From Weak Signals to Structural Curvature: An Intent-Based Diagnostic Framework for Persistent Drift in Policy and Organizations

Code+Philosophy
The Intent Economy™

Abstract

Institutions do not merely respond to interventions; they record them. Building on the dynamical framework introduced in *Intent Memory in Complex Adaptive Institutions*, institutional systems can be modeled as state vectors subject to directional perturbation (intent), friction topology, adaptive propagation, and residual displacement (memory). This paper operationalizes that framework into an applied diagnostic method for governance and organizational design.

We present a repeatable workflow for identifying how intent propagates through friction, how weak signals accumulate into thresholds, how bulk behavior compresses into boundary structures, and how irreversibility emerges as reversion cost. The contribution is not a physics-to-society transfer, but an applied discipline of persistence modeling: measure intent, map friction topology, model action propagation, detect behavioral residue, identify boundary encoding, and estimate the memory displacement that will remain after the stimulus dissipates. The central question is not what happens immediately, but what persists.

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1 The Problem of Persistent Drift

Most policy and organizational interventions are planned as if reversibility is cheap: issue the directive, deploy the program, observe behavior change, end the stimulus, and return to baseline. In practice, institutions frequently fail to return to baseline. Trust baselines shift, norms entrench, incentives harden, and procedures evolve. The system remains permanently displaced even after the initial intervention ends.

Using the canonical model, let the institutional system be represented by a state vector:

$$S(t) \in \mathbb{R}^n$$

If the post-stabilization state differs from baseline, the institution has recorded the event as memory.

Figure 1. Residual institutional displacement (concept)

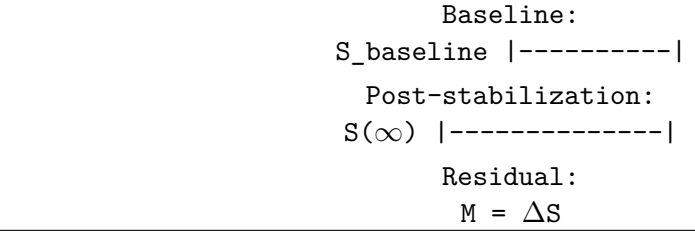


Figure 1: Persistent drift appears as residual displacement from baseline equilibrium.

2 Canonical Model (Applied Form)

Institutional dynamics evolve according to:

$$\frac{dS}{dt} = I(t) - \Gamma(S,t)\,S + \Phi(S,t)$$

where $I(t)$ is intent (directional perturbation), Γ is friction topology (constraint geometry), and Φ captures adaptive response, strategic behavior, and nonlinear feedback.

Boundary encoding is modeled as a compression of bulk history into institutional surfaces:

$$B(t) = \mathcal{C}[S(0:t)]$$

and boundary conditions feed back into bulk evolution:

$$\frac{dS}{dt} = F(S,B)$$

Memory is defined as:

$$M = S(\infty) - S_{baseline}$$

Reversal cost is proportional to memory magnitude:

$$E_{reversal} \propto \|M\| + \kappa$$

3 The Diagnostic Goal

This paper addresses a single operational question:

How do we estimate M before we create it?

Equivalently: *what will remain after this is over?*

4 Diagnostic Workflow Overview

The method is a repeatable loop:

1. Define boundary layer
2. Encode intent vector
3. Map friction topology
4. Model propagation channels
5. Detect weak-signal accumulation
6. Project residual displacement M
7. Estimate reversal cost $E_{reversal}$
8. Redesign the intervention if needed

Figure 2. Applied institutional memory diagnostic loop (concept)

