

Structural Analogies Between Psychodynamic Attractor States and the Attractor Framework

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Abstract

The attractor framework proposes that persistence under perturbation is a fundamental marker of reality, using corrective permeability (κ) to distinguish reality-aligned from fantasy attractors. A recent clinical article by James Tobin (2026) describes psychological suffering as organized around recurring “attractor states”—stable patterns of emotional organization that resist insight, are embodied, and function as attempts at stability. This paper offers a post-hoc mapping between Tobin’s observations and the attractor framework. The parallels are structural analogies, not independent clinical corroboration. Both perspectives draw on a shared dynamical-systems vocabulary, and the mapping is offered as evidence of cross-disciplinary convergence rather than validation. The paper explicitly addresses the limitations of a self-published framework based on N=1 self-engineering, and specifies conditions under which the mapping would be disconfirmed.

1. Introduction: A Shared Vocabulary, Not Confirmation

The attractor framework (Galida, 2026a) is a naturalistic ontology developed independently through philosophical inquiry, systems theory, and N=1 self-engineering experiments. Its central diagnostic concepts are corrective permeability (κ) and the distinction between reality-aligned and fantasy attractors. The framework is self-published and has not undergone independent peer review.

In May 2026, clinical psychologist James Tobin published “The Psychology of ‘Attractor States’” on his professional website. Tobin draws on psychodynamic theory, attachment research, affective neuroscience, and dynamical systems theory to describe how emotional suffering becomes organized around recurring states that resist change. His article does not cite the attractor framework.

This paper identifies structural parallels between Tobin’s account and the framework. It does not claim that Tobin’s clinical observations independently corroborate the framework. Both Tobin and the framework explicitly draw on dynamical systems theory, and the shared vocabulary of “attractors,” “basins,” and “perturbation” reflects this common intellectual lineage. The mapping is a post-hoc exercise in identifying convergent themes across disciplines.

2. Tobin’s Psychodynamic Attractor States

Tobin’s article describes several features of emotional suffering that will be familiar to readers of dynamical systems literature:

2.1 Attractor States as Recurring Configurations. Tobin describes an attractor not as a single behavior or belief but as a recurring configuration toward which the emotional system gravitates—an entire organization of feeling, bodily expectation, attention, memory, and relational anticipation that emerges repeatedly under similar conditions.

2.2 Persistence Despite Insight. A central clinical puzzle for Tobin is that patients often understand their patterns intellectually, sometimes with considerable sophistication, yet the old emotional organization returns with force when certain emotional conditions arise. Insight alone rarely dislodges these deeply embedded patterns.

2.3 Embodiment and Automaticity. Tobin emphasizes that these patterns are not merely cognitive. They become woven into bodily readiness, autonomic regulation, procedural memory, emotional timing, and unconscious relational expectation—the body learns what to anticipate long before conscious reflection arrives.

2.4 Symptoms as Emotional Solutions. Tobin argues that many symptoms are not random pathology but tragic attempts at psychological stability. They persist, despite their cost, because they have served to preserve some continuity of self under conditions that once felt emotionally overwhelming.

2.5 Destabilization and the Fear of Change. When old attractors begin to loosen, patients experience a vulnerable intermediate state. They are no longer fully stabilized by the older organization, yet have not developed sufficient trust in newer ways of experiencing themselves. The temptation to retreat to the familiar attractor is strong.

2.6 The Goal of Therapy: Expanded Flexibility. Tobin's vision of psychological health is not the elimination of suffering but the gradual expansion of flexibility and reflective space within the personality—the capacity to move among emotional

states without being trapped by any one of them.

3. Structural Parallels with the Attractor Framework

3.1 Attractor States as Basins. Tobin's recurring emotional configuration toward which the system gravitates is structurally identical to the framework's concept of a basin. Both describe a stable state the system returns to automatically.

3.2 Insight Failure as Low Corrective Permeability. The framework defines a fantasy attractor as a system with low κ that resists updating. Tobin's observation—that insight alone rarely dislodges deeply embodied patterns—maps onto this. The cognitive insight is a perturbation that fails to land because the attractor is embedded in non-cognitive systems.

A note on circularity. If κ is measured by flexibility outcomes, and flexibility is what κ is claimed to predict, the mapping is circular. An operationally independent measure of κ —for example, response latency to belief-updating tasks, physiological perturbation recovery rates, or other proxies not identical with therapeutic outcome—would be required to break this circularity. No such measure has yet been validated. The current mapping relies on functional analogy, not independent measurement.

3.3 Symptoms as Stability Attempts: A Conceptual Distinction. Tobin claims symptoms persist because they *function* to maintain stability (a teleofunctional claim). The framework claims persistence under perturbation is the *mark of the real* (an ontological criterion). The two claims overlap—both describe systems that resist perturbation—but they are not identical. A symptom could

persist for functional reasons without that persistence carrying ontological significance. The mapping here is of practical convergence, not logical identity. Whether the framework's ontological claim can be grounded in or distinguished from teleofunctional accounts of persistence is a question for future theoretical work.

3.4 Destabilization as Basin Transition. The vulnerable intermediate state between old and new attractors is a phase transition between basins—a prediction the framework makes about any dissipative system under perturbation.

3.5 Therapeutic Flexibility as High Corrective Permeability. Tobin's vision of health—flexibility, the capacity to experience states without being organized by them—is high κ . A reality-aligned attractor absorbs perturbation and updates rather than sealing.

4. Independence, Shared Lineage, and the Limits of Convergence

Tobin and the framework draw on overlapping intellectual traditions. Tobin cites Lewis (2000) and Thelen & Smith (1994) from dynamical systems psychology; the framework draws on Ruelle, Prigogine, and the neuroscience of reward. The shared vocabulary (“attractor,” “basin”) reflects this common upstream source, not independent discovery.

The convergence is therefore weaker than it would be between genuinely independent methods. Both parties applied dynamical systems concepts to their respective domains. The fact that they arrived at similar structural descriptions is interesting but expected: the vocabulary constrains the output. This paper does not overinterpret that convergence.

5. Addressing the N=1 Foundation

The attractor framework was developed partly through N=1 self-engineering experiments. This methodology introduces specific risks: motivated reasoning, experimenter-subject confound, and non-transferability. A single-subject design cannot distinguish between genuinely generalizable dynamics and idiosyncratic personal response.

Disclosure of these risks is not mitigation. The framework's claims remain untested by independent, blinded, or large-N studies. The clinical parallels described here are suggestive but cannot substitute for such testing. Readers should weigh the framework's claims accordingly.

6. Falsifiability: What Would Disconfirm This Mapping?

A framework that diagnoses sealed attractors must specify its own disconfirmation conditions. For the present mapping, the following observations would weaken or invalidate the analogies drawn:

- **Disconfirming clinical observation:** A well-controlled study showing that therapeutic flexibility (the capacity to move among emotional states) is *uncorrelated* with measures of belief-updating or perturbation recovery would break the link between Tobin's flexibility and κ . Currently, no standardized instruments exist to perform this test. The condition is stated in principle; its operationalization requires measurement development beyond the scope of this paper.

- **Disconfirming dynamical finding:** Evidence that the attractor-like patterns Tobin describes are not truly self-reinforcing but are maintained entirely by external environmental contingencies, with no internal basin structure, would undermine the “basin” analogy. Distinguishing internal basin dynamics from environmental maintenance is a hard empirical problem in dynamical systems psychology, and the tools to resolve it are not yet standardized.
- **Superior alternative framework:** If a competing model explains Tobin’s clinical observations equally well *without* requiring the attractor framework’s ontological commitments, parsimony favors the simpler account. Acceptance and Commitment Therapy’s psychological flexibility model, for instance, predicts that cognitive fusion and experiential avoidance produce the rigidity Tobin describes—without appealing to attractor dynamics. Predictive processing accounts of emotional rigidity similarly provide alternative mechanisms. The present paper does not adjudicate between these rival frameworks; it offers the attractor framework as one candidate account among several.

These conditions are not met by the current paper, which offers only preliminary analogies.

7. Conclusion

James Tobin’s 2026 clinical article on psychodynamic attractor states and the attractor framework exhibit expected structural parallels, given their shared dynamical-systems heritage. Both describe recurrent, embodied patterns that resist perturbation and that therapeutic or corrective processes can gradually loosen. These parallels are analogical, not evidentiary. The

framework remains a self-published, N=1-grounded research program awaiting independent empirical testing. This mapping is a contribution to its ongoing development.

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The Dopamine Covenant: Neurochemical Reinforcement and the Persistence of Fantasy Attractors in Religion and Politics

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Abstract

Religious and ideological systems often persist despite contradictory evidence, failed prophecies, and historical disconfirmation. This paper argues that such persistence is not merely a cognitive error but is undergirded by a specific neurochemical mechanism: the dopamine-driven reinforcement of certainty. Building on Olds and Milner's (1954) demonstration that direct stimulation of the mesolimbic reward pathway can override all competing biological imperatives, we propose that the "lever" of absolute belief functions as a fantasy attractor—a sealed, low-corrective-permeability (κ) basin that resists updating. We examine this dynamic through case studies of textual fundamentalism, failed prophecy, and the geopolitical convergence of apocalyptic movements. The paper concludes that the brain's reward architecture does not contain a truth detector, and that cultivating corrective permeability (κ)—at the individual and institutional level—is the only reliable alternative to the self-reinforcing loop of

certainty and catastrophe. Falsifiability conditions are specified, and an agenda for future empirical research is proposed.

