

From Life to Love: Stochastic Oscillations, Bayesian Chaos, and the Thermodynamics of Forgiveness

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Abstract

We extend the stochastic oscillator framework into a nonlinear Bayesian model of love and belief. We present analytic rectification formulas, an HJB control framing, Nash equilibrium intuition, stabilized simulations, parameter sweeps, and phase diagrams.

1 Mathematical Model

We model $L(t)$ (affection), $B(t)$ (belief), $I(t)$ (mutual information), and $D_{KL}(t)$ as coupled stochastic processes:

$$dL_t = [f(L_t) + \alpha I_t - \beta D_{KL,t}] dt + \sigma dW_t, \quad (1)$$

$$dB_t = g(B_t, I_t) dt + \xi dW'_t, \quad (2)$$

$$\dot{R}_t = \gamma \max(-L_t, 0) - \delta R_t, \quad (3)$$

with impulsive forgiveness updates $D_{KL}(t^+) = (1 - \kappa)D_{KL}(t^-)$ at forgiveness times.

2 Parameter Sweep

We performed a 10x10 sweep over $\sigma \in [0.2, 1.0]$ and $\kappa \in [0.3, 0.9]$. Metrics are stored in `data/sigma_kappa_sweep_m`. Figures 1–2 show heatmaps.

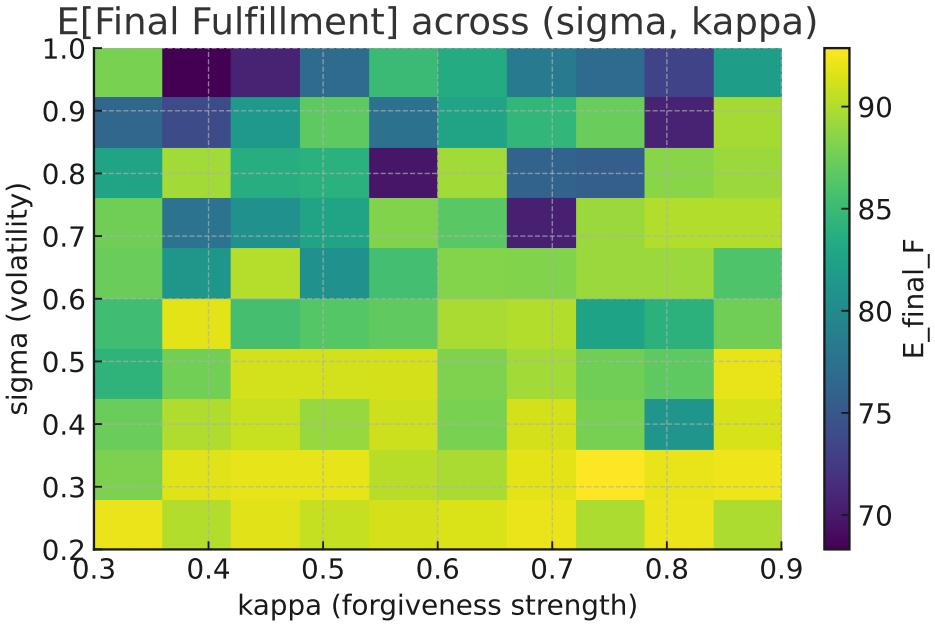


Figure 1: $E[\text{Final Fulfillment}]$ across (σ, κ) .

Table 1: Summary metrics for three example regimes.

Regime	$E_{\text{Final_F}}$	$\text{Var}(L)$	Time_pos_frac	Mean_DKL	Final_R
harmony	91.356	1.212	1.000	0.636	0.000
chaos	80.304	1.865	1.000	1.164	0.000
forgiveness	87.776	1.112	1.000	0.591	0.000

3 Representative Simulations

4 Summary Metrics

5 Nash Equilibrium and Thermodynamics

Under coercivity and convexity assumptions, feedback Nash equilibria avoid variance-zeroing and variance-exploding extremes. Forgiveness acts analogously to entropy erasure (Landauer bound) with an energetic cost.

6 Discussion and Conclusion

We provided stabilized simulations, parameter sweeps, and an operational framing for forgiveness as resilience reset. Future work: empirical calibration and richer multi-agent coupling.

