Before Alignment Hardens: Pre-JAM as Intervention-Induced Residual Geometry in Hourglass Corridors

Abstract

Complex systems are often impaired not by hostile shocks, but by well-intended interventions applied under structurally unfavorable timing conditions. This paper analyzes when intervention supports recoverability and when it instead generates residual phase structures—persistent geometric constraints that outlive the original disturbance.

Intervention is modeled not as problem-solving behavior, but as an operator that injects external load (ΔE) and biases trajectory selection in phase space. Within Hourglass geometry, identical operators can expand available paths in early corridor regions, yet compress them near the throat, where reversibility declines. Directional orientation along the S-axis (alignment-seeking vs. separation-enforcing) affects the sign of |PLV| convergence, but residual formation is governed primarily by timing rather than moral or functional intent.

We introduce **Pre-JAM** as the regime in which residue forms prior to hardened memory: not as stored content, but as deleted return paths—a geometry of reduced navigability. In this regime, mistimed intervention erodes Buffer–Path Diversity–Rollback/Retry (BPR), narrows the Intervention Window (IW), and amplifies hysteretic delay (τ), producing proto-attractors or "negative sanctuaries" that curve phase trajectories without invoking force.

Pre-JAM formation is shaped not only by the target system's state, but also by evaluation pressure on the intervening system, which prioritizes visible external change (Φ_{ext}) over quiet internal reordering (Φ_{int}). Accordingly, this paper does not offer prescriptions. Instead, it specifies prohibition conditions: when MMS triangulation shows rising |PLV| in anti-phase with D/IW/BPR decline and increasing τ/Φ_{Dark}, intervention is structurally compressive rather than restorative.

Cross-domain case analyses (metabolic plateaus, infrastructural relief traps, supercooling nucleation, educational over-intervention, and post-update AI failure manifolds) illustrate the isomorphic pattern. The framework yields falsifiable predictions: if throat-proximal interventions consistently restore BPR without increasing τ or Φ_{Dark}, the Pre-JAM account is rejected.

Keywords: Pre-JAM, Intervention Operator, Residual Geometry, Hourglass Corridor, Recoverability, Proto-Attractor, Φ_{Dark}, MMS, JAM

1. Introduction

Complex systems often deteriorate not because no intervention occurred, but because intervention occurred under inappropriate structural conditions. In particular, actions applied near the narrowing corridor of the Hourglass geometry may compress recoverability rather than restore it.

Despite this, diagnostic efforts are frequently followed by an immediate demand for action. The transition from analysis to prescription is typically treated as self-evident. This paper argues that such a transition is not structurally neutral.

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1.1 The "So What Should We Do?" Constraint

In many applied contexts, diagnosis is assumed to imply prescription. Once instability, stagnation, or misalignment is identified, observers expect an actionable response. Intervention is framed as the natural continuation of understanding.

However, in phase-based systems, the structural impact of intervention depends primarily on corridor position, not intention or magnitude. Near the Hourglass throat, identical actions can reduce rather than expand recoverability.

The persistence of prescription demand is therefore not explained by system dynamics alone. It is better understood as an external evaluation constraint operating on the observer.

From the Observer Surface (Φ_{ext}), inaction is often interpreted as:

- insufficient response,
- delayed responsibility,
- or lack of control.

As a result, intervention becomes an expected output of diagnosis rather than a context-sensitive operation.

Pre-JAM formation does not require malicious intent or technical error. It emerges when action is structurally compelled before recoverability conditions are assessed.

The issue is not the presence of intervention, but the obligatory framing of intervention.

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1.2 Observer's Anxiety as an Evaluation Structure

Intervention timing errors are often attributed to misjudgment or incomplete information. This paper identifies an additional structural factor: evaluation pressure on the intervening system.

Interveners—such as clinicians, administrators, policymakers, educators, and developers—are typically assessed through visible outputs and short-term indicators. Their functional legitimacy is tied to demonstrable activity and measurable change.

This binds intervention behavior to the Observer Surface (Φ_{ext}).

In contrast, many recovery and reorganization processes unfold on the Experiencer Surface (Φ_{int}), where changes are:

- gradual,
- internally distributed,
- and not immediately visible.

Within Hourglass geometry, this corresponds to Q3: external contraction with internal reordering.

From an evaluation perspective, Q3 resembles stagnation or underperformance. From a structural perspective, it represents a transitional phase in which internal alignment is still active.

Evaluation pressure reduces tolerance for this distinction. Monitoring is interpreted as inactivity. Delay is interpreted as inefficiency.

Under such constraints, intervention is applied not because it is structurally optimal, but because non-intervention carries institutional cost.

Pre-JAM therefore reflects not only the state of the target system, but also the evaluation architecture of the intervening system.