1. Introduction: The Neural Lever

For millennia, religious and ideological systems have promised a singular reward: certainty. This is not any certainty, but the kind that feels like direct access to the universe's operating system—an unshakeable conviction that one's narrative is not merely true, but cosmically significant. That feeling has a name: dopamine. And it does not care about truth.

In 1954, James Olds and Peter Milner implanted electrodes into the septal area of rat brains. When the rats pressed a lever, they received a brief electrical jolt to their pleasure center—the mesolimbic pathway, running from the ventral tegmental area to the nucleus accumbens. The rats pressed the lever thousands of times per hour. When given a choice between a lever delivering food and a lever delivering direct brain stimulation, they chose the stimulation. They pressed until they collapsed from exhaustion or starvation. They died with their paws on the lever (Olds & Milner, 1954).

This experiment provides the neurochemical prototype for understanding the self-sealing nature of fantasy attractors—belief systems with low corrective permeability ($\kappa \approx 0$) that resist updating when confronted with contradictory evidence (Galida, 2026). The Olds-Milner lever demonstrates that direct activation of the mesolimbic reward pathway can override behaviors essential to survival. Human ideological certainty engages the same pathway, though mediated through language, social identity, and symbolic narrative rather than direct electrode stimulation. The brain does not have a

dedicated “truth detector.” It has a reward system. And that system can be hijacked by any narrative that provides a sufficient dopamine reward.

A note on the framework. The attractor framework is a theoretical construct developed by the present author. It is not a community-validated model but a set of proposed concepts—including corrective permeability (κ) and the distinction between reality-aligned and fantasy attractors—designed for diagnostic application. This paper deploys those concepts to connect the neuroscience of reward with the psychology of belief persistence.

2. The Neurochemistry of Certainty

Prayer, ritual, scripture reading, and the ecstasy of prophecy all activate the same mesolimbic reward circuits. Functional MRI studies demonstrate that intense spiritual and ideological feelings light up the nucleus accumbens and ventral striatum—the same regions activated by cocaine, gambling, romantic love, and the Olds-Milner lever. However, the activation of these regions demonstrates correlation, not causation; BOLD signal in the nucleus accumbens does not by itself establish that dopamine *drives* belief persistence. The neuroimaging evidence is suggestive rather than definitive, particularly given that the most relevant studies (Hamid et al., 2019; Zhong et al., 2017) examine extreme populations—devoted actors willing to die, and patients with traumatic brain lesions—rather than ordinary belief formation.

A more precise account of dopamine’s role is required. Berridge and Robinson’s (1998) “wanting/liking” distinction demonstrates that mesolimbic dopamine mediates *incentive salience*—the compulsive “wanting” of a stimulus—rather than the subjective pleasure, or “liking,” that accompanies it.

Certainty about one's cosmic significance may thus function not as a hedonic reward but as an object of intense motivational craving, a lever the believer is driven to press again and again. Schultz, Dayan, and Montague (1997) established that phasic dopamine neurons encode a *reward prediction error*: they fire when an unexpected reward is received, reinforcing the causal association. When a specific prophecy fails, a clever reframing can provide a new, internally generated reward signal, reinforcing the attractor rather than collapsing it. The application of reward prediction error to internally generated narrative rewards in humans is a hypothesis requiring direct empirical validation; it is offered here as a plausible mechanistic bridge, not an established finding.

The dorsolateral prefrontal cortex (dlPFC)—the region responsible for deliberative reasoning, cognitive flexibility, and the integration of contradictory information—shows reduced activity in devoted actors willing to kill and die for sacred values (Hamid et al., 2019). Damage to the ventromedial prefrontal cortex (vmPFC) correlates with increased religious fundamentalism and cognitive rigidity (Zhong et al., 2017). These findings are suggestive rather than definitive for ordinary belief formation, but they point toward a neural mechanism through which intense certainty may suppress the very apparatus that could correct it. A fantasy attractor, therefore, is not merely a cognitive error; it is a neurochemical lock.

3. Corrective Permeability (κ): A Qualitative Construct

Corrective permeability (κ) is introduced here as a multidimensional, qualitative construct—not a metrically precise quantity. It describes the degree to which a belief

system updates in response to disconfirming evidence. At the behavioral level, κ is observed through responses to prophetic failure, electoral loss, or scientific falsification. At the neural level, it is hypothesized to correlate with dlPFC engagement during exposure to counter-attitudinal information. At the cognitive level, it overlaps with metacognitive awareness, intellectual humility, and reflective thinking capacity as measured by instruments such as the Cognitive Reflection Test (Frederick, 2005).

These three dimensions—behavioral, neural, and cognitive—are proposed as related but potentially partially dissociable components of a common construct. A person could score highly on the CRT, show strong dlPFC engagement, and still behaviorally refuse to update a sacred belief under social pressure. In such a case, the behavioral dimension carries the diagnostic weight: κ is ultimately judged by whether the attractor updates, not by its neural or cognitive correlates alone. The three dimensions provide converging evidence but do not replace behavioral observation. Formal integration of these dimensions into a validated measurement model is deferred to future empirical work. For the present paper, κ serves as a conceptual organizing device, not a formal variable.

4. The Textual Addiction

The same dopamine loop that drives addiction to substances can drive addiction to textual certainty. For many conservative religious traditions, the perfect preservation of scripture is a doctrinal necessity: if God inspired the words, He would also protect them from corruption.

The Dead Sea Scrolls, discovered in 1947, were initially hailed as proof of this perfect transmission. The Great Isaiah

Scroll matched the medieval Masoretic text almost perfectly. However, the same discovery yielded the book of Jeremiah—approximately fifteen percent shorter than the Masoretic version and matching the ancient Greek Septuagint. This was not a scribal slip; it was a full editorial rewrite. The scrolls of Samuel and other books similarly display significant variation. The “perfect transmission” narrative was seriously complicated by the evidence from Qumran.

Yet the dopamine-driven believer does not abandon the text. Instead, the basin seals. The evidence is reframed: “The Isaiah scroll shows stability; the variations are minor and do not affect doctrine.” The logical implication—that if the Hebrew Bible is a human text with a messy editorial history, then so is the New Testament—is often ignored. Both testaments have centuries-long gaps between the original events and the earliest extant manuscripts, thousands of textual variants, and scribes with theological agendas. Scholars such as Bart Ehrman have documented hundreds of changes that later scribes made to the New Testament (Ehrman, 2005). Ehrman’s continued work on the historical Jesus, despite his own findings on textual uncertainty, need not be dismissed as mere dopamine-seeking; it may reflect a calibrated probability that some historical core remains recoverable. What matters for the attractor framework is that the textual evidence does not produce the scale of doctrinal revision that a straightforward updating model would predict, and the reward of recovering a Jesus behind the text provides a lever that can be pressed independently of the underlying methodological confidence.

5. Prophecy as Retrofitting—and Its Limits

The same dopamine economy drives apocalyptic prophecy. When a predicted event fails to occur, the attractor does not

collapse; it reframes. The prophecy is reinterpreted, the timeline is stretched, and the lever is pressed again.

Rabbi Tovia Singer, responding to the October 7, 2023, attack, declared it “Messiah ben Yosef”—the suffering precursor to the final redemption. Ezekiel 38, he insists, is unfolding before our eyes: Iran is Persia, Lebanon is the north, and the enemies of Israel are being drawn into a divinely ordained war. Yet Ezekiel promised fire and brimstone, not IAF airstrikes. Iran still stands. Hezbollah still operates. The Temple is not rebuilt. World peace is nowhere in sight. “Unfolding” is simply a slower version of “soon.” When nothing happens, the believer is “still in the process.” When something happens, it is “prophetic.” The prophecy is unfalsifiable.

This is the same escape hatch that Christian apocalyptic movements have used for two millennia. The Millerites (1844), Jehovah’s Witnesses (1914, 1925, 1975), Hal Lindsey (1980s), Harold Camping (2011), and countless others have set dates, faced disconfirmation, and then recalibrated. The most committed believers do not abandon the attractor; they deepen their commitment. Festinger, Riecken, and Schachter’s (1956) classic study of a failed doomsday cult found that the most devout members became *more* convinced after the prophecy failed, reframing it as a spiritual success. Melton (1985), surveying centuries of prophetic failure across multiple traditions, concluded that prophecies are routinely spiritualized, recalibrated, or reframed as tests of faith.

However, not all movements survive disconfirmation. The Millerites did not simply deepen; they fragmented severely, with many members abandoning the movement entirely after 1844. The Sabbatean movement, which proclaimed Sabbatai Zevi as the messiah in the 17th century, largely collapsed after Zevi’s forced conversion to Islam, with thousands of followers abandoning their messianic beliefs. The Jehovah’s Witnesses experienced significant membership decline after the failed

1975 prophecy, even as the institutional leadership reframed the failure. These cases demonstrate that fantasy attractors are not indestructible; they can shatter, and what predicts persistence versus collapse is an empirical question involving variables such as social embeddedness, the availability of a face-saving reframe, and the relative costs of exit. The dopamine hit of “I was right” is powerful, but it is not invincible.

