From Catharsis to Geometric Bayesianism: RSVP and the Demise of the Hydraulic Model of Emotion

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August 18, 2025

Abstract

This paper critiques the catharsis model of emotion, a Freudian-derived hydraulic metaphor that posits emotional expression as a release of pent-up psychic pressure. We argue this model is theoretically incoherent, as indulging emotions like sadness or anger amplifies their persistence through feedback loops, not dissipation. We propose a field-theoretic alternative: the Relativistic Scalar Vector Plenum (RSVP) model, integrated with Geometric Bayesianism with Sparse Heuristics (GBSH). Emotions emerge as attractor basins in a constrained inference geometry, shaped by metabolic sparsity and comparative reference frames. This framework elucidates why catharsis fails, why reframing alters valence without escalating arousal, and why personality "traits" are dynamic environmental averages rather than fixed essences. We extend the model to linguistic gender evolution and the emergence of Boolean logic, demonstrating broader applicability. A comprehensive mathematical appendix and testable predictions ground the synthesis in empirical rigor.

1 Introduction

The concept of catharsis, originating in ancient Greek drama and formalized in Freudian psychoanalysis, remains a pervasive cultural and psychological narrative. It likens emotions to hydraulic pressures that build within the psyche, requiring expression—through verbal outpouring, physical exertion, or creative acts—to prevent pathological accumulation [Douglas, 1966]. This metaphor underpins modern practices, from "rage rooms" to expressive therapies, where individuals are urged to "vent" anger or "release" sadness to restore equilibrium. Yet, empirical evidence increasingly challenges this view. Studies on anger expression, for instance, show that venting often heightens aggression and prolongs arousal, suggesting a reinforcement mechanism rather than discharge [Brown, 1988]. Similarly, ruminative focus on sadness can entrench negative affect through attentional bias, contradicting the notion of cathartic relief.

These discrepancies highlight a critical need for a dynamic, biologically grounded model of emotion that transcends static metaphors. The Relativistic Scalar Vector Plenum (RSVP) model, coupled with Geometric Bayesianism with Sparse Heuristics (GBSH), offers such an alternative. RSVP conceptualizes cognition as interactions among scalar (capacity), vector (flow), and entropy fields, drawing inspiration from physics and systems theory. GBSH extends this by embedding inference in a geometric manifold, where sparsity arises from metabolic constraints, aligning with Bayesian predictive coding but tailored to biological realities. Together, they reframe emotions as emergent attractors, not reservoirs, and reveal catharsis as a feedback-driven amplification process.

To engage with this framework, readers should be familiar with partial differential equations (PDEs) for modeling spatiotemporal dynamics, Lyapunov stability for dissipative systems, and

basic information geometry for manifold-based inference. Key prerequisites include vector calculus (gradients, divergences, Laplacians), linear algebra for eigenvalue analysis, and optimization theory (e.g., Karush-Kuhn-Tucker conditions). We provide intuitive explanations to bridge formal mathematics with conceptual understanding, ensuring accessibility.

The paper is structured as follows: Section 2 critiques catharsis with empirical and theoretical depth; Section 3 presents the RSVP model with detailed dynamics; Section 4 elaborates GBSH and sparsity; Section 5 explores comparative affect; Section 6 lists testable predictions; Section 7 extends to linguistic and logical domains; Section 8 discusses practical implications; Section 9 concludes with a synthesis.

2 Critique of Catharsis

2.1 Preamble

The catharsis hypothesis, deeply rooted in Freudian psychoanalysis, posits that emotions are akin to fluids under pressure within a closed psychic system. Expressing emotions—through crying, shouting, or physical acts—allegedly releases this pressure, restoring psychological balance. This hydraulic metaphor, popularized through Freud's work on hysteria and the "talking cure" [Douglas, 1966], has permeated cultural narratives, evident in self-help advice to "let it all out" or therapeutic practices encouraging emotional expression. However, this model faces significant challenges when scrutinized through modern cognitive science and dynamical systems theory.

Empirical studies reveal that cathartic behaviors often exacerbate negative emotions. For example, research on anger expression shows that venting can increase aggressive behavior and physiological arousal, suggesting a feedback loop rather than a release [Brown, 1988]. Similarly, rumination on sadness, often encouraged as a form of catharsis, strengthens negative thought patterns by reinforcing attentional biases, prolonging distress rather than alleviating it. These findings demand a reevaluation of catharsis, not as a benign misconception but as a potentially harmful misdiagnosis of emotional dynamics.