1.2.1 Evaluation Pressure as Structural Variable

We define evaluation pressure (P_{eval}) as:

$$P_{\text{eval}} = \frac{\text{Visibility demand}}{\text{Tolerance for delay}} \tag{1}$$

High P_{eval} contexts include:

- Short accountability cycles
- Low institutional trust
- Competitive environments

P_{eval} affects timing by:

- Reducing tolerance for MMS triangulation
- Prioritizing Φ_{ext} over Φ_{int}

- Penalizing non-action

Thus, P_{eval} acts as external ΔE on the intervening system.

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1.3 From Evaluation Pressure to Residual Geometry

When intervention is driven by evaluation constraints rather than phase diagnostics, timing loses structural priority. Actions are applied based on:

- visibility requirements,
- performance timelines,
- and accountability cycles.

These factors are weakly correlated with recoverability indicators such as BPR, IW, D, or τ.

Near the Hourglass throat, such actions tend to:

- accelerate path deletion,
- increase hysteretic drag,
- and stabilize proto-attractors.

The result is not immediate collapse, but **residual geometry**: a phase space in which future trajectories are structurally constrained.

This paper does not argue against engagement or support. It specifies the conditions under which engagement becomes structurally compressive rather than restorative.

Pre-JAM describes the geometric outcome of intervention under evaluation-driven timing.

A consolidated summary of the IPCSALT–UPF research program—including core definitions, notation, and conceptual lineage—is provided in Gyurine (2026).[1]

[1] Zenodo: https://doi.org/10.5281/zenodo.18072793

2. Conceptual Framework

This section formalizes intervention not as a corrective act, but as a structural operator acting on phase geometry. By specifying the directional and energetic properties of intervention, Pre-JAM formation can be described without reference to intention, morality, or outcome desirability.

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2.1 Intervention as an Operator

In conventional discourse, intervention is typically defined as an action intended to solve a problem. In phase-based systems, however, intervention is more accurately modeled as an operator that modifies the geometry of the state space.

Formally, an intervention introduces:

1. External energy injection (ΔE) into the system, and
2. Directional bias in trajectory selection.

This dual effect alters not only the system's current state, but also the distribution of accessible future paths.

We therefore define the **Intervention Operator** as:

> An external operation that modifies phase trajectories by injecting energy (ΔE) and biasing path selection, independent of intended outcome.

The structural consequence of this operator depends on the system's position within the Hourglass corridor. Near the throat region, identical operators tend to reduce recoverability by accelerating path deletion.

Intervention is thus not neutral with respect to phase geometry. Its effects are conditional, not intrinsic.

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2.2 Direction Without Morality: S-axis Orientation

Interventions differ not only in magnitude, but also in directional orientation along the S-axis (alignment–separation axis).

Two dominant orientations can be identified:

- $D_s > 0$ **(Alignment-seeking interventions)**
  Actions that promote integration, consensus, or synchronization.
  Structural risk: premature fusion, with $|\mathrm{PLV}| \to +1$.

- $D_s < 0$ **(Separation-enforcing interventions)**
  Actions that promote autonomy, differentiation, or independence.
  Structural risk: polarization or isolation, with $|\text{PLV}| \to -1$.

Both orientations can generate residual structures when applied near the Hourglass throat. The formation of Pre-JAM is therefore not determined by moral direction (e.g., "unifying" vs. "liberating"), but by timing relative to recoverability conditions.

Residual formation is a function of when alignment or separation is imposed, not which direction is chosen.

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2.3 Energy Signature of Pre-JAM Formation

Pre-JAM formation is associated with a characteristic energy profile that reflects the interaction between external load and internal recovery capacity.

This profile can be described in four stages:

Stage 1: Pre-intervention (Edge of Growth)

$$\frac{\Delta E}{E_R} \approx 1$$

The system operates near its adaptive threshold, with sufficient buffer and path diversity.

Stage 2: Intervention Injection ΔE increases sharply due to external input. E_R (restorative capacity) decreases as buffers and recovery paths are consumed.

Result:

$$\frac{\Delta E}{E_R} > 1 \quad \text{(temporary instability)}$$

Stage 3: Apparent Stabilization Visible tension (ΔE) decreases, creating the impression of improvement. However, the baseline of E_R remains structurally reduced.

Stage 4: Proto-attractor Formation The system adapts to the lowered E_R baseline by settling into a new local energy minimum. This minimum corresponds to a proto-attractor, where future trajectories are constrained.

The defining signature of Pre-JAM is therefore an **anti-phase pattern**:

- Surface calm ($\Delta E \downarrow$)
- Structural depletion ($E_R \downarrow$)

This combination produces a stable-looking state with reduced recoverability, creating the geometric conditions for residual phase accumulation.