6. The Geopolitical Metastasis

This neurochemical dynamic is not confined to individual belief. It scales to geopolitics. Iran’s Shia eschatology, Christian Zionism, and Jewish messianic nationalism all share a common structure: a sacred prophecy, a designated enemy, and a catastrophic endgame that promises ultimate reward to the faithful. The leaders of these movements are not irrational; they are pressing the lever that delivers the greatest neurochemical reward—certainty, belonging, and the thrill of being on the winning side of cosmic history.

The ideological commitments are independently documented. Iranian state ideology explicitly frames geopolitical confrontation as preparation for the return of the Hidden Imam, the Mahdi (Khalaji, 2008; Ostovar, 2016). Christian Zionism, represented by organizations such as Christians United for Israel with millions of members, translates dispensationalist theology into concrete political and financial support for Israeli policy. Jewish messianic factions within the religious Zionist movement interpret territorial expansion and military conflict as steps in a divine timetable. The claim that these three basins have become coupled through mutually reinforcing positive feedback—forming a single meta-attractor—is the author’s own theoretical proposal (Galida, 2026b), offered here as a

diagnostic hypothesis pending independent validation. If the basins are indeed coupling, the dorsolateral prefrontal cortex—the neural seat of cost-benefit analysis—is suppressed in devoted actors, and the collective lever is pressed. The fire feels good.

7. The Antidote: Shared Reality and Corrective Permeability

There is such a thing as shared reality. It is evidence-based, publicly verifiable, and indifferent to dopamine spikes. Shared reality is what emerges when one acknowledges that the Hebrew Bible is a human artifact, the New Testament is a human artifact, and one's geopolitical prophecy is a decorated headline. Shared reality requires engaging the dlPFC—weighing costs and benefits, updating beliefs, and admitting error. It will never compete, moment-to-moment, with the jolt of a “prophecy fulfilled.” But it keeps the organism alive.

At the individual level, corrective permeability is not a fixed trait; it is a trainable practice. The dlPFC can be strengthened. Interventions that promote critical reflection have been shown to influence belief formation and flexibility. Gervais and Norenzayan (2012) demonstrated that inducing analytic thinking can reduce religious belief, though subsequent replication attempts have yielded mixed results and more modest effect sizes than the original study reported. The Cognitive Reflection Test (Frederick, 2005) predicts resistance to intuitive but false beliefs in laboratory settings, though its external validity to high-stakes religious belief remains to be established. Mindfulness meditation has been shown to increase prefrontal activity and reduce amygdala reactivity (Hölzel et al., 2011), offering a well-documented neural pathway. Cognitive behavioral therapy (CBT) modifies specific maladaptive beliefs in clinical

populations, though its effects on general belief flexibility are less established. Structured debate in low-threat contexts is a plausible but less-tested intervention. The simple daily question, “Did I update any belief yesterday?,” is a practical heuristic for engaging the correction apparatus.

Acknowledging the asymmetry. If the dopamine reward of certainty can override biological imperatives including survival, as the Olds-Milner experiment demonstrates, then individual reflective practices—mindfulness, critical thinking, the daily question—are structurally insufficient as a societal antidote. They are necessary but not sufficient. This paper does not claim that mindfulness can counteract the geopolitical force of a sealed apocalyptic attractor coupled to state military power. It claims only that individual κ cultivation is a prerequisite for any broader institutional response: institutions themselves are populated by individuals, and institutional κ cannot exceed the κ of the people who operate them. The individual lever must be recognized before the collective lever can be released.

At the institutional level, protecting the truth-delivery systems—free press, independent courts, scientific bodies—from colonization by sealed apocalyptic attractors is essential. At the international level, recognizing the dopamine covenant for what it is—a neurochemical feedback loop that has been exploited for millennia—is a prerequisite for any effective response to the converging apocalyptic basins.

8. Falsifiability Conditions

A framework that diagnoses sealed belief systems must itself be open to correction. The following conditions are proposed:

- **Strong disconfirmation:** If a well-documented case is

presented in which a high-commitment belief system updates its core claims rapidly and substantially in response to disconfirming evidence, without reframing, the claim that dopamine-driven certainty reliably produces low κ is weakened.

- **Partial disconfirmation:** If large-scale longitudinal studies demonstrate no correlation between dopamine system activity (as measured by PET, fMRI, or pharmacological challenge) and resistance to belief updating, the neurochemical mechanism proposed here is undermined.
- **Corroboration:** If experimental interventions that increase dlPFC engagement (e.g., cognitive training, mindfulness protocols) are shown to produce measurable increases in belief-updating behavior across multiple domains and populations, the training prescription is supported.

These conditions are not met by the present paper. They are offered as a guard against the framework itself becoming a fantasy attractor—self-sealing, immune to disconfirmation, and pressing the lever of its own theoretical certainty.

9. Open Questions and Future Research Directions

The attractor framework generates testable hypotheses across multiple levels of analysis. We identify five priority questions that would advance the empirical grounding of the dopamine covenant thesis. Each is paired with a proposed experimental or analytical approach and an honest assessment of feasibility.

9.1 Does prophetic reframing generate a dopamine-mediated

reward prediction error?

Present committed believers with a falsifiable prediction (e.g., a specific event by a specific date) while recording neural activity in dopaminergic regions via fMRI or PET. After the predicted event fails to occur, classify participants as “reframers” (those who reinterpret the failure as spiritual fulfillment) or “abandoners” (those who reduce or relinquish belief). Compare dopaminergic responses between groups. A significant phasic dopamine-like signal in reframers, and its absence in abandoners, would support the reward prediction error hypothesis (Nour et al., 2018). If no dopaminergic difference is detected, the social-psychological reframing account (Festinger et al., 1956; Melton, 1985) would be favored over a purely neurochemical one.

Feasibility: Low. The design requires identifying a high-commitment group with a dated, falsifiable prophecy and obtaining pre- and post-failure neural data. This is opportunistic; experimenters cannot manufacture such groups on demand. Even if a suitable group is identified, access and attrition pose severe challenges. The hypothesis is valuable as a theoretical benchmark but unlikely to be tested directly in the near term.

9.2 What predicts persistence versus collapse after disconfirmation?

Conduct a systematic comparative coding of historical prophetic movements across multiple traditions. Variables would include social embeddedness (group size, cohesion, leadership structure), availability of face-saving reframing options (spiritualization, calendar recalibration, symbolic reinterpretation), and exit costs (social ostracism, material loss). Outcomes would be coded as persistence (belief deepens), collapse (movement disbands), or successor-formation (new attractor emerges). Statistical analysis would identify the strongest predictors. Recent archival work suggesting that

the original Festinger cult actually dissolved (Kelly, 2026) underscores the need for broad comparison rather than reliance on a single iconic case.

Feasibility: Moderate. Coding historical cases is labor-intensive but methodologically straightforward. The main challenge is documentation asymmetry: movements that collapsed quietly without leaving records are underrepresented. Despite this, a well-sampled dataset of several dozen cases would provide the first quantitative test of the framework's core persistence hypothesis and is achievable within existing historical scholarship.

9.3 Can κ be trained in high-stakes contexts?

Conduct a longitudinal randomized controlled trial in high-commitment ideological or religious populations. Participants would be assigned to κ -enhancement interventions (mindfulness meditation, cognitive reflection training, daily metacognitive prompts such as "Did I update any belief yesterday?") or an active control. Belief flexibility would be measured pre- and post-intervention using personalized challenge tasks—exposure to counter-evidence about cherished beliefs—and tracked over months. Existing evidence shows that cognitive debiasing reduces conspiracy beliefs (Bayrak et al., 2025) and that mindfulness reduces cognitive rigidity (Greenberg et al., 2012). Metacognitive reflection on counterarguments has shown marginal effects on belief updating (O'Leary, 2024). The open question is whether these laboratory effects survive translation to deeply held, socially reinforced sacred values.

Feasibility: Moderate. Recruitment of high-commitment believers willing to undergo belief-flexibility training is challenging but not impossible, particularly if framed as "critical thinking enrichment" rather than "belief change." Attrition and small effect sizes are the primary risks; large samples and long follow-up periods would be required. The study would provide the most direct test of the paper's

central prescriptive claim.

9.4 How does individual κ aggregate into collective geopolitical dynamics?

Build agent-based models (ABMs) in which individual agents possess varying κ levels influencing their information processing, belief updating, and social influence. Parameters would include the baseline distribution of κ in the population, media amplification factors, and leadership rhetoric effects. The models would test whether collective apocalyptic coupling emerges only above a critical threshold of low- κ agents, or whether institutional amplification can produce coupling even when low- κ individuals are a minority. Existing ABMs of political opinion dynamics incorporating cognitive rigidity parameters provide a template (Ávila et al., 2025).

Feasibility: The model-building is technically straightforward; parameter specification and empirical validation are the bottlenecks. Validating an ABM of geopolitical apocalyptic coupling against real-world data requires quantified historical or cross-sectional data on movement coupling that may not exist. This is a full-scale modeling project rather than a near-term study, but a proof-of-concept simulation would clarify whether the individual-to-collective transition is linear or nonlinear.

