

# Experience Entry Contract

## Constraint-Based Cross-Modal Binding in Stratified Agent Architectures

Stephen A. Putman

[putmanmodel@pm.me](mailto:putmanmodel@pm.me)

Version 0.2 — February 2026

### Abstract

Stratified agent architectures separate perception, representation, memory, and governance layers, yet the boundary governing experience formation remains under-specified. Without an explicit contract, cross-modal binding—linking language, affect, and sensor observations—can unintentionally alter durable state, destabilize baselines, or amplify drift across memory tiers.

This paper introduces the Experience Entry Contract (EEC), a constraint-based framework governing how interaction-derived events become memory records. An EEC is defined as a set of invariants and transition predicates that determine whether an event may form an associative trace or a canonical commitment. The contract formalizes the distinction between canonical state (durable commitments capable of action gating) and associative traces (contextual bindings permitted to influence attention but prohibited from mutating durable state).

The framework establishes architectural guarantees: associative-by-default binding, governed promotion with multi-factor predicates, re-ingestion of recall-derived signals, guarded baseline updates with bounded stabilization, non-writing reflex behavior, non-authorizing recall, and deterministic transition logging. It does not prescribe embodiment or sensor implementation; instead, it specifies interface-level constraints under which cross-modal memory formation may occur.

By sealing the perception–memory boundary under explicit invariants, the EEC reduces unintended state mutation, preserves identity coherence across tiers, and strengthens drift resistance in multi-layer agent systems.

## 1. Problem Statement

### 1.1 The Missing Boundary

Stratified agent architectures distinguish between perception, representation, memory tiers, and governance layers. Memory stratification defines persistence topology; deviation engines regulate drift; representation layers encode structure. However, the transition from interaction to persistence remains under-specified when multiple modalities combine into a single event.

In practice, perception, language, affect, and contextual signals are often bound implicitly. Retrieval then reintroduces those bindings into reasoning pipelines, where they may influence stance, planning, or belief without a defined promotion pathway. This