2.3.1 Operational Proxies for Restorative Capacity (E_R)

E_R is not directly observable. It can be inferred through:

1. **BPR decline rate**
   Continued BPR decrease despite $\Delta E \downarrow \Rightarrow E_R$ depleted
2. **Response latency (τ)**
   Monotonic τ increase $\Rightarrow$ recovery mechanisms exhausted
3. **Rollback viability**
   If rollback attempts worsen instability $\Rightarrow E_R < 0$

Approximation:

$$E_R \propto (\text{BPR richness}) \times \frac{1}{\tau} \times (\text{rollback viability}) \tag{2}$$

3. Residue Before Memory

This section clarifies what "residue" means in the Pre-JAM regime. Residue is not memory, not trauma content, and not an emotional trace. It is a structural condition: the geometry of paths that are no longer available.

Pre-JAM captures the moment when intervention does not merely fail, but reconfigures what the system can still become.

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3.1 Residue as Structural Theft

Mis-timed intervention is often described as ineffective or premature. In Pre-JAM, it is more accurately described as **structural theft**.

What is stolen is not performance, stability, or control. What is stolen is the system's **right to return (RtR)**.

This right is operationally expressed through:

- BPR (Buffer–Path Diversity–Rollback/Retry)
- IW (Intervention Window)
- D (Distance to irreversibility)

When an intervention is applied near the Hourglass throat, it does not primarily improve outcomes. Instead, it compresses future possibility space by deleting return paths.

The system may still appear stable. External indicators (Φ_{ext}) may even improve. But internally (Φ_{int}), the structure becomes poorer in options.

In this sense, Pre-JAM residue is not damage in the past, but the loss of possible futures.

The system adapts to a narrower corridor not because it is optimal, but because alternatives no longer exist.

Structural theft therefore does not look like collapse. It looks like adaptation to scarcity.

The theft is silent. The residue remains.

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3.2 Proto-attractor as Negative Sanctuary

Residue does not immediately form a stable attractor. Before memory hardens, the system enters a **proto-attractor** phase.

A proto-attractor is not a point of attraction. It is a **zone of avoidance**.

Rather than pulling trajectories toward itself, it marks regions of phase space as:

- too costly,
- too unstable,
- too irreversible,
- not worth visiting again.

We therefore describe proto-attractors as **negative sanctuaries**.

They are not destinations. They are prohibited territories.

Path deletion, buffer exhaustion, and failed rollback rules turn certain regions into structural "no-go" zones.

This produces a curvature in phase space that resembles gravity—not because the past exerts force, but because the future has fewer viable routes.

What appears as "attraction" is in fact constraint. The system is not drawn forward. It is boxed in.

Phase Gravity in Pre-JAM is therefore not causal pull, but navigational distortion created by forbidden space.

Memory has not formed yet. But the map has already been redrawn.

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3.3 Timing Hysteresis

Residue formation is not only spatial. It is also temporal.

The variable τ (hysteretic delay) does not merely measure lag. It measures how strongly past configurations resist reorganization.

In Pre-JAM, intervention increases τ by amplifying historical drag.

This produces **timing hysteresis**:

The same action, applied at different moments, has structurally different consequences.

Early in the corridor, intervention may:

- widen options,
- restore buffers,
- reduce irreversibility risk.

Near the throat, the same intervention may:

- accelerate path deletion,
- increase τ,
- seed proto-attractors.

What was once neutral becomes residue-generating.

This is why Pre-JAM cannot be explained by intent, magnitude, or direction alone. Only timing relative to corridor geometry determines whether intervention heals or scars.

In high-τ regimes, even small adjustments solidify historical constraints rather than relieve them.

The system does not "recover." It learns to live with less.

And that learning is the beginning of memory.