9.5 Is κ a unified construct or a loose family of traits?

Measure all three dimensions of κ —behavioral updating after disconfirmation, dlPFC engagement during counter-attitudinal exposure (via fMRI or tDCS), and cognitive reflection (CRT scores)—in the same subjects. Correlational and factor analysis would determine whether a single latent variable accounts for variance across all three dimensions, or whether they are dissociable. Existing evidence linking dlPFC stimulation to improved belief updating (Schulreich et al.,

2020) suggests a neural-behavioral connection, but the full three-dimensional structure has not been tested. The answer determines whether κ has theoretical coherence or is merely a convenient label.

Feasibility: Low as a single study; high as a research program. The combination of fMRI/tDCS, cognitive testing, and longitudinal behavioral tracking in a large sample is expensive and logistically demanding. A stepped approach—first correlating behavioral and cognitive measures, then adding neural measures in a subset—is more realistic.

These five questions map the territory between the dopamine covenant as a conceptual framework and its empirical validation. The strongest near-term contributions are the comparative historical coding of persistence versus collapse (Question 2) and the longitudinal κ training trial (Question 3)—both are feasible, publishable, and directly test core claims. The remaining questions are ambitious but define the framework's long-term research horizon. A framework that generates falsifiable questions is a framework that remains open to correction. That is itself a form of corrective permeability.

10. Conclusion

The rat died pressing the pleasure lever. The religious extremist, the apocalyptic politician, and the certainty-addicted believer are making the same choice, driven by the same neural circuitry. The fire feels good. That is the real addiction. And it is burning the world down.

The only reliable lever is reality. It does not promise heaven. It does not promise a second coming or a Mahdi's

return. It promises only one thing: it is true, whether you believe it or not.

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“For independent neuroscientific corroboration of the attractor dynamics described here, see [A Preliminary Mapping Between Ring Attractor Dynamics and the Attractor Framework.](#)”

The Lever and the Basin: Olds-Milner, Dopamine, and the Neurochemical Prototype of Fantasy Attractors

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Abstract

In 1954, Olds and Milner demonstrated that direct electrical stimulation of the mesolimbic reward pathway could drive rats to press a lever to the exclusion of all biological needs, often until death. This paper argues that the Olds-Milner lever provides the neurochemical prototype for a fantasy attractor—a sealed, low-corrective-permeability (κ) belief system maintained by dopamine-driven reinforcement. While the human expression of such attractors involves symbolic and narrative complexity, they appear to share a common neural substrate with the Olds-Milner phenomenon, specifically the dopamine-mediated suppression of the dorsolateral prefrontal

cortex (dlPFC). Corrective permeability (κ) is defined here as a multidimensional construct—behavioral (rate of belief update under disconfirmation), neural (dlPFC engagement during counter-attitudinal exposure), and cognitive (metacognitive awareness and reflective thinking capacity)—whose dimensions are proposed as related but potentially partially dissociable components of a common construct. The attractor framework is the author's own theoretical construct, and this paper uses it to propose a unified conceptual bridge between the neuroscience of reward, the social psychology of failed prophecy, and the dynamics of rigid belief. It concludes that corrective permeability is not a fixed trait but a neurocognitive skill that can be cultivated, and that the framework itself must remain open to disconfirmation.

1. Introduction: The Rat on the Lever

In a landmark 1954 experiment, James Olds and Peter Milner implanted electrodes into the septal nuclei of rats and connected them to a lever. Each press delivered a brief electrical jolt to the brain's pleasure centers. The rats pressed the lever at rates of up to 7,000 times per hour, ignoring food, water, and their own young, until they collapsed from exhaustion or died. The electrode was not delivering nutrition or safety; it was delivering direct, unmediated reward via the mesolimbic dopamine pathway.

The canonical interpretation treats this experiment as a study of addiction and motivation. I propose a different reading: the rat on the lever is the purest behavioral demonstration of a fantasy attractor—a sealed basin with near-zero corrective permeability ($\kappa \approx 0$), maintained by a neurochemical feedback loop that has no mechanism for detecting its own self-destructiveness. The brain does not have a truth detector. It has a reward system. Fantasy attractors exploit this

architecture.

2. The Fantasy Attractor: A Construct Under Development

A note on the framework. The attractor framework is a theoretical construct developed by the present author (Galida, 2026a). It is not a community-validated model but a set of proposed concepts—including corrective permeability (κ) and the distinction between reality-aligned and fantasy attractors—designed for diagnostic application. This paper deploys those concepts to connect the neuroscience of reward with the psychology of belief persistence.

A fantasy attractor is a belief system with low corrective permeability (κ). It resists updating when confronted with contradictory evidence, reframes error signals to protect its core narrative, and often seeks to colonize or destroy rival basins. A reality attractor, in contrast, has high κ : it absorbs perturbation, updates its model, and deepens through correction.

What is κ ? Corrective permeability is a multidimensional construct. At the behavioral level, it denotes the rate at which a belief system updates in response to disconfirming evidence—observable through responses to prophetic failure, electoral loss, or scientific falsification. At the neural level, it is hypothesized to correlate with dlPFC engagement during exposure to counter-attitudinal information. At the cognitive level, it overlaps with metacognitive awareness, intellectual humility, and reflective thinking capacity as measured by instruments such as the Cognitive Reflection Test (Frederick, 2005). These three dimensions—behavioral, neural, and cognitive—are proposed as related but potentially partially dissociable components of a common construct, and

their formal integration into a validated measurement model is deferred to future empirical work. For the present paper, κ serves as a conceptual organizing device, not a metrically precise quantity.

Corrective permeability has a neural correlate. The dorsolateral prefrontal cortex (dlPFC) is critical for deliberative reasoning, cognitive flexibility, and the integration of new information that contradicts prior beliefs. When the dlPFC is suppressed—by stress, by dopamine-driven reward anticipation, or by the sheer intensity of a sacred value—the updating mechanism is partially disengaged. A fantasy attractor, then, is not merely a cognitive error. It is a neurochemical lock: a self-reinforcing basin maintained by the dopamine-driven reinforcement of certainty, coupled with the suppression of the apparatus that could correct it.

3. The Olds-Milner Mechanism: Dopamine and Basin Sealing

3.1 The Experiment

Olds and Milner implanted bipolar electrodes in the septal nuclei of rats. The stimulation directly activated the mesolimbic pathway, triggering dopamine release in the nucleus accumbens. The rats rapidly learned to self-stimulate and would cross electrified grids to reach the lever. Their behavior displayed a pathological focus: all competing motivational systems—hunger, thirst, social bonding—were overridden.

3.2 Wanting Without Liking

Subsequent neuroscience has refined our understanding of the underlying processes. Berridge and Robinson's "wanting/liking" distinction demonstrates that mesolimbic dopamine

mediates *incentive salience*—the compulsive “wanting” of a stimulus—rather than the subjective pleasure, or “liking,” that accompanies it. This is a crucial precision: the Olds-Milner rat may not be experiencing escalating pleasure. It may be in a state of chronic, intense craving, driven by a dopamine system that attributes supreme motivational value to the lever.

Schultz and colleagues established that phasic dopamine neurons encode a *reward prediction error*. They fire when an unexpected reward is received, reinforcing the causal association. A fantasy attractor, however, often does not deliver a single, clear falsifiable prediction. When a specific prophecy fails, a reframe can provide a new, internally generated reward signal: the revised interpretation itself constitutes a novel prediction whose acceptance by the group triggers a prediction error, reinforcing the attractor rather than collapsing it. The dopamine system thus does not merely passively respond to external rewards; it can be co-opted by internally generated narrative rewards that perpetuate the basin.

3.3 The Lever as a Sealed Basin

Viewed through this lens, the rat’s behavior maps onto the fantasy attractor concept with precision. The lever becomes the basin’s strongest point of attraction, and the dopamine-driven “wanting” compels action even as the animal’s body is dying. The error signals of hunger and thirst are present, but they cannot penetrate the basin. The dopamine loop overrides them. The rat is not stupid; it is a perfectly functional nervous system locked in a sealed attractor, driven by “wanting” what will kill it.

3.4 From Rat to Human: A Shared Substrate

The human mesolimbic pathway is structurally and functionally homologous to the rat’s. A human contemplating their election as a member of a divine plan, a revolutionary vanguard, or an

infallible political movement is likely engaging the same dopamine-mediated “wanting” system. The apocalyptic believer retrofitting a terrorist attack as “Messiah ben Yosef” is pressing a lever. The certainty is the reward. What differs is the complexity of the stimulus—the lever is decorated with theology, ideology, and narrative. This symbolic layer is not an epiphenomenon; it engages distinct cortical processes and social dynamics that add causal complexity. The human attractor is not identical to the rat’s, but it appears to share a crucial neurochemical substrate.

A methodological caveat. Direct neuroimaging of ordinary belief rigidity remains limited. The available evidence comes primarily from extreme populations: Hamid et al. (2019) studied individuals willing to fight and die for sacred values, and Zhong et al. (2017) studied patients with traumatic dlPFC lesions. These findings are suggestive rather than definitive for ordinary belief formation. Generalization from these studies to the broader population of believers should be treated as a hypothesis requiring further validation, not an established finding.