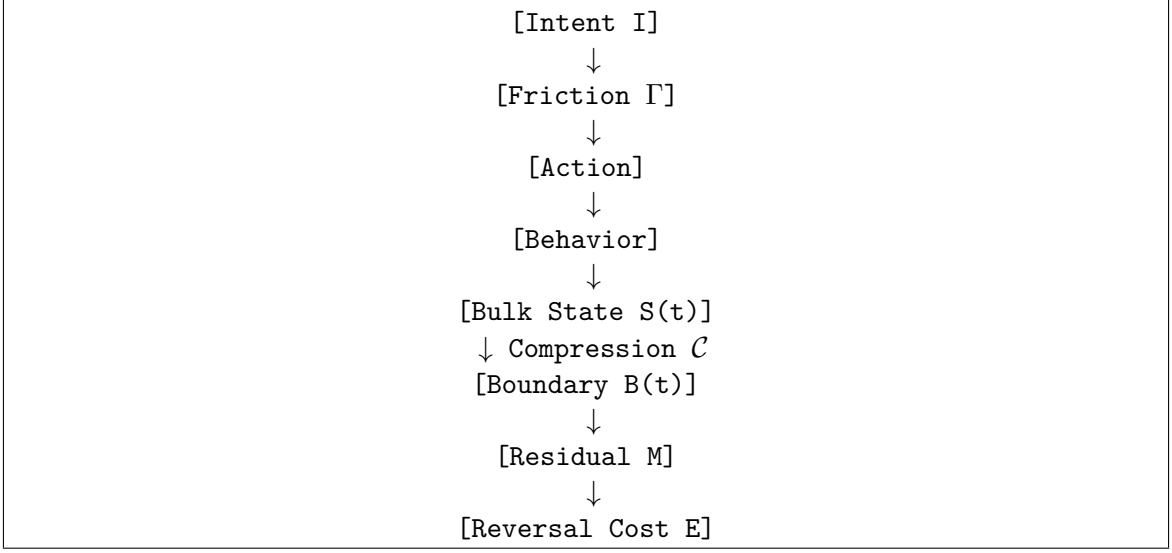


Figure 2: End-to-end diagnostic workflow for forecasting institutional memory and drift.

5 Step 1 — Define the Boundary Layer

Before measuring drift, define what counts as the "surface" of the system: the structures that encode history and constrain future action. We represent boundary structure as $B(t)$. Boundary variables commonly include law and regulation, enforcement patterns (what is actually punished or ignored), standard operating procedures, market rules and access constraints, and narratives that function as legitimacy priors. The point of this step is identifying where memory gets stored.

Figure 3. Bulk–boundary compression and feedback (concept)

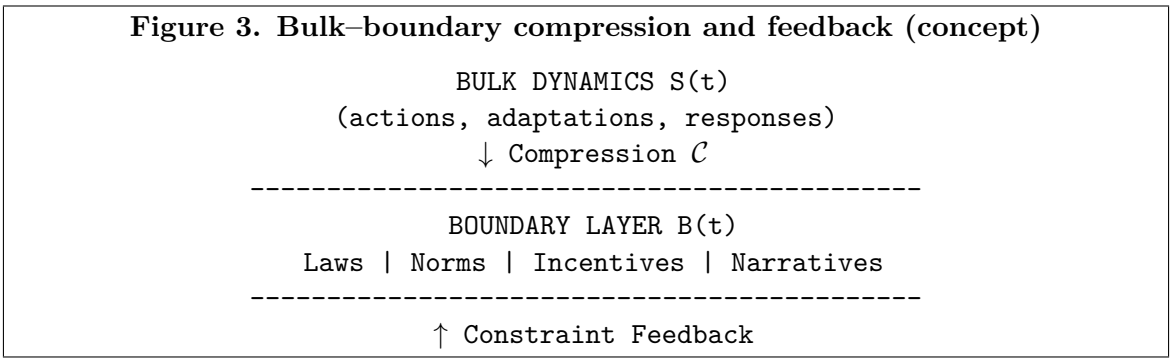


Figure 3: Bulk dynamics compress into boundary layers that recursively constrain future evolution.

6 Step 2 — Encode Intent as a Directional Vector

Intent is modeled as an initial perturbation:

$$I(t_0) = \Delta S_0$$

In applied settings, "intent" can be ambiguous, political, or performative, so we operationalize intent with evidence: budget choices, enforcement priorities, staffing and procurement, incentive

design, time horizon commitments, and measured tradeoffs.

Diagnostic output: Intent Vector Profile with four attributes:

- **Direction:** what is being increased or decreased
- **Magnitude:** resources and authority deployed
- **Duration:** one-time shock vs. sustained signal
- **Coherence:** alignment between stated and revealed intent

Figure 4. Intent vector profile (concept)

```
Stated intent → (what is said)
Revealed intent → (what is funded / enforced)
Gap analysis → (where drift is born)
```

Figure 4: Drift often begins where stated and revealed intent diverge.

7 Step 3 — Map Friction Topology

Friction is not just "resistance." It is the geometry of constraints. We model it as:

$$\mathcal{F}(S) = \Gamma S$$

In practice, friction includes procedural friction (approvals, veto points), economic friction (cost barriers), cultural friction (legitimacy deficits), and informational friction (opacity, asymmetric information). The structure of Γ determines whether intent is damped, redirected, or amplified.
Diagnostic output: Friction Topology Map (ranked constraints + likely redirection channels).