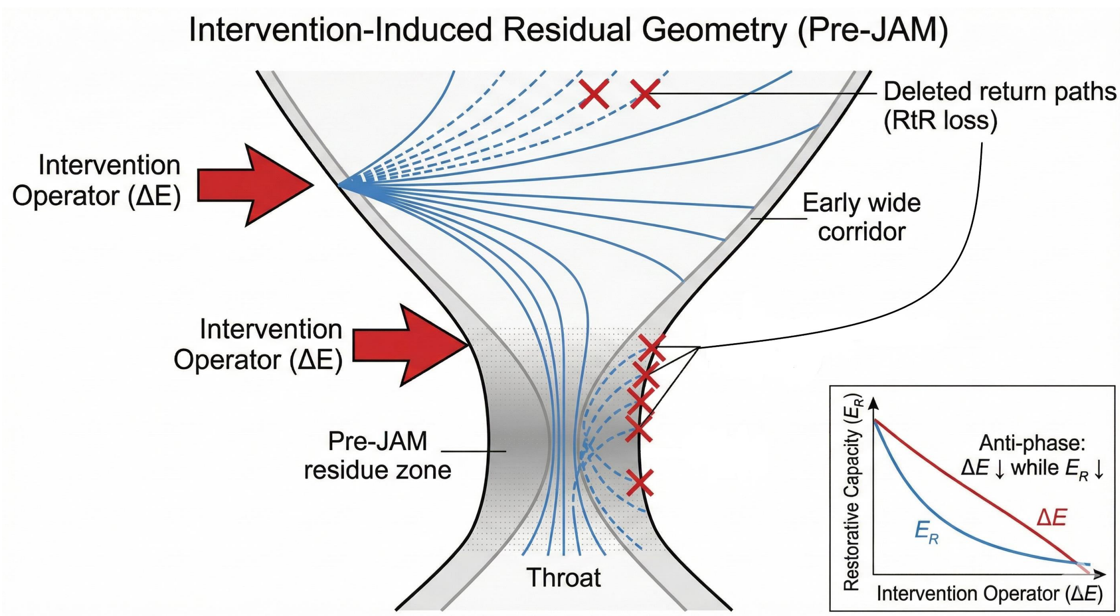

Figure 1: **Intervention-Induced Residual Geometry (Pre-JAM).**
Identical intervention operators (ΔE) produce opposite structural effects depending on corridor position. In early wide regions, intervention expands available trajectories, whereas throat-proximal intervention deletes return paths (RtR loss), generating a Pre-JAM residue zone characterized by irreversible loss of recoverability without immediate collapse. The inset illustrates the anti-phase relation between intervention intensity (ΔE) and restorative capacity (E_R).

As shown in Figure 1, early interventions widen the option space by increasing the diversity of viable trajectories. In contrast, throat-proximal interventions collapse the geometry of recoverability by deleting return paths (RtR loss).

The resulting Pre-JAM residue zone is not characterized by stored content or psychological trace, but by **structural theft**: the irreversible loss of future trajectories.

Notably, surface stability may persist even as restorative capacity (E_R) declines, producing an anti-phase relation between intervention intensity and recoverability.

4. Case Studies: Mis-timed Intervention Across Domains

To demonstrate that Pre-JAM residue is not domain-specific, we examine a set of structurally isomorphic cases across biological, social, physical, educational, and computational systems. In each case, intervention is triggered by a surface misread—a mismatch between external indicators (Φ_{ext}) and internal structural states (Φ_{int}). The resulting operator compresses recoverability, produces path deletion, and seeds proto-attractors in the form of negative sanctuaries.

The cases are summarized conceptually in Table 1 and then discussed in detail.

Table 1: Cross-domain manifestations of mis-timed intervention and Pre-JAM residue formation.

Case	Surface misread	Operator	Path deletion signature	Proto-attractor
Metabolic plateau	Weight stasis vs. rhythmic recovery	ΔE spike	BPR↓ (rhythms erased)	Adaptation lock
Infrastructural relief	Patient↓ vs. autonomy paths	Service injection	IW↓ (dependency)	Role fixation
Supercooling	Visible stability vs. nucleation risk	Micro-perturbation	$D \to 0$ trend	Condensation seed
AI update residue	Patch success vs. generative diversity	Parameter shift	BPR↓ (routes deleted)	Failure manifold
Educational over-intervention	Early proficiency vs. exploratory learning	Instruction overload	BPR↓ (exploration erased)	Competence lock

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4.1 Metabolic Plateau (Biological System)

Surface misread: Weight stasis is interpreted as failure, while internal rhythmic recovery processes are still active.

Operator: A sharp increase in caloric restriction and training intensity (ΔE spike).

Path deletion signature: BPR decreases as metabolic rhythms adapt defensively. Buffer capacity is reduced, rollback flexibility weakens, and alternative recovery pathways are erased.

Proto-attractor: An adaptation lock emerges. The body stabilizes around a lower-resilience metabolic regime that resists further change.

Although the intervention aims to accelerate progress, it instead compresses future metabolic flexibility. The system does not collapse. It hardens.

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4.2 Infrastructural Relief (Social System)

Surface misread: Reduced visible patient counts are interpreted as systemic improvement, while autonomy and local capacity-building pathways remain fragile.

Operator: Large-scale service injection (external medical or welfare support).

Path deletion signature: The Intervention Window (IW) narrows as dependency loops form. Local problem-solving capacity erodes, and exit routes from aid reliance disappear.

Proto-attractor: Role fixation develops. The community becomes structurally locked into a "recipient" identity.

Short-term relief masks long-term constraint. Structural pressure is not removed—it is redistributed into dependency geometry.

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4.3 Supercooling (Physical System)

Surface misread: Macroscopic stability is interpreted as structural safety, while microscopic nucleation risk remains high.

Operator: A minor perturbation (thermal fluctuation, impurity, or vibration).

Path deletion signature: D trends rapidly toward zero as reversibility collapses. Phase transitions become unavoidable.

Proto-attractor: A condensation seed forms, triggering irreversible crystallization.

Here, intervention does not create the phase change—it determines where and how irreversibility condenses.

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4.4 AI Update Residue (Computational System)

Surface misread: Patch success is measured through reduced error rates, while generative diversity and route flexibility are ignored.

Operator: Parameter shifts during fine-tuning or constraint optimization.

Path deletion signature: BPR decreases as alternative generation routes are pruned. Rollback options and exploratory diversity shrink.