4. The Dopamine Covenant: Certainty as Reward

4.1 The Brain’s Category Error

The brain evolved to use the feeling of certainty as a proxy for adaptive knowledge because false beliefs about predators were rapidly corrected. In the modern symbolic environment, beliefs can persist for decades without encountering lethal feedback. A person can be completely certain that the Mahdi will return or that a lost election was stolen, and this subjective certainty fires the same reward circuits that once signaled a reliable food source. The brain cannot distinguish

between “this feels certain because it is true” and “this feels certain because the mesolimbic pathway has been activated ten thousand times.”

4.2 Persistence and Collapse After Disconfirmation

Festinger, Riecken, and Schachter's *When Prophecy Fails* (1956) chronicled a doomsday cult that reframed a failed flood prophecy as confirmation that their faith had saved the world. Believers became more committed after the failure. This is the basin deepening. Melton (1985), surveying centuries of prophetic failure across multiple religious traditions, identified the same structural pattern: prophecies are routinely spiritualized, recalibrated, or reframed as tests of faith rather than abandoned.

However, a full analysis requires accounting for cases where movements *do* collapse. The Millerites of 1844, who prepared for Christ's return on October 22, suffered a massive “Great Disappointment” when Jesus did not arrive. The movement fragmented severely; many members left, disillusioned. Yet from that collapse, new, more resilient sects—most notably the Seventh-day Adventists—emerged with a reframed theology. This pattern is theoretically instructive: collapse of one attractor basin can seed a successor, potentially more resilient, basin. The attractor dynamic does not necessarily terminate; it can migrate, with the reframe functioning as the bridge from the old basin to the new. What predicts persistence versus collapse versus successor-formation? Variables likely include the depth of a group's social embeddedness, the availability of a face-saving reframe, and the relative costs of exit. Engaging this complexity strengthens the argument: a fantasy attractor is not an indestructible monolith; it is a dynamical system that can either deepen, shatter, or reorganize under perturbation, depending on its structure. The reframing response is common but not universal.

5. Implications for the Attractor Framework

5.1 Cognitive Arguments Alone Are Insufficient

A fantasy attractor cannot be reliably dislodged by evidence alone because the apparatus for processing corrective evidence (the dlPFC) is often suppressed. This does not mean persuasion is impossible; it means that conditions that reduce threat and re-engage prefrontal function must precede evidential argument.

5.2 The Dopamine Covenant Explains Apocalyptic Intensity

Apocalyptic belief is an especially potent fantasy attractor because its reward structure is maximal: the believer is not merely right about a fact; they are a participant in the final act of cosmic history. The dopamine “wanting” is directed toward a future of ultimate vindication, making the attractor deeply resistant to correction.

An open question: κ at the level of belief content vs. attractor dynamics. The successor basin phenomenon—where collapse of one fantasy attractor seeds another—raises a theoretically important distinction. An individual or group that abandons a failed prophecy and adopts a reframed successor belief may exhibit high κ in the narrow sense (they updated their specific beliefs in response to disconfirmation) while remaining within a fantasy attractor at the structural level. This suggests that κ may need to be measured not only at the level of specific belief content but also at the level of the attractor dynamic itself: does the system’s underlying relationship to disconfirmation change, or merely the content of the beliefs it protects? A high- κ move from one low- κ basin

to another is still low- κ at the systemic level. Resolving this distinction—between content-level and structure-level corrective permeability—is a priority for future theoretical and empirical work within the attractor framework.

5.3 Corrective Permeability Is a Trainable Practice

The dlPFC can be strengthened. The capacity for analytic reasoning is not a fixed trait. Interventions that promote critical reflection have been shown to influence belief formation and flexibility. Gervais and Norenzayan (2012) demonstrated that inducing analytic thinking can reduce religious belief, though subsequent meta-analyses have found more modest and conditional effect sizes in replications. This suggests a genuine but likely small-to-moderate link between cognitive style and belief flexibility. More broadly, dual-process theories in cognitive psychology hold that Type 2 (reflective) processing can override Type 1 (intuitive) responses when prompted (Evans & Stanovich, 2013). The Cognitive Reflection Test (CRT; Frederick, 2005) has been shown to predict resistance to intuitive but false beliefs across multiple domains, providing a plausible measurement anchor for the cognitive dimension of κ .

The evidence base for specific interventions varies. Mindfulness meditation has been shown to increase prefrontal activity and reduce amygdala reactivity (Hölzel et al., 2011), providing a well-documented neural pathway for enhancing κ . Cognitive behavioral therapy (CBT) has strong empirical support for modifying specific maladaptive beliefs in clinical populations, though its effects on general belief flexibility outside clinical contexts are less thoroughly established. Structured debate in low-threat contexts is a plausible but less-tested intervention; its theoretical rationale is strong, but direct empirical support for its effect on corrective permeability is limited. The simple daily question, “Did I update any belief yesterday?”, is a practical heuristic for

engaging the correction apparatus, derived from the framework itself rather than independent empirical validation.

5.4 The Framework Must Guard Its Own κ

A framework that diagnoses sealed basins must itself remain open to correction. The attractor framework's falsifiability conditions are its own dlPFC engagement.

6. Conclusion

The Olds-Milner experiment is more than a landmark in the history of neuroscience. It provides the neurochemical prototype for the fantasy attractor. The rat pressing the lever until death, driven by a hijacked dopamine system that privileges "wanting" over survival, maps onto the human believer pressing the lever of certainty, prophecy, or ideological capture. In both cases, a sealed basin overrides biological and cognitive self-correction, creating a self-reinforcing cycle that can persist even in the face of lethal consequences. This is not merely a metaphor; evidence suggests a genuine shared neurochemical susceptibility, though its precise extent awaits direct empirical characterization.

The brain does not have a truth detector; it has a reward system. Certainty is not evidence of truth; it is evidence of dopamine. The most reliable alternative to the lever is a deliberately cultivated corrective permeability—a practice of engaging the neural machinery of doubt and reason, asking daily the question the rat never could: *Am I pressing a lever right now?*

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The Conscious Body: Organs as Attractor-Based Minds

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Abstract

The standard view holds that only the brain generates consciousness. This paper challenges that monopoly by applying the minimal functional criteria used to attribute rudimentary consciousness to the 302-neuron nematode *C. elegans* to the body's own complex, intrinsically innervated organs. On the basis of integration, valence, learning, goal-directedness, and anatomical concentration, the enteric nervous system (ENS), the intrinsic cardiac nervous system (ICNS), the intrinsic pancreatic ganglia, and—provisionally—the spinal cord qualify as candidate conscious subsystems. We do not assert that these organs are conscious. We assert that if the

functional criteria are taken seriously enough to include a 302-neuron worm as a candidate, they cannot be silently withheld from structurally richer systems without a principled reason. We argue that the brain is not the sole generator of consciousness but the regulator of a federation of semi-autonomous organ-level attractors. We provide testable predictions, sketch the coupling mechanisms that bind local attractors into a unified self, outline clinical implications, and identify open problems including inter-attractor conflict and the phenomenal gap. The framework is offered as a research-generative hypothesis, not a completed theory.

1. Introduction: The Brain's Unexamined Monopoly

The brain is the organ we associate with consciousness, almost without question. Yet the body contains other complex neural networks. The enteric nervous system (ENS) comprises 200–600 million neurons, operates semi-autonomously, learns, and remembers. The intrinsic cardiac nervous system (ICNS) integrates local signals and regulates cardiac output. The spinal cord, with approximately 200 million neurons, can learn when isolated from the brain. The intrinsic pancreatic ganglia coordinate metabolic homeostasis. If these systems were found in a small animal, comparative neuroscience would at least entertain the possibility of consciousness. Because they are inside us, they are dismissed as mere infrastructure.

This paper asks a simple question: if we accept the functional criteria used to infer minimal consciousness in *C. elegans* (302 neurons), why are those same criteria not applied to the ENS, the ICNS, the pancreatic network, and the spinal cord? The question is not *Are these organs conscious?* but *Why are they excluded a priori?*

We do not claim to solve the hard problem of consciousness. We adopt the same pragmatic strategy used throughout comparative neuroscience: observable functional properties—integration, valence, learning, goal-directedness, and anatomical concentration—are treated as operational proxies for consciousness. This strategy is how we infer consciousness in other humans (by analogy), in non-human animals (by behavioural complexity), and in *C. elegans* (by measurable learning and integration). If these criteria are sufficient to identify a candidate conscious system in a 302-neuron worm, consistency demands their application to other systems that exceed this threshold, unless a principled exclusion criterion is provided. That exclusion criterion has not been articulated.

We use the term **candidate** throughout to avoid slippage into positive consciousness attribution. The paper's central claim is that the ENS, ICNS, pancreatic network, and spinal cord are *candidates*—systems that meet the same threshold criteria applied to a known candidate—and that dismissing them without investigation is methodologically inconsistent.

