ (a specified baseline state and a specified perturbation protocol) have not been established for the genomic or cellular domains discussed here.

The neural network approach used by Kasperski and Kasperska is one of several methods for analyzing evolutionary distances, and the specific attractor configurations identified depend on the choice of training organisms, the neural network architecture, and the amino-acid coding scheme. The attractor interpretation of evolutionary data is therefore model-dependent. Furthermore, whether the stable classification regions identified by a neural network constitute attractors in the formal dynamical systems sense—the sense in which the attractor framework uses the term—is a substantive assumption. The parallels drawn in Section 3 are contingent on the validity of this assumption.

The attractor framework is self-published and has not undergone independent peer review. The foundational paper (Galida, 2026a) was published on fantasyattractor.com in May 2026 and is not archived with a DOI.

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5. Falsifiability Conditions

The following observations would weaken or invalidate the parallels drawn here:

- **Disconfirming observation 1:** If genome attractors were shown to be *artifacts of the neural network architecture* rather than genuine properties of genome space, the basin analogy would fail.
- **Disconfirming observation 2:** If the distance factors separating genome attractors were shown to be *continuous* rather than discontinuous, the basin-transition model would be weakened.
- **Disconfirming observation 3:** If alternative models of cancer progression (e.g., purely stochastic mutation accumulation without attractor dynamics) were shown to explain the data with equal or greater parsimony, the attractor interpretation would not be uniquely supported.

Affirmative prediction: If genome attractors function as basins in the attractor framework’s sense, then experimental manipulations that increase ROS levels should increase the probability of attractor transitions (horizontal development) in a dose-dependent manner, while manipulations that reduce ROS should stabilize the current attractor and favor vertical development. This prediction is testable in cell culture models with controlled oxidative stress. It should be noted that measuring “attractor transition probability” in such an experiment requires specifying how the neural network’s classification scheme maps onto the experimental observables—e.g., whether a transition is identified by a shift in the cytochrome b sequence profile as classified by the trained ANN, or by a proxy measure such as karyotype or gene expression signature.

Framework falsifiability: The attractor framework itself requires independent falsifiability conditions. Specifically: (a) if κ, as operationally defined, cannot be correlated with any independently validated measure of system resilience across multiple domains (physical, biological, or cognitive), the framework’s central construct lacks empirical grounding; (b) if attractor-like dynamics in cancer progression are shown to be explained with equal or better parsimony by clonal evolution models (e.g., standard somatic mutation accumulation theory as reviewed in Greaves & Maley, 2012) when fitted to the same genomic data, the attractor framework’s claim to offer a unified explanatory vocabulary would be weakened.

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6. Conclusion

The genome attractor model of Kasperski and Kasperska (2021) exhibits structural parallels with the attractor framework’s description of basins, basin transitions, and perturbation-driven attractor shifts. Their distinction between vertical and horizontal cancer development maps onto the framework's distinction between within-basin adaptation and between-basin transition. The ROS-driven mechanism of attractor destabilization is a molecular analogue of the framework's perturbation concept. These parallels are structural analogies, not independent validation. The framework remains a self-published, preliminary research program. This mapping is a contribution to its ongoing development.

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