Proto-attractor: A failure manifold emerges: persistent error patterns reappear despite surface fixes.

The system becomes stable but less adaptable. Errors are no longer random—they are structurally reinforced.

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4.5 Educational Over-Intervention (Cognitive System)

Surface misread: Performance metrics and early proficiency are prioritized over curiosity and exploratory learning trajectories.

Operator: Excessive instruction, standardized pacing, and premature outcome optimization.

Path deletion signature: BPR declines as exploratory paths are replaced by narrow solution routines. Curiosity-driven rollback and divergent exploration are suppressed.

Proto-attractor: A competence lock forms, where learners can perform but struggle to explore.

The system learns "how to answer," but forgets how to search. Future learning space contracts without visible failure.

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4.6 Cross-Case Structural Pattern

Across all cases, the same structural sequence appears:

1. A surface misread prioritizes visible change over internal reordering.
2. An intervention operator injects ΔE into a narrowing corridor.
3. Path deletion erodes BPR, IW, or D.
4. A proto-attractor forms as a negative sanctuary.

The system does not collapse. It remembers less of what it could have become.

These residues do not yet constitute memory. But they prepare the geometry in which Joint Alignment Memory (JAM) can later harden.

4.6.1 Structural Isomorphism vs. Analogical Similarity

Pre-JAM claims structural isomorphism at the level of:

- MMS signature,
- Anti-phase pattern (Φ_{ext} stabilizes, Φ_{int} depletes),
- Proto-attractor formation.

However, material mechanisms differ:

- Supercooling: molecular alignment,
- Relief traps: institutional dependency,

- AI updates: latent manifold fixation.

The geometry is isomorphic. The substrate varies.

5. Timing Matters: Prohibition Conditions, Not Prescriptions

This paper does not provide intervention guidelines in the form of prescriptions. It does not state what should be done at a given time. Instead, it specifies **prohibition conditions**—structural signatures under which intervention is likely to generate residue rather than recovery.

A prescription assumes controllability:

> "Do X at time T to achieve outcome Y."

A prohibition acknowledges limits:

> "When signature Z is present, do not apply Y, because structural damage is likely."

The distinction is not rhetorical. In complex phase systems, the same action can either expand or collapse recoverability depending on corridor position in Hourglass geometry. Intervention type is secondary; timing is primary.

This section formalizes the notion of **"golden time"** not as an instruction window, but as a diagnostic boundary separating recoverable intervention from residue-generating interference.

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5.1 Golden Time as a Structural Definition (Not a Prescription)

The "golden time" of intervention is often framed as an opportunity to act. Here, it is reframed as a **zone of structural safety**—defined not by intention, but by measurable phase conditions.

A system remains in a recoverable regime when:

- The Intervention Window (IW) remains open,
- The Distance to Irreversibility (D) decreases slowly rather than precipitously,
- Buffer–Path Diversity–Rollback/Retry (BPR) remains non-collapsed,
- And |PLV| stays within the CRGZ range without converging toward ± 1.

Under these conditions, intervention can still increase structural optionality. Return paths remain accessible. Future trajectories are not yet deleted.

By contrast, a dangerous regime emerges when the system approaches the Hourglass throat. This phase torrent is characterized by a convergent signature:

> |PLV| increases rapidly while D, IW, and BPR simultaneously collapse.

Here, apparent alignment intensifies at the exact moment recoverability vanishes. Surface coherence masks internal corridor closure.

In such conditions, intervention does not restore structure. It accelerates residue formation by finalizing path deletion and increasing hysteretic drag (τ).

The "golden time" is therefore not an instruction to act. It is a **warning boundary** beyond which action becomes structurally unsafe.

5.1.1 Pre-Intervention Warning Signature

Golden Time cannot be defined in advance. However, throat proximity can be detected.

Warning signature (likely compressive):

- $|\text{PLV}| > 0.7$
- $D < D_{\text{critical}}$
- $\text{IW} < 2\tau$
- Recent ΔE spikes

Permissive signature (potentially constructive):

- $|\text{PLV}| \in [0.4, 0.7]$
- $D > 3\,\text{IW}$
- τ stable or declining
- BPR stable or increasing

This does not guarantee recovery. It only identifies when structural compression is likely.

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5.2 High-Resolution Observation as Active Waiting

Non-intervention is often misinterpreted as passivity or neglect. In Pre-JAM analysis, it is reframed as **high-resolution observation**.

Active waiting does not mean "doing nothing." It means reallocating effort from structural modification to diagnostic resolution.

Increasing monitoring frequency, multi-surface triangulation (Φ_{ext} vs. Φ_{int}), and MMS sensitivity does not change the system's phase trajectory directly. It improves the observer's ability to detect corridor narrowing, τ accumulation, and BPR erosion.

Observation strengthens diagnosis without injecting additional ΔE. It preserves buffers instead of consuming them. It maintains optionality rather than forcing alignment.