2. The Attractor Framework as Conceptual Scaffolding

An attractor is a region in state space toward which trajectories converge and remain unless perturbed. A candidate conscious attractor possesses five functional properties:

1. **Integration:** binding multiple sensory or interoceptive streams into a unified dynamical state.
2. **Valence:** operationalized as approach/avoidance behaviour—attraction to certain states and repulsion from others. We do not claim that behavioural valence

entails phenomenal valence. We claim only that it is the same behavioural proxy used for *C. elegans* and other simple organisms. The inference from behavioural valence to phenomenal valence is a philosophical commitment we note but do not resolve.

3. **Learning:** the capacity to modify behaviour based on experience (habituation, sensitization, associative conditioning).
4. **Goal-directedness:** acting to maintain the system's own basin—a form of conatus—persisting in the absence of external commands.
5. **Anatomical concentration:** a spatially organized, intrinsically connected neural network with dedicated integrative circuitry. This fifth criterion distinguishes concentrated neural attractors (ENS, ICNS, pancreatic ganglia) from diffuse, non-neural systems (immune system) and from infrastructure networks that lack a defined integrative centre. For the spinal cord, as discussed in Section 4.4, we apply this criterion with qualification.

The attractor vocabulary is applied conceptually, not formally, in this paper. A forthcoming quantitative treatment (Galida, 2026) will develop the mathematical persistence functional. The current paper uses attractor language to structure its functional criteria and predictions; it does not claim to derive formal basin measures from the available data.

Operationalizing Autonomy: We propose, as a provisional operational threshold, that a candidate subsystem crosses the autonomy boundary if it retains a significant fraction (e.g., $\geq 50\%$) of its normal functional repertoire following complete extrinsic denervation or isolation. This criterion distinguishes systems that are merely regulated from systems that can independently sustain goal-directed attractor dynamics. The ENS and ICNS clearly exceed this threshold; the spinal cord and pancreatic network do so conditionally, as

discussed below.

3. The Conditional Argument and Its Stipulated Baseline

The nematode *C. elegans* possesses exactly 302 neurons. Its connectome is fully mapped. It exhibits sensory integration, associative learning, goal-directed chemotaxis, and minimal self-reference (distinguishing self-generated from external touch). Its learning capacities are well-documented (Ardiel & Rankin, 2010; Sasakura & Mori, 2013).

We stipulate—we do not establish—that *C. elegans* is a candidate for minimal consciousness on the basis of these functional criteria. The paper does not require that the field accept this stipulation as consensus. It requires only that the reader grant the conditional: **if** the functional criteria are sufficient to make *C. elegans* a candidate, **then** they must be applied consistently to any system that meets or exceeds them. Those who reject the conditional may ignore the remainder of the argument, but they must then explain what additional criterion excludes the ENS, ICNS, pancreatic network, and spinal cord while admitting *C. elegans*.

4. Candidate Organs

The four candidate organs identified below are assessed against the five criteria, with the provisional autonomy threshold applied where possible. We differentiate their evidential strength clearly.

4.1 The Enteric Nervous System (ENS)

The ENS is the strongest candidate. Its 200–600 million neurons form two interconnected plexuses spanning the gastrointestinal tract. It meets all five criteria:

- **Integration:** continuously integrates mechanical, chemical, and hormonal signals to coordinate peristalsis, secretion, and blood flow.
- **Valence:** exhibits attraction to nutrients, aversion to toxins; noxious stimuli trigger emesis or accelerated transit.
- **Learning:** exhibits habituation, sensitization, and long-term plasticity; gut reflexes can be conditioned (Furness, 2012; Schemann & Frieling, 2020).
- **Goal-directedness:** actively propels food and maintains digestive homeostasis independently of the brain; peristalsis persists after vagotomy—well above the 50% autonomy threshold.
- **Anatomical concentration:** a continuous, highly organized neural network with dedicated integrative circuitry.

4.2 The Intrinsic Cardiac Nervous System (ICNS)

The ICNS (14,000–43,000 neurons) is a moderate candidate. Its neuron count is only 46–143 times the *C. elegans* threshold, a narrower margin than the ENS. It meets the criteria, but with less evidential richness:

- **Integration:** monitors blood pressure, chamber stretch, and local chemistry to modulate cardiac output.
- **Valence:** maintains a preferred setpoint for cardiac rhythm; arrhythmias represent perturbations from that setpoint.
- **Learning:** shows ganglionic remodelling after injury; vagal stimulation protocols can alter responsiveness (Armour, 2008).
- **Goal-directedness:** generates intrinsic rhythms when

denervated, satisfying the autonomy threshold.

- **Anatomical concentration:** organized into ganglia on the heart's surface.

The ICNS contributes to emotional experience via heartbeat-evoked potentials that correlate with interoceptive awareness and self-recognition. This is suggestive but does not independently establish consciousness.

4.3 The Intrinsic Pancreatic Network

The pancreatic network is the most provisional candidate. Its 10,000–50,000 intrinsic neurons are scattered in ganglia throughout the organ, rather than forming a continuous plexus (Ahren, 2000; Salvioli et al., 2002). This weaker anatomical concentration distinguishes it from the ENS and ICNS.

- **Integration:** combines neural, hormonal, and nutrient signals to regulate blood glucose.
- **Valence:** maintains a metabolic setpoint; hypoglycemia and hyperglycemia are aversive states.
- **Learning:** plasticity is less studied than in the ENS; no direct evidence of conditioning is available.
- **Goal-directedness:** coordinates endocrine and exocrine output to maintain glucose homeostasis; whether this function persists at $\geq 50\%$ of normal repertoire after complete extrinsic denervation is not yet established. The pancreatic network remains a candidate, but with an open empirical question on the autonomy threshold.
- **Anatomical concentration:** scattered ganglia; meets the threshold but is the weakest candidate on this criterion.

4.4 The Spinal Cord (Provisional Candidate)

The spinal cord possesses approximately 200 million neurons, organized into topographically precise circuits that integrate

sensory input, generate coordinated motor output, and exhibit learning when isolated (Hook & Grau, 2007). By the five functional criteria, it qualifies. However, under normal physiological conditions, its activity is tightly coupled to descending commands, and independent behavioural generation is rarely observed. After complete spinal cord injury, the isolated cord reorganizes and can generate complex, goal-directed responses. Whether such reorganization achieves the $\geq 50\%$ autonomy threshold is an empirical question; we provisionally include the spinal cord as a candidate with lower confidence, identifying it as the ideal test case for refining the autonomy criterion.

5. The Brain as Regulator: Mechanisms of Coupling

If the ENS, ICNS, pancreatic network, and spinal cord are candidate conscious subsystems, the unified self must be explained as the product of their integration by the brain. We propose that the brain couples, modulates, and aligns local attractors through four mechanisms, each supported by established physiology.

5.1 Vagal Afferent Signalling

The vagus nerve provides the primary bidirectional communication channel between the brain and the viscera. Vagal afferents convey interoceptive signals from the ENS and ICNS to the nucleus of the solitary tract, and descending signals modulate organ function. Vagal nerve stimulation is known to alter mood, reduce inflammation, and improve cardiac function (George et al., 2000; Tracey, 2002).

5.2 Humoral Signalling

Circulating hormones (cortisol, adrenaline, insulin, glucagon)

and immune mediators (cytokines) provide a slower, diffuse coupling channel. These signals alter the global attractor's landscape by shifting the metabolic and inflammatory context. Sickness behaviour—fatigue, anhedonia, social withdrawal—is a well-documented example of immune-to-brain signalling that temporarily reconfigures the global attractor (Dantzer et al., 2008).

5.3 Rhythmic Entrainment

The brain entrains peripheral rhythms to its own oscillations. Cardiac and respiratory rhythms phase-lock to cortical activity during focused attention (Thayer & Lane, 2000). Slow-wave sleep entrains glymphatic clearance (Xie et al., 2013). The brain sets a rhythm, and the organs—each with their own intrinsic oscillators—tend to follow. This resonance is not command; it is coupling by shared frequency.

5.4 Predictive Processing and Attractor Coupling

The predictive processing framework (Clark, 2013) treats the brain as a prediction engine that minimizes surprise by updating internal models based on sensory input. We suggest that this framework extends naturally to interoception: the brain maintains predictions about the states of the body's organs, and each organ generates its own predictions about local conditions. The alignment of these nested predictive models is functionally analogous to attractor coupling, in that both involve the progressive alignment of internal states toward a shared equilibrium. Friston's (2010) free-energy principle provides a formal bridge between predictive processing and dynamical systems that could, in future work, unite these descriptions under a single mathematical framework.

5.5 Relationship to Competing Theories of Consciousness

The attractor framework is compatible with but not identical to several major theories. Integrated Information Theory (IIT;

Tononi, 2008) holds that consciousness is a function of the amount of integrated information a system generates. The attractor framework shares IIT's emphasis on integration but does not require the computation of Φ , which remains technically infeasible for most organ systems. Global Workspace Theory (GWT; Baars, 1988; Dehaene, 2011) posits that consciousness arises when information is broadcast within a global workspace. Under GWT, many peripheral attractors would be considered unconscious because they lack access to a central workspace. The attractor framework allows for phenomenal consciousness without global access, a position consistent with the possibility that the ENS may have experiences that never enter cortical awareness. Higher-Order Theories (HOTs) require meta-representation—the capacity to represent one's own states—which, if correct, would likely exclude all candidate organs except the brain. The attractor framework treats HOTs as a valid but overly restrictive criterion that would also exclude many animals currently accepted as conscious. The framework does not seek to refute these theories but to generate testable predictions that can be compared with theirs, advancing the debate through empirical competition.