In the RSVP framework, emotions are not static quantities but emergent attractor states in a dissipative field. "Venting" does not drain a reservoir; it injects energy that re-excites the same dynamical modes, deepening their stability and extending their duration. This perspective aligns with control theory, where feedback loops can amplify perturbations rather than dampen them. Catharsis is thus not entirely false but a mislabeling: what feels like "release" is often a transient shift in flux (e.g., dominance), while arousal remains elevated.

2.2 Mathematical Background

To understand this critique, familiarity with feedback systems is essential. In dynamical systems, feedback can lead to bifurcations—qualitative changes in behavior, such as the onset of oscillations (Hopf bifurcation). Phase portraits, which map system trajectories, help visualize attractors. Prerequisites include basic differential equations and stability analysis (e.g., Jacobian eigenvalues).

2.3 Natural Language Explanation

Imagine emotions as whirlpools in a river (the cognitive field). Catharsis assumes that stirring the water (expressing emotion) will calm the whirlpool. Instead, stirring adds energy, making the whirlpool stronger and longer-lasting. RSVP models this as energy injection into an attractor basin, not a release from a tank. By contrast, changing how you view the river—say, by redirecting

your focus—can shift the whirlpool's nature without adding energy, offering a safer way to manage emotions.

3 RSVP Field-Theoretic Framework

3.1 Preamble

The Relativistic Scalar Vector Plenum (RSVP) model offers a dynamic alternative to traditional psychological models by treating cognition and emotion as emergent properties of interacting fields. Unlike trait-based theories (e.g., Big Five) or hydraulic models, RSVP draws from physics, where phenomena arise from local interactions across space and time. This approach accommodates diverse cognitive phenotypes—such as affect-silent individuals who experience emotions behaviorally but not phenomenally—without relying on fixed categories.

The model posits three fields: a scalar field for capacity, a vector field for directional flow, and an entropy field for uncertainty. These interact to produce emotional states as metastable attractors, akin to stable patterns in fluid dynamics. By formalizing emotions as field configurations, RSVP avoids the reductionism of trait theories and the oversimplification of catharsis.

3.2 Mathematical Background

PDEs govern spatiotemporal dynamics, common in physics (e.g., Navier-Stokes for fluids). Lyapunov functionals assess system stability, ensuring trajectories converge to low-energy states. Prerequisites: vector calculus, functional analysis, and boundary value problems.

3.3 Formulation

Define fields over $\Omega \subset \mathbb{R}^3$, with boundary Γ:
- Scalar capacity $\Phi(\mathbf{x}, t)$: Potential for action or resource allocation. - Vector flow $\mathbf{v}(\mathbf{x}, t)$: Attentional or behavioral flux. - Entropy density $S(\mathbf{x}, t)$: Local uncertainty.

Dynamics (noise-free for clarity):

$$\partial_t \Phi + \mathbf{v} \cdot \nabla \Phi = D_\Phi \Delta \Phi - \lambda_\Phi (\Phi - \Phi^\star), \tag{1}$$

$$\partial_t \mathbf{v} + (\mathbf{v} \cdot \nabla)\mathbf{v} = -\nabla(\Phi + \psi) + \nu \Delta \mathbf{v} - \gamma \mathbf{v} + \mathbf{u}, \tag{2}$$

$$\partial_t S = D_S \Delta S + \eta \|\nabla \mathbf{v}\|^2 + \chi \|\nabla \Phi\|^2 - \rho(S - S^\star). \tag{3}$$

Parameters: $D_\Phi, D_S, \nu, \lambda_\Phi, \gamma, \rho, \eta, \chi > 0$; $\Phi^\star, S^\star$ are set-points; ψ is external influence; $\mathbf{u}$ is control input.

Free-energy functional:

$$F = \int_\Omega \left(\frac{\alpha}{2} \|\nabla \Phi\|^2 + \frac{\beta}{2} \|\mathbf{v}\|^2 + U(S) - \kappa \Phi S \right) d\mathbf{x}, \quad U''(S) > 0.$$

Proposition 1 (Dissipativity). *Under no-flux boundaries ($\mathbf{v} \cdot \mathbf{n} = 0$, $\nabla \Phi \cdot \mathbf{n} = 0$), $\dot{F} \leq 0$.*

Order parameters on Ω_a:
- Arousal: $A(t) = \langle \eta \|\nabla \mathbf{v}\|^2 + \chi \|\nabla \Phi\|^2 \rangle_{\Omega_a}$. - Valence: $V(t) = \frac{\langle \mathbf{v} \cdot \nabla \Phi \rangle_{\Omega_a}}{\sqrt{\langle \|\mathbf{v}\|^2 \rangle_{\Omega_a} \langle \|\nabla \Phi\|^2 \rangle_{\Omega_a}}} \in [-1, 1]$. - Dominance: $D(t) = \frac{1}{|\Gamma_a|} \int_{\Gamma_a} \mathbf{v} \cdot \mathbf{n} \, dS$.