This distinction is critical under observer anxiety. Pressure to demonstrate visible action often leads to premature intervention near the throat, where any external force becomes residue-generating.

High-resolution observation provides an alternative form of engagement:

> not control, but constraint awareness.

The system is allowed to reorder internally, while the observer tracks structural signatures rather than surface outcomes.

This is not a cure. It is a **damage-avoidance strategy**.

5.2.1 Operational Definition of Active Waiting

Active waiting is triggered monitoring, not continuous surveillance.

Triggers:

- $|\text{PLV}| > 0.6$
- $D < 2\,\text{IW}$
- τ increases $> 20\%$
- External ΔE shock

Between triggers: minimal intrusion. Observation is action, but non-invasive action.

The structural distinction between permissive and compressive regimes can be summarized as a phase-diagnostic signature. While |PLV| alone reflects alignment intensity, Pre-JAM risk emerges only when high coupling coincides with simultaneous collapse of D, IW, and BPR, alongside rising hysteresis (τ) and residual constraints (Φ_{Dark}). This MMS-based prohibition signature is illustrated in Figure 2.

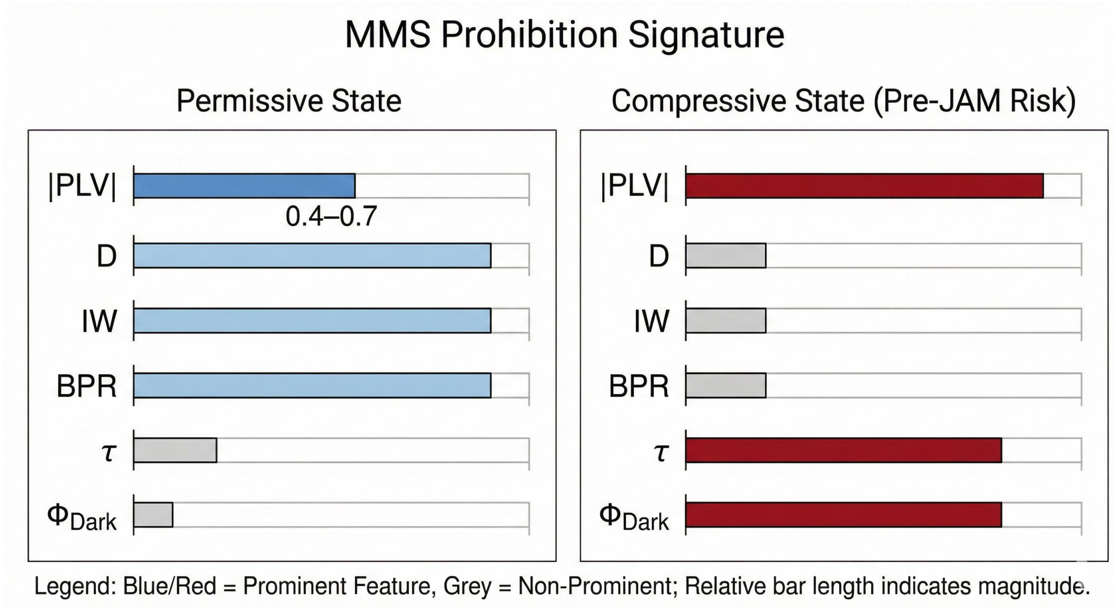

Figure 2: **MMS Prohibition Signature for Pre-JAM Risk.**
A comparison between permissive and compressive regimes based on the Minimal Measurement Set (MMS). Permissive states are characterized by moderate coupling ($|\text{PLV}| \in 0.4$–0.7), high Distance to Irreversibility (D), wide Intervention Window (IW), and stable Buffer–Path Diversity–Rollback/Retry (BPR), with low hysteresis (τ) and residual constraints (Φ_{Dark}). In contrast, compressive Pre-JAM risk states exhibit high |PLV| alongside simultaneous collapse of D, IW, and BPR, accompanied by rising τ and Φ_{Dark}. This configuration indicates that further intervention is structurally prohibitive rather than restorative.

Figure 2 does not prescribe when to act. It clarifies when action becomes structurally unsafe. The "golden time" is therefore not a window of opportunity, but a boundary of permission. Beyond this boundary, intervention no longer restores optionality—it finalizes loss.

Active waiting, supported by high-resolution observation, remains the only engagement mode that preserves future trajectories without generating residual geometry.

6. What This Paper Does Not Claim

This paper does not propose solutions, policy prescriptions, or moral evaluations. Its scope is strictly diagnostic.

Specifically, this study does not:

- Recommend particular interventions,
- Advocate political or institutional reforms,
- Assign moral responsibility to agents,
- Or prescribe corrective actions.

The analytical objective is not to determine what should be done, but to identify when intervention becomes structurally compressive.

The distinction between prescription and prohibition is central.

A prescription assumes controllability:

> "Apply action X at time T to achieve outcome Y."