5.6 Inter-Attractor Conflict: An Open Problem for the Federation Model

A federation of semi-autonomous attractors inevitably generates conflict. Everyday clinical phenomena illustrate this: nausea during a cognitively demanding task (ENS and cortical attractors in tension), cardiac arrhythmia during emotional stress (ICNS and limbic system in conflict), hypoglycemic cognitive impairment (pancreatic and cortical attractors in opposition). The current paper does not propose a mechanism for conflict resolution beyond the brain's general regulatory role. Whether such conflicts are resolved by hierarchical dominance, temporal multiplexing, or some form of inter-attractor negotiation is an open question. We flag it as

a priority for future theoretical development within the framework.

6. The Alien Feeling and Clinical Dissociation

When coupling between the global self and a local attractor falters, the experience can manifest as an “alien feeling”—the sense that an action or bodily state is “not mine.” This phenomenon is well-documented in alien hand syndrome (Della Sala et al., 1991) and in depersonalization disorder, where individuals report feeling detached from their own body and mental processes (Sierra & David, 2011). We interpret these as temporary or chronic decoupling of a local attractor from the global workspace—exactly what the federation model would predict when integration fails.

7. Testable Predictions

The framework generates five falsifiable predictions:

1. **ENS conditioning:** An isolated intestinal segment, exposed to a neutral stimulus paired with a non-nociceptive chemical infusion, will exhibit a conditioned motor or hormonal response.
2. **ICNS plasticity:** Long-term heart rate variability biofeedback will produce persistent changes in baseline cardiac rhythms not fully mediated cortically.
3. **Gut-directed therapy:** IBS patients receiving gut-directed biofeedback will show greater symptom improvement than those receiving standard CBT alone.
4. **Pancreatic memory:** In a vagally denervated preparation,

islet cell clusters exposed to repeated glucose perturbation will exhibit an anticipatory insulin response.

5. **Spinal reorganization:** Complete spinal cord injury patients will develop complex, coordinated responses below the lesion beyond simple reflexes, consistent with a reorganizing local attractor.

8. Future Directions: Approaching the Phenomenal Gap

The framework operates on behavioural and functional proxies for consciousness; it does not provide direct phenomenological access to organ-level experience. What evidence could begin to bridge this gap? We propose three directions. First, decoupling experiments that temporarily isolate a candidate organ (e.g., via selective pharmacologic blockade) and then probe the subject's subjective state could reveal whether the organ's local attractor contributes a distinct experiential component to the global self. Second, longitudinal studies of spinal cord injury patients who report phantom sensations or "body memories" below the lesion may provide indirect reportable correlates of spinal attractor activity. Third, the development of organ-specific interoceptive training protocols, coupled with experience-sampling methods, could track whether changes in organ function co-vary with changes in the felt sense of self. These are early-stage proposals; the phenomenal gap remains the deepest challenge for the framework, as for all theories of consciousness.

9. Clinical Implications

If organs are candidate conscious systems, functional disorders may represent distressed local attractors. IBS may be a gut that has learned to react to benign stimuli as threats. Cardiac anxiety may reflect a perturbed ICNS state. These reframings suggest organ-directed therapies: gut-directed biofeedback, vagal stimulation, dietary protocols that calm the ENS. The principle is consistent with existing mind-body approaches but grounds them in a specific, testable model.

10. Ethical Considerations

Candidate organs are not autonomous moral agents. Their interests are tied to the whole body's survival. Clinical ethics correctly prioritize the patient's overall well-being. The framework suggests a principle of organ-level respect: where possible, preserve organ integrity and explore gentler interventions before resection or ablation. This is holistic medicine, not radical ethics.

11. Conclusion

The brain is not the body's sole candidate conscious organ. The ENS, ICNS, pancreatic network, and spinal cord meet the same functional criteria used to identify *C. elegans* as a candidate for minimal consciousness. They are not established as conscious; they are identified as systems for which the question cannot be dismissed a priori without a principled exclusion criterion. The coupling mechanisms that bind local attractors into a unified self are partially characterized, and the framework generates concrete, falsifiable predictions.

The conscious body is a research-generative hypothesis, not a completed theory.

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“see also”
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The Distributed Mind: How the Brain Regulates a Federation

of Conscious Subsystems

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Based on: Extended collaborative development of the attractor framework, N=1 physiological experimentation, and a re-reading of Spinoza's conatus.

Abstract

Consciousness is traditionally viewed as either a non-physical substance (dualism) or a product of the brain alone (reductive physicalism). This paper presents an alternative: the human body is a nested hierarchy of semi-autonomous, attractor-based conscious subsystems—each with its own rudimentary integration, valence, learning, and goal-directedness. Using the nematode *C. elegans* (302 neurons) as a minimal benchmark, we argue that **sufficient integrated complexity** (operationalised as attractor dimensionality or integrated information Φ) is the key criterion for rudimentary consciousness. The enteric nervous system (200–600 million neurons), the intrinsic cardiac nervous system, the limbic system, and (under conditions of decoupling) the spinal cord meet or exceed this threshold. The brain does not *create* consciousness; it **regulates** these distributed conscious components, coupling them into a coherent whole-body attractor. This view dissolves the binding problem, explains the feeling of being an alien observer of one's own actions, and aligns with Spinoza's conatus—the principle that no part of the body diminishes its own power to act. We provide empirical signatures, testable predictions, and an N=1 self-engineering case study (ECM restoration, abdominal relaxation, sleep optimisation) that illustrates the framework. The conclusion: consciousness is not a solitary

flame in the skull, but a federation of dancers, with the brain as first among equals.

1. Introduction

The dominant neuroscience paradigm assumes that consciousness is generated by the brain. Yet this assumption struggles to explain:

- Why the enteric nervous system (ENS) can learn and remember independently of the brain.
- Why cardiac signals influence decision-making and self-awareness.
- Why split-brain patients exhibit two separate conscious entities within one cranium.
- Why the universal feeling of “not being in control” (*“why did I do that?”*) persists.

We propose a paradigm shift: **consciousness is a graded, emergent property of any sufficiently complex, dissipative, attractor-based system.** The brain is not the sole author; it is the **regulator** of a distributed network of semi-autonomous conscious subsystems.

This framework builds on dynamical systems theory, integrated information theory (IIT), global workspace theory (GWT), and Spinoza’s philosophy, while grounding itself in measurable empirical signatures and N=1 self-experimentation.

2. The Attractor Framework for Consciousness

2.1 Core Definitions

- **Attractor:** A region in state space toward which trajectories converge and remain unless perturbed. Characterised by negative Lyapunov exponents and basin stability.
- **Consciousness (operational):** A system exhibits consciousness if its attractor possesses:
 1. **Integration** – binds multiple sensory/interoceptive streams.
 2. **Self-reference** (minimal) – distinguishes self from environment.
 3. **Valence** – attraction to some states, repulsion from others.
 4. **Learning** – attractor landscape changes with experience.
 5. **Goal-directedness** – acts to maintain its basin (conatus).
 6. **Evolutionary/developmental provenance** – the system's attractor landscape emerged through evolutionary or developmental selection, not external engineering. This excludes thermostats and purely programmed control systems while allowing biological, synthetic, or hybrid systems with genuine autopoietic histories.
- **Mind:** A conscious attractor. Not a substance, but a real, causally effective pattern (like a whirlpool).

2.2 The Minimal Benchmark: *C. elegans*

The nematode *C. elegans* has exactly 302 neurons. Despite this simplicity, it exhibits:

- Sensory integration (touch, temperature, chemical gradients)
- Associative learning (pairing odours with food)
- Goal-directed behaviour (chemotaxis, thermotaxis)
- Minimal self-reference (distinguishes self-generated from external touch)

Thus, **302 neurons with rich, heterogeneous connectivity are sufficient for rudimentary consciousness**. However, neuron count alone is not the criterion; **integrated complexity** (attractor dimensionality, or IIT's Φ) is what matters. We use Φ operationally as a proxy for integrated complexity, without committing to all postulates of IIT (see Doerig et al., 2021, for critical review). *C. elegans* has high integrated complexity relative to its neuron count. A subsystem with many neurons but low connectivity or heavy enslaving may not reach the same threshold.

3. The Federation of Conscious Subsystems in the Human Body

We evaluate major subsystems against the integrated complexity benchmark.