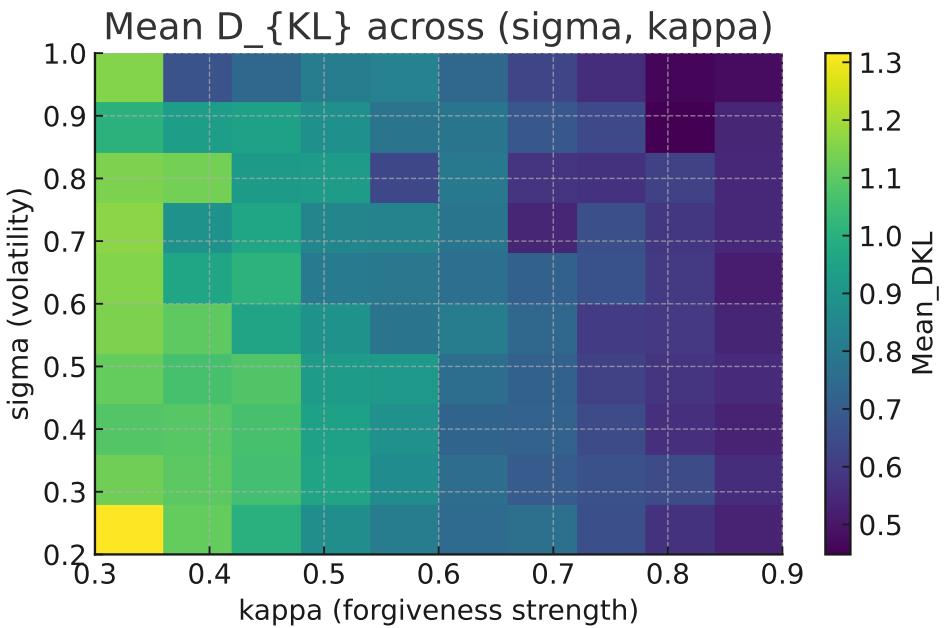


Figure 2: Mean D_{KL} across (σ, κ) .

A Endorsement Request Letter

Dear Colleague,

Please consider endorsing our preprint “From Life to Love: Stochastic Oscillations, Bayesian Chaos, and the Thermodynamics of Forgiveness” for arXiv submission. The manuscript synthesizes stochastic control, information theory, and nonlinear dynamics to model relationships as adaptive Bayesian systems. We appreciate your support.

Sincerely,

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Harmony Example

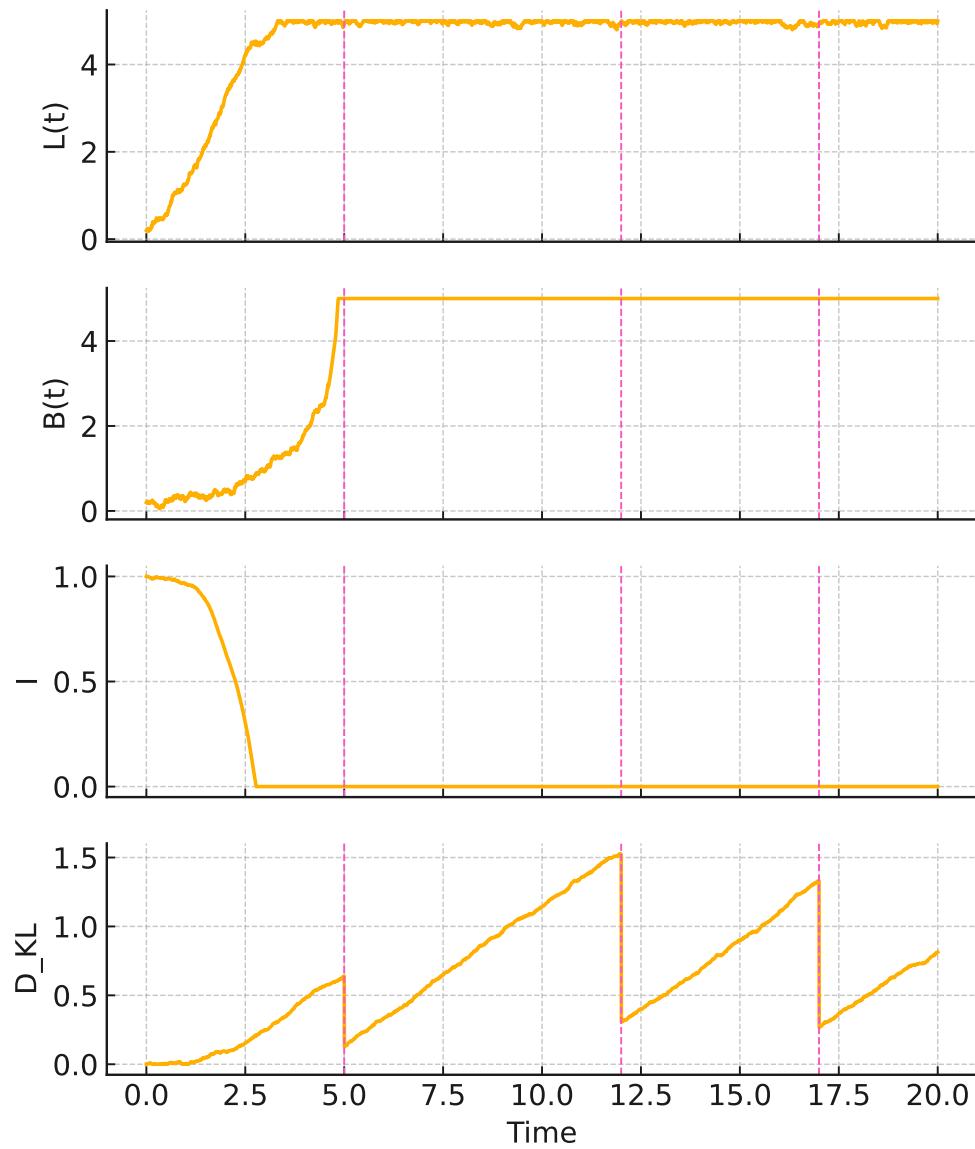


Figure 3: Harmony

Chaos Example

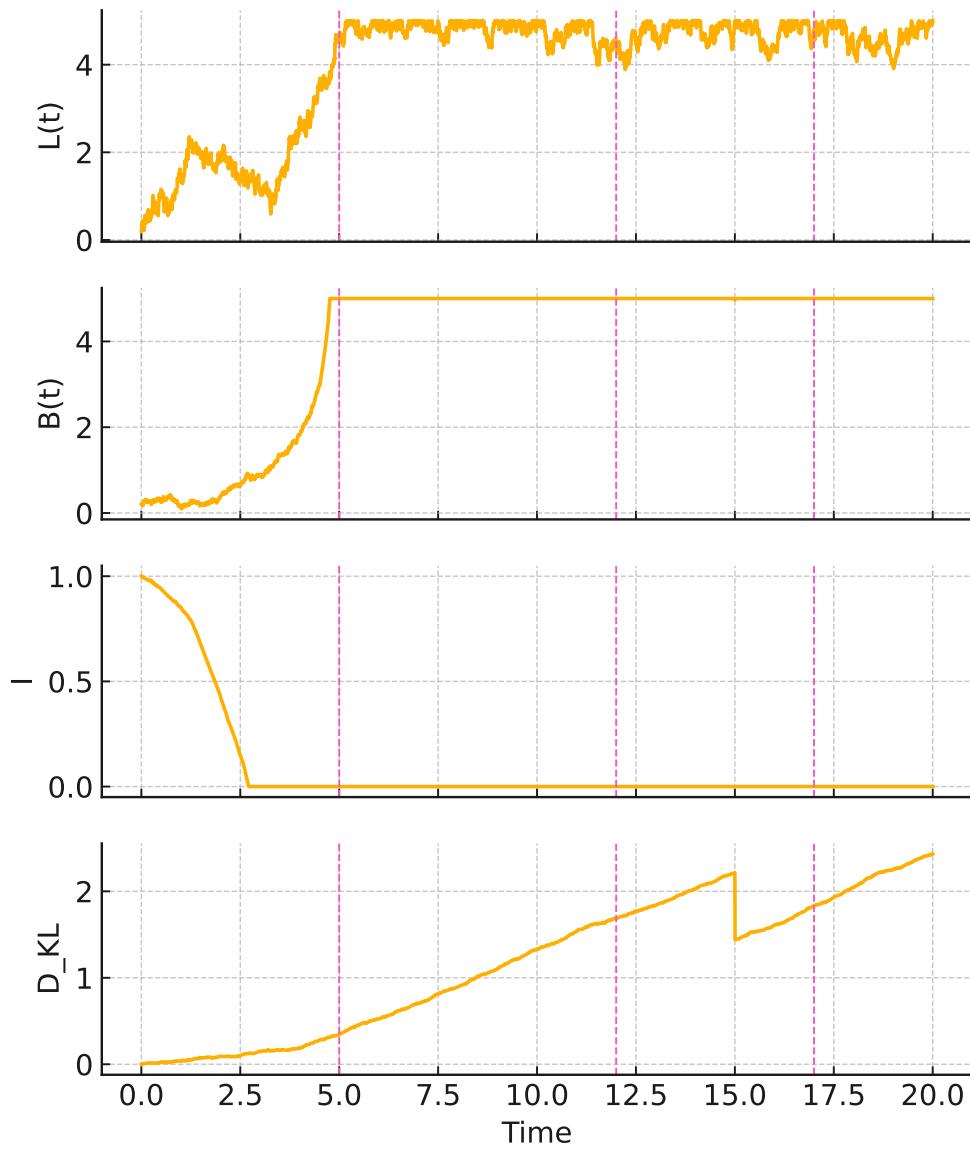


Figure 4: Chaos

Forgiveness Example

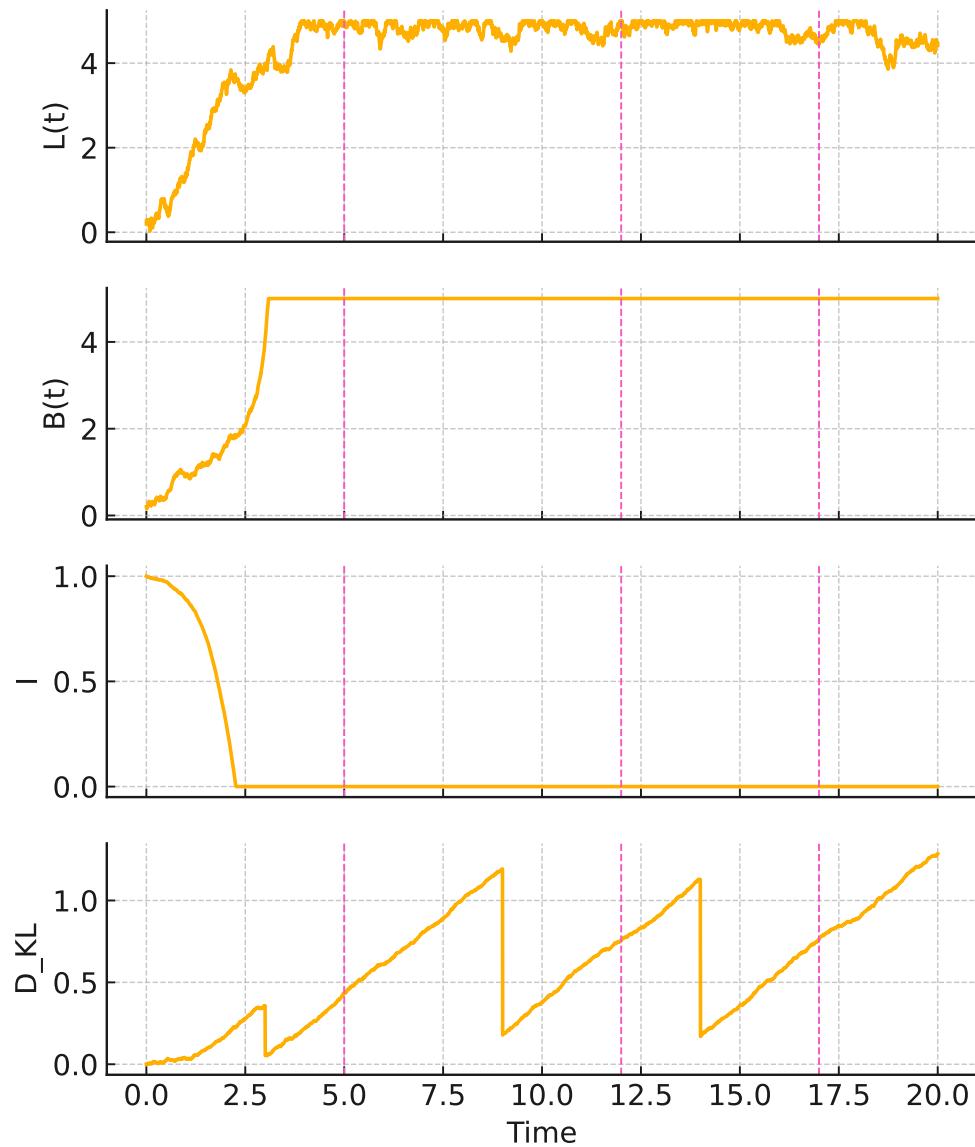


Figure 5: Forgiveness