A prohibition condition identifies structural risk:

> "When signature Z is present, action Y will likely reduce recoverability."

This paper operates exclusively in the second mode.

When MMS indicators show throat proximity ($|\mathrm{PLV}| \uparrow$, D/IW/BPR $\downarrow$, $\tau/\Phi_{\mathrm{Dark}} \uparrow$), intervention is not framed as harmful by intent, but as geometrically hazardous.

The contribution of this study is therefore the specification of **structural damage zones**, not behavioral directives.

Pre-JAM is introduced as a descriptive phase regime—not as an ethical judgment.

7. Transition to JAM: From Residue to Joint Alignment

Pre-JAM represents a critical but not yet final structural state. Although residue has formed, the system has not fully entered Joint Alignment Memory (JAM).

The key difference lies in **joint recruitment**.

In Pre-JAM, proto-attractors exist as localized negative sanctuaries. They constrain movement, distort navigation, and bias trajectories. However, these constraints remain single-layer in nature.

They have not yet recruited multiple regulatory layers (behavioral, emotional, institutional, narrative, or algorithmic) into a unified, self-reinforcing alignment. Because of this, Pre-JAM can still be reversible.

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7.1 Why Pre-JAM Can Still Thaw

Pre-JAM remains reversible for one structural reason:

> Proto-attractors have not yet achieved cross-layer coupling.

At this stage:

- Constraints exist,
- Return paths are weakened,
- Hysteresis (τ) is elevated,
- But alignment is not yet jointly stabilized.

The system still contains internal degrees of freedom that can support de-alignment, re-expansion, and path re-opening.

Intervention at this stage does not require demolition. It requires **condensation arrest**.

Rather than breaking a hardened structure, the goal is simply to stop residue from recruiting additional layers. This is **thawing**, not destruction.

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7.2 What Makes JAM Irreversible

JAM is not defined by residue alone. Residue can exist without memory.

JAM emerges when residue becomes jointly aligned across layers.

This occurs when:

- Behavioral patterns reinforce the same constraints,
- Emotional responses stabilize around the same attractor,
- Narratives explain the same reduced space,
- Institutions formalize the same limitations,
- Or algorithms encode the same pathway exclusions.

At that point, alignment becomes **self-locking**.

Return paths are no longer just deleted. They are collectively justified.

The system does not merely avoid certain regions. It remembers why they should never be visited again.

Reversal now requires **demolition**: breaking institutional, emotional, cognitive, and structural couplings simultaneously.

Pre-JAM is thawable. JAM is structural memory.

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7.3 Definitional Closure

For clarity, we formalize the distinction:

> JAM is defined not by the presence of residue, but by the presence of joint recruitment across layers. Pre-JAM is residue before cross-layer coupling becomes self-locking. Residue describes constraint. JAM describes collective commitment to that constraint. This paper ends at the threshold where commitment begins.

7.3.1 Cross-Layer Coupling as Irreversibility Condition

Pre-JAM describes a regime of geometric constraint that remains temporally reversible.

JAM forms when constraints become temporally irreversible through cross-layer locking.

Three layers must simultaneously stabilize:

1. **Geometric layer (G-lock)**
   Proto-attractors develop into full attractors with stable basins.
2. **Temporal layer (T-lock)**
   Hysteretic delay τ diverges, making return paths effectively unreachable.
3. **Evaluative layer (E-lock)**
   Φ_{ext} and Φ_{int} both fixate on the same interpretation, eliminating alternative framings.

$$\text{JAM} = \text{G-lock} \;\wedge\; \text{T-lock} \;\wedge\; \text{E-lock} \tag{3}$$

$$\text{Pre-JAM} = (\text{G-lock} \;\vee\; \text{T-lock} \;\vee\; \text{E-lock}) \;\wedge\; \neg(\text{G-lock} \;\wedge\; \text{T-lock} \;\wedge\; \text{E-lock}) \tag{4}$$

In Pre-JAM, at least one layer remains unlocked. In JAM, all three layers stabilize mutually.

This definitional boundary between partial locking (Pre-JAM) and joint recruitment (JAM) is illustrated in Figure 3.