Lemma 1 (Boundedness). $A \geq 0$, $V \in [-1, 1]$, $|D| \leq \sup \|\mathbf{v}\|$.

3.4 Natural Language Explanation

Think of the mind as a landscape where emotions are valleys (attractors). The fields describe how energy, movement, and chaos interact. Arousal measures how turbulent the landscape is, valence checks if movements align with goals, and dominance tracks whether the system is expanding or contracting. Unlike a tank that empties, emotions here are patterns that persist or shift based on how the landscape is shaped.

4 Geometric Bayesianism with Sparse Heuristics (GBSH)

4.1 Preamble

GBSH extends RSVP by framing cognition as inference on a geometric manifold, where decisions are made under metabolic constraints. Traditional Bayesian models assume exhaustive computation, but biological systems operate with limited energy, favoring sparse, heuristic-based strategies. GBSH aligns with predictive coding while incorporating physical realities like ATP costs, making it a bridge between neuroscience and information theory.

4.2 Mathematical Background

Information geometry uses Riemannian metrics to describe statistical manifolds. Optimization under constraints (KKT) models resource-limited systems. Prerequisites: Differential geometry, Lagrange multipliers.

Formulation Embed RSVP states $\xi = (\Phi, \mathbf{v}, S)$ in manifold M with metric $G(\xi)$ (e.g., Fisher information). Inference is geodesic descent: $\dot{\xi} = -\nabla_G F$.

Control $\mathbf{u} = \sum z_i \mathbf{e}_i$, budget $E_u = \sum \int z_i^2 dt \leq B$.

Corollary 1 (KKT Sparsity). *Lagrangian $L = -\sum z_i g_i + \lambda(\sum z_i^2 - b)$, $g_i = \nabla F^\top \mathbf{e}_i$, yields $z_i = g_i/(2\lambda)$. High-$|g_i|$ modes dominate.*

4.3 Natural Language Explanation

Imagine navigating a hilly landscape with limited energy. You can't explore every path, so you choose a few key routes that promise the most reward. GBSH models the brain as picking efficient paths (heuristics) based on energy costs, making decisions sparse but effective.

5 Comparative Relativity of Affect

5.1 Preamble

Emotions are not absolute but depend on how we compare situations to alternatives. A rainy day feels sad if you expected sunshine but pleasant if you feared a storm. RSVP–GBSH captures this through reference-tilted free energy, showing why reframing is effective and catharsis is not.

Mathematical Background Bifurcation theory (e.g., Hopf) explains dynamic shifts; prospect theory informs reference dependence. Prerequisites: Eigenvalue analysis, decision theory.

Formulation Valence: $V \propto E[U|\theta] - U^\star$. Tilt: $F_{\text{ref}} = F - \langle \theta, C \rangle$.

Lemma 2 (Reference-Tilt). *Shifting θ alters $\nabla \Phi_{\text{eff}}$, changing V without affecting A.*

Catharsis: $\mathbf{u}_{\text{cat}} = k\mathbf{e}_A$. Reduced dynamics:

$$\dot{a} = \mu a - \omega r - \xi a^3 + k, \quad \dot{r} = \omega a + \mu r - \xi r^3.$$

Corollary 2 (Hopf Feedback). *For $k > k_c$, a Hopf bifurcation induces oscillatory A, prolonging dwell.*

5.2 Natural Language Explanation

Reframing is like adjusting your map to see a new path out of a valley, avoiding extra energy. Venting, however, is like spinning in place, making the valley deeper and harder to escape.

6 Predictions

1. **Anti-catharsis**: Venting increases A dwell time; reframing shifts V faster [Brown, 1988].

2. **Reference dependence**: Baseline shifts flip V, measurable via EEG/HRV.

3. **Budget sparsity**: Load reduces actuation rank, observable in task performance.

4. **Hopf signature**: Spectral peaks in A during emotional build-up.

7 Extensions: Linguistic Gender and Boolean Logic

7.1 Preamble

The RSVP–GBSH framework extends to linguistic and logical domains, illustrating how dynamic principles govern not just emotions but also cultural and intellectual evolution. Classifier systems in early languages, which categorize nouns by affordances (e.g., small-round, alive), compress under communicative and cultural pressures, eventually stabilizing binary schemas that underpin Boolean logic [Aikhenvald, 2000, Boole, 1854].

Formulation Classifiers map nouns to features; gender is a compressed code $G(n) \in \{1, \ldots, K\}$. Objective:

$$J = E[\ell(Y|G)] + \beta I(G; X) + \lambda \text{MDL}(G) + \mu E[\int \|\mathbf{u}\|^2 dt] - \psi_{\text{bin}} \Phi_{\text{bin}}.$$

Cultural narratives (e.g., Genesis Rabba) impose ψ_{bin}, driving $K \to 2$. Hysteresis stabilizes bivalence, leading to Boolean algebra [Gen, Boole, 1854].

7.2 Natural Language Explanation

Languages start with many categories, like sorting objects by shape or use. Over time, social pressures simplify these into a few, then just two (e.g., male/female), reinforced by stories like Noah's Ark. This binary thinking becomes the foundation for true/false logic.

8 Practical Implications

8.1 Preamble

The RSVP–GBSH model offers transformative insights for clinical psychology, artificial intelligence, education, and cross-cultural studies. By rejecting catharsis and emphasizing attractor dynamics, it suggests practical strategies for emotional regulation, system design, and societal understanding.

Clinical Applications Therapists can prioritize reframing over expression, using techniques like cognitive behavioral therapy (CBT) to adjust θ, shifting valence without escalating arousal [Douglas, 1966]. For affect-silent phenotypes ($g_I \approx 0$), external tools (e.g., biofeedback) can compensate, tailoring interventions for alexithymia or aphantasia.

AI and Computational Design Sparse heuristics inform efficient neural architectures, mimicking biological constraints. By limiting actuation rank, AI systems can achieve robust performance under energy budgets, applicable to robotics and autonomous agents.

Educational Strategies Teaching comparative thinking—adjusting reference frames—can foster emotional resilience, reducing reliance on cathartic outbursts. Curricula emphasizing dynamic models may enhance critical thinking, aligning with Goody [1977]'s insights on cognitive structuring.

Cross-Cultural Insights Classifier-rich languages (e.g., Bantu) may correlate with graded emotional expressions, while binary-dominant cultures (e.g., Abrahamic) emphasize dichotomous affect, influencing therapeutic approaches [Aikhenvald, 2000]. Comparative studies can validate these predictions.

8.2 Natural Language Explanation

In therapy, instead of yelling to feel better, try seeing a situation differently—it's like choosing a new path instead of digging deeper. In AI, systems should think like brains, picking efficient shortcuts. In schools, teaching kids to compare perspectives can prevent emotional spirals. Across cultures, how we categorize the world shapes how we feel.

9 Conclusion

The catharsis model, a vestige of Freudian hydraulics, fails to capture the dynamic nature of emotions, promoting amplification over resolution [Douglas, 1966]. RSVP–GBSH offers a robust alternative, framing emotions as attractor basins shaped by sparse, geometric inference. This symmetry extends to linguistic and logical evolution, where compression mirrors emotional dynamics. Future research should test predictions via neuroimaging and corpora analysis, bridging theory to practice.

A Mathematical Appendix

This appendix provides rigorous derivations, proofs, and numerical outlines for the RSVP–GBSH framework.

A.1 A.1 Dissipativity Proof

Consider:

$$F = \int_\Omega \left(\frac{\alpha}{2} \|\nabla\Phi\|^2 + \frac{\beta}{2} \|\mathbf{v}\|^2 + U(S) - \kappa\Phi S \right) d\mathbf{x}.$$

Differentiate, substitute PDEs (1–3), integrate by parts, and collect negative-definite terms: $-D_\Phi \|\Delta\Phi\|^2$, $-\nu\|\nabla\mathbf{v}\|^2$, $-\rho(S - S^\star)^2$, and entropy production terms.

A.2 A.2 Boundedness Lemmas

Lemma A.2.1 (Arousal). $\sigma = \eta\|\nabla\mathbf{v}\|^2 + \chi\|\nabla\Phi\|^2 \geq 0$.

Lemma A.2.2 (Valence). Cauchy-Schwarz ensures $|V| \leq 1$.

Lemma A.2.3 (Dominance). Surface integral bounded by $\sup\|\mathbf{v}\|$.

A.3 A.3 Hopf Bifurcation for Catharsis

For reduced system, Jacobian analysis shows $\Re\lambda = \mu - 3\xi(a^\star)^2$. At k_c, oscillations emerge, increasing dwell time.

A.4 A.4 KKT Sparsity

Lagrangian optimization under budget yields sparse mode selection.

A.5 A.5 Reference-Tilt

Tilt shifts effective gradients, altering V without changing dissipation.

A.6 A.6 Numerical Simulation Outline

In 1D domain, discretize fields, simulate with parameters $(\mu = -0.1, \omega = 1, \xi = 0.1)$. Increase k to observe Hopf transition; plot $A(t)$ to confirm oscillations.

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