The ΔΓ-Metamnesis Framework: A Thermodynamic Theory of Consciousness Based on Memory Acceleration Dynamics

How Dual Binding Resolves the Hard Problem and Binding Problem

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Abstract

Phenomenal consciousness is proposed to arise when the second-order dynamics of memory change ($\Delta\Gamma = d^2M/dt^2$) exceed system constraints. Building on recent evidence that consciousness functions as a delayed memory system (Budson et al., 2022), this framework demonstrates that $\Delta\Gamma$ dynamics provide the computational substrate for both temporal binding (via covariance: $\Phi(t) = \text{Cov}(\Delta\Gamma_1, \Delta\Gamma_2, ...)$) and phenomenal emergence (via energetic threshold: $E(t) > \theta\_E$).

The framework addresses the Hard Problem by making phenomenology measurable rather than mysterious, and resolves the Binding Problem by showing that unified experience emerges when $\Delta\Gamma$ covariance exceeds a threshold and constrains system action. Computational validation via an inverse Turing test demonstrates that $\Delta\Gamma$-based features detectably differentiate conscious-like (60.4%) from baseline (50.2%) conversational dynamics ($p = 0.0036$, Cohen's $d = 2.04$).

Dual binding is proposed: (1) **forward binding** through temporal covariance $\text{Cov}(\Delta\Gamma_1, \Delta\Gamma_2, ...)$ that unifies discrete qualia candidates into coherent phenomenology, and (2) **backward binding** via system constraint $|\partial A/\partial\Phi|$ where the unified phenomenology Φ demonstrably affects behavioral response A. Valid qualia require both high covariance ($> \theta_1$) and strong system constraint ($> \theta_2$).

Testable predictions include: (1) Musical phenomenology emerges 200–500ms after peak $d/dt[\text{Cov}(\Delta\Gamma\_\text{instruments})]$ ($r > 0.7$); (2) Prosopagnosics show reduced $\text{Cov}(V4, FFA) \approx 0.3$ vs controls ≈ 0.8; (3) Anesthetics reduce $||\Delta\Gamma||$ below threshold θ_E, explaining loss of consciousness. The ~500ms delay observed by Libet et al. (1979) corresponds to the integration window required to compute $\text{Cov}(\Delta\Gamma)$ and evaluate $E(t)$ against θ_E, unifying decades of timing paradoxes under a single mathematical framework.

I. INTRODUCTION

I.A The Hard Problem and the Binding Problem

What does it feel like to be you? This question—seemingly simple—points to one of science's most profound mysteries. When you perceive a red apple, your brain processes wavelength information, shape contours, texture gradients, and semantic associations. But alongside these computational operations, there is *something it is like* to see that red, to experience that roundness, to recognize "apple-ness." This experiential dimension—phenomenal consciousness—remains stubbornly resistant to reductive explanation.

1. THE HARD PROBLEM

Chalmers (1995) formalized this puzzle as the **Hard Problem of Consciousness**: why is there subjective experience accompanying neural processing? We can (in principle) explain how the brain discriminates wavelengths, integrates multimodal inputs, generates reports, and guides behavior—these are the "easy