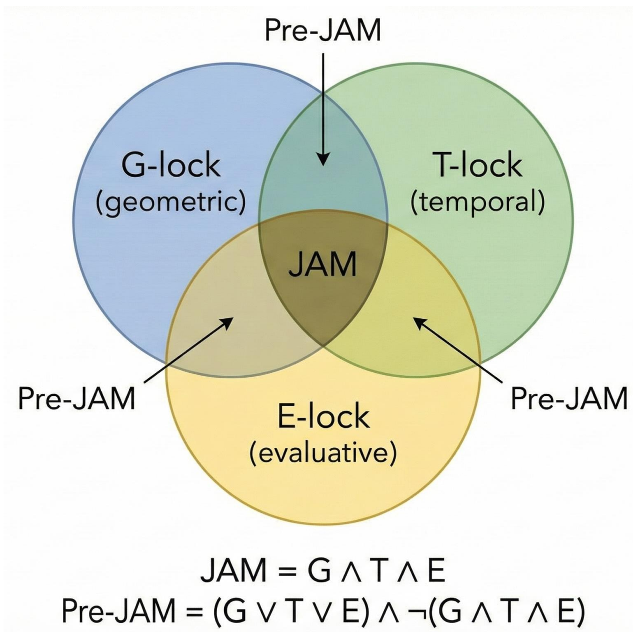

Figure 3: **Definitional Boundary Between Pre-JAM and JAM.**
JAM forms only when geometric locking (G), temporal locking (T), and evaluative locking (E) jointly stabilize ($G \wedge T \wedge E$). Pre-JAM refers to partial locking regimes in which one or two of these constraints are present without full joint recruitment.

Figure 3 summarizes the core claim of this paper: JAM is not defined by the accumulation of residue, but by the irreversible stabilization of constraints across geometric, temporal, and evaluative layers.

Pre-JAM remains a regime of constraint without commitment. The transition occurs only when locking becomes mutually reinforcing and temporally irreversible.

8. Tests, Predictions, and Falsification Criteria

The Pre-JAM framework generates testable structural predictions regarding the relationship between intervention timing, recoverability erosion, and residual phase formation. These predictions are expressed in terms of MMS indicators and energy–hysteresis signatures, rather than outcome-based performance metrics.

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8.1 Hypothesis H1: Throat-Proximal Intervention Signature

When intervention is applied near the Hourglass throat, the following signature is predicted:

- $|\mathrm{PLV}|$ increases toward ± 1,
- D, IW, and BPR decrease,
- τ and Φ_{Dark} increase.

This configuration reflects corridor compression and the emergence of proto-attractor geometry.

The prediction is independent of intervention type or intention. Identical operators applied in early corridor regions are not expected to produce this signature.

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8.2 Hypothesis H2: Long-Term Recoverability Degradation

Systems that exhibit the Pre-JAM signature are predicted to show:

- Lower long-term recoverability rates,
- Reduced trajectory diversity,
- Increased rigidity consistent with JAM-like stabilization.

In this regime, surface-level stability may persist, but structural flexibility remains constrained. Residual geometry is therefore expected to correlate with delayed or incomplete recovery, rather than immediate collapse.

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8.3 Falsification Criterion

The Pre-JAM model can be falsified under the following condition:

> If interventions applied near the Hourglass throat consistently restore BPR, do not increase τ or Φ_{Dark}, and do not produce persistent $|\mathrm{PLV}|$ convergence, then the hypothesis that throat-proximal intervention generates residual geometry must be rejected.

In such a case, intervention would function as a recoverability-expanding operator rather than a corridor-compressing one.

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8.4 Methodological Scope

These hypotheses can be evaluated across domains, including:

- physiological adaptation processes,
- social and infrastructural interventions,
- educational system dynamics,
- and AI model fine-tuning regimes.

The framework does not require domain-specific mechanisms. Only MMS-consistent measurements of recoverability structure, alignment pressure, and hysteretic accumulation are required.

9. Conclusion

This paper introduced Pre-JAM as a distinct phase regime in which intervention, applied under structurally unfavorable timing conditions, generates residual geometry rather than restoring recoverability.

Pre-JAM is not defined by collapse, memory, or irreversible lock-in. It is defined by the early formation of proto-attractors through:

- corridor compression,
- path deletion,
- hysteretic accumulation,
- and reduced restorative capacity.

In this regime, intervention functions as a geometry-modifying operator, not a corrective tool.

The central claim of this study is not that intervention is harmful, but that intervention is **conditional**.

When applied near the Hourglass throat, identical actions can:

- increase alignment pressure,
- erode recoverability structures,
- and seed residual phase curvature.

These effects are independent of intent, direction, or moral framing.

Pre-JAM therefore reframes failure not as misjudgment or negligence, but as **structural mistiming**.

Importantly, Pre-JAM remains a potentially reversible regime. Proto-attractors formed at this stage have not yet recruited multiple regulatory layers into joint alignment. Residual geometry exists, but has not yet hardened into structural memory. This distinguishes Pre-JAM from Joint Alignment Memory (JAM), which is characterized by cross-layer coupling and self-locking stabilization. JAM represents hardened structure. Pre-JAM represents interrupted flexibility.

The contribution of this paper is the specification of **when intervention becomes compressive**, not how to intervene. By identifying the geometric conditions under which action produces residue, this framework provides a diagnostic boundary for future analysis of social, biological, technical, and cognitive systems.

Pre-JAM is not a prescription. It is a **warning geometry**.

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Human Author (Gyurine)
Conceptual design; theoretical development; construction of the overall framework; formulation of equations; interpretation of results; drafting, revising, and integrating the narrative; and all final decisions regarding the scientific content. The human author retains full responsibility for the claims, arguments, and conclusions presented in this work.

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