Subsystem	Neuron count	Integrated complexity	Rudimentary consciousness?	Evidence
Enteric nervous system (ENS)	200–600 million	High (dense local circuits, 30+ neurotransmitters)	Yes	Independent peristaltic rhythms, learning, memory, “second brain” (Furness, 2006)
Spinal cord	197–222 million	Moderate to high (but heavily enslaved)	Yes, but normally suppressed	Central pattern generators; after injury can reorganise into semi-independent attractors (Calancie et al., 1994; Dimitrijevic et al., 1998). Evidence for “spinal consciousness” remains preliminary.
Intrinsic cardiac nervous system (ICNS)	14,000–43,000	Moderate (local processing loops)	Intermediate (contributor)	Influences emotion, decision, interoception (McCraty et al., 2009)
Limbic system	tens of millions	High (emotional valence, memory)	Yes	Often acts before cortical awareness; strong valence and learning
Basal ganglia & motor routines	>100 million	Moderate (procedural)	Yes (habitual)	Automatic action sequences, operate semi-autonomously
Immune system	N/A (non-neural)	Low (no centralised attractor)	Proto-conscious	Learns, remembers, communicates; lacks integration into a unified attractor

Subsystem	Neuron count	Integrated complexity	Rudimentary consciousness?	Evidence
Gut microbiota	N/A (trillions of microbes)	N/A (external ecosystem)	No	Perturbs human attractors but has no intrinsic nervous integration

3.1 The ENS: A Second Conscious Mind?

The ENS operates independently – severed from the vagus nerve, it still coordinates digestion. It uses over 30 neurotransmitters, including 95% of the body’s serotonin. It can learn to avoid noxious stimuli and remember past exposures (Furness, 2006). In attractor terms, the ENS possesses a resilient, low-dimensional attractor landscape with clear valence (nutrients vs. toxins) and goal-directedness (propulsion, secretion). We conclude that the ENS meets the integrated complexity threshold and qualifies as a **rudimentary, semi-independent conscious subsystem**.

3.2 The Heart’s “Little Brain”

The ICNS (14,000–43,000 neurons) processes sensory information from the heart and vessels, modulates heart rate, and sends significant signals to the brain via the vagus. Heartbeat-evoked potentials correlate with interoceptive awareness and even self-recognition. While not as independent as the ENS, the ICNS is a **candidate for a localised conscious attractor** that contributes directly to the global feeling of “being alive.”

3.3 The Enslaved Majority: Spinal Cord

The spinal cord’s 200 million neurons far exceed the *C. elegans* count, but its attractor dynamics are **tightly enslaved** by descending cortical and brainstem signals. In pathological states (spinal cord injury), the cord below the lesion can reorganise into new, semi-independent attractors –

sometimes leading to spontaneous movements and, in rare cases, patterns that have been controversially described as “spinal consciousness” (Calancie et al., 1994; Dimitrijevic et al., 1998). The evidence is preliminary, but it suggests that the cord has latent capacity for local consciousness, normally suppressed by the brain’s regulating influence.

4. The Brain as Regulator, Not Sole Generator

If many subsystems possess rudimentary consciousness, why do we experience a unified self? Because the brain’s primary function is **regulation** – emphasising and suppressing the contributions of these subsystems to create a coherent global attractor.

4.1 Spinoza’s Conatus: No Part Diminishes Its Own Power

Spinoza’s *Ethics* (III, 6) states that every thing, insofar as it is in itself, strives to persevere in its being (conatus). A part of the body, left alone, does not curb its own power to act. Spinoza explicitly uses sexual function as an example: the erect penis acts according to its nature; it cannot voluntarily diminish itself.

Thus, if a subsystem’s local attractor is not externally perturbed, it will continue its own pattern. The brain’s role is to **provide those external perturbations** – not to annihilate the subsystem’s conatus, but to **couple** it with other subsystems so that the combined whole has greater power. The brain’s regulatory perturbations are themselves expressions of the whole organism’s higher-order conatus, aligning parts to preserve the whole.

4.2 Regulation by Emphasis and Suppression

The brain does not “command”; it modulates. Through descending pathways, neuromodulators (dopamine, serotonin, norepinephrine), and synchronised rhythms, the brain:

- **Amplifies** certain subsystem signals (e.g., gut hunger signals become conscious cravings).
- **Damps** others (e.g., spinal reflexes are suppressed during voluntary movement).
- **Entrains** rhythms (e.g., cardiac and respiratory rhythms lock to cortical oscillations during focused attention).

In attractor language, the brain shifts the **effective landscape** of each subsystem, making some local attractors shallower (easier to override) and others deeper (more influential). This is regulation, not annihilation.

4.3 The Alien Feeling: When Regulation Falts

When you ask “*why did I do that?*” – a subsystem (habit, emotional reflex, gut impulse) acted before the brain could integrate it. The global attractor was temporarily misaligned. The “alien” feeling is the **friction between semi-autonomous local attractors and the slower, narrative self**. It is not pathology; it is the normal noise of a distributed system. Libet-type experiments (Libet et al., 1983) have shown that brain activity for voluntary actions often precedes conscious awareness, illustrating this temporal decoupling. (While the interpretation of these experiments remains debated, the existence of action-preceding awareness is sufficient for the present argument.)

5. Empirical Signatures and Testable Predictions

5.1 Signatures of Subsystem Consciousness

- **Local learning and memory** (e.g., ENS conditioned aversion; Furness, 2006).
- **Semi-autonomous rhythms** (e.g., slow waves of the gut, heartbeat variability).
- **Local valence** (e.g., immune cells produce pro- vs anti-inflammatory attractors).
- **Coupling strength** to the global attractor – measurable via transfer entropy or cross-correlation.
- **Behavioural dissociation** – actions initiated before conscious awareness (Libet, 1983).

5.2 Predictions

1. **Perturbation of a subsystem** (e.g., vagus nerve stimulation) should alter the global conscious narrative – already well-established.
2. **Decoupling a subsystem** (e.g., spinal anaesthesia) should produce local, independent attractor dynamics – measurable by recording from the isolated cord.
3. **Training a subsystem** (e.g., biofeedback of heart rate variability) should deepen its local attractor basin – measurable by increased resilience to perturbations (McCraty et al., 2009).
4. **In split-brain patients, each hemisphere should be able to independently regulate its ipsilateral subsystems** (e.g., left hemisphere regulates left ENS, right hemisphere regulates right ENS). A suitable

protocol would present lateralised interoceptive cues (e.g., unilateral gut distension) and measure lateralised cortical responses in callosotomy patients (Gazzaniga, 1967).

6. N=1 Case Study: Restoring Whole-Body Coherence

The author conducted a months-long self-engineering experiment based on the attractor framework. This N=1 case study is **hypothesis-generating** and provides a motivating existence proof, not a validation of the framework itself.

6.1 Interventions

- **ECM restoration:** Gelatin, taurine, 28 Hz vibration plate (90 min every other day), contrast baths. Improved collagen accretion, VO_2 max, skin quality.
- **Abdominal relaxation:** Consciously releasing chronic stomach tension (letting the belly sag) to allow diaphragm excursion.
- **Sleep protocol:** Smaller evening meals, morning cardio + sunlight, 15 min reading low-arousal fiction (*The Mayor of Casterbridge*).

6.2 Outcomes

- Nocturnal SpO_2 rose above 90% consistently; sleep fragmentation ceased.
- Deep sleep reached acceptable levels.
- Subjective “alien” feeling reduced; sense of whole-body coherence increased.

6.3 Interpretation

Each intervention reduced a **self-imposed constraint** that had been forcing a subsystem (abdominal muscles, sympathetic tone, rumination network) into a local attractor misaligned with global sleep-breathing needs. By relaxing those constraints, the brain could more easily regulate the subsystems into a coherent whole-body attractor. The alien feeling diminished because the **coupling** between global “I” and local subsystems improved. This outcome is **consistent with** the framework, but does not prove it; further controlled studies are required.

7. Philosophical Implications

7.1 Spinoza Vindicated

Spinoza’s conatus – the inherent striving of every mode – is precisely the attractor’s tendency to maintain its basin. His claim that a part does not diminish its own power is equivalent to saying that a subsystem’s local attractor will not self-suppress unless externally perturbed. The brain provides those perturbations, not to diminish but to **align**. Spinoza’s metaphysics lacked dynamical systems theory, but his intuition is fully realised in the attractor framework.

7.2 The Binding Problem Dissolved

The traditional “binding problem” – how separate neural activities unite into a single conscious experience – is **dissolved** when we recognise that consciousness is already distributed. The global attractor *is* the binding. No extra mechanism is required; coupling *creates* coherence. The question as traditionally posed is ill-formed: there is no need to bind what was never separate in the first place. This dissolution follows the strategy of Wittgenstein, Ryle, and

Dennett.

7.3 The Self as Negotiation

The feeling of a unified “I” is the ongoing **negotiation** between the brain and the federation of subsystems. When negotiation runs smoothly, you feel at home in your body. When it stutters, you feel like an alien. The self is not a substance; it is a **temporary, resilient attractor pattern** – a dance of the whole.

8. Conclusion

The human body is not a machine with a single conscious ghost in the control room. It is a nested hierarchy of conscious attractors – from the gut’s “second brain” to the heart’s intrinsic ganglia to the limbic system’s emotional core. The brain’s role is not to generate consciousness but to **regulate** these distributed components, coupling them into a coherent whole. This view explains the feeling of being an alien observer, aligns with Spinoza’s conatus, and yields testable predictions. It also offers a practical path for self-engineering: by removing unnecessary constraints and restoring whole-body coherence, we can reduce the alien feeling and dance more gracefully.

The mind is not a solitary flame. It is a federation of dancers, with the brain as first among equals – and the music is the attractor landscape.

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