Figure 5. Friction as propagation geometry (concept)

```
High Γ → damped propagation → local change
Low Γ → rapid propagation → systemic change
Mixed Γ → redirection + unintended channels
```

Figure 5: Friction topology shapes which intent trajectories are possible and which are distorted.

8 Step 4 — Model Propagation Channels

Intent propagates through action, and action triggers strategic behavior. The applied evolution equation:

$$\frac{dS}{dt} = I(t) - \Gamma(S,t)\, S + \Phi(S,t)$$

where Φ captures adaptation such as compliance, avoidance, workarounds, exploitation, countermessaging, opportunistic rent-seeking, and emergent coordination effects. This step identifies dominant propagation channels and likely second-order effects.
Diagnostic output: Propagation Pathway Map (primary channel + 2–3 secondary channels).

Figure 6. Propagation pathway map (concept)

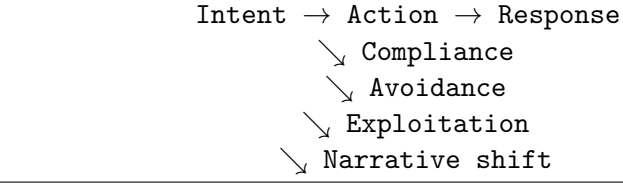


Figure 6: Systems respond through multiple channels; drift often emerges from secondary channels.

9 Step 5 — Detect Weak Signal Accumulation

Most structural drift does not come from one dramatic decision. It comes from repeated low-amplitude signals. Define soft intent:

$$I_{soft}(t) = \epsilon_i \quad \text{where } \epsilon_i \ll 1$$

Accumulation over time:

$$\int_{t_0}^{t_1} I_{soft}(t)\, dt = \Sigma\epsilon_i$$

When accumulation exceeds threshold:

$$\Sigma\epsilon_i > \lambda_{critical}$$

the system reparameterizes: what was once "noise" becomes new structure.

Figure 7. Soft intent threshold model (concept)

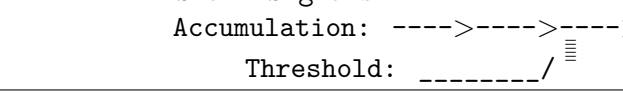


Figure 7: Repeated low-amplitude signals can cross thresholds and produce durable structural shifts.

10 Step 6 — Project Residual Displacement

Once the intervention ends:

$$\lim_{t\to\infty} I(t) = 0$$

If the system stabilizes to $S(\infty)$, memory is:

$$M = S(\infty) - S_{baseline}$$

This step estimates what remains after the stimulus dissipates: trust displacement, incentive displacement, norm displacement, enforcement displacement, and market structure displacement. **Diagnostic output: Memory Projection** (qualitative + quantitative where possible).

Figure 8. Memory projection as a residue ledger (concept)

Domain Baseline Post-state Residue
Trust T0 T∞ ΔT
Enforcement E0 E∞ ΔE
Norms N0 N∞ ΔN
Incentives I0 I∞ ΔI

Figure 8: Institutional memory can be tracked as residue by domain.

11 Step 7 — Estimate Reversion Cost

Memory is also the future cost of undoing what remains. Reversion cost:

$$E_{reversal} \propto \|M\| + \kappa$$

where $\|M\|$ captures displacement magnitude and κ captures coordination and legitimacy cost. This step asks: if we are wrong, can we afford to reverse this later?
Diagnostic output: Reversion Budget Estimate (time, money, political capital, legitimacy).

12 Step 8 — Redesign Intervention to Control Memory Formation

Once you can forecast likely residue, you can redesign the system to control memory formation. Drift can be reduced by improving intent coherence, reshaping friction (removing bottlenecks and adding guardrails), adjusting boundary conditions early (laws, SOPs, incentives), improving measurement (what the system "knows" and rewards), and dampening exploit channels (reducing adversarial amplification in Φ).

Figure 9. Memory-aware governance strategy (concept)

Forecast M $\rightarrow$ Reduce |M| $\rightarrow$ Lower E_reversal

Figure 9: Governance design becomes memory-aware when it explicitly minimizes harmful residual displacement.

Conclusion

Institutions remember. Intent functions as an initial condition. Friction shapes propagation geometry. Adaptive behavior produces nonlinear drift. Bulk dynamics compress into boundary conditions. Residual displacement becomes memory. Reversal requires energy.

The applied question is not "What happens immediately?" It is "What will remain after this is over?" Governance is not merely event management; it is the engineering of memory. Every intent leaves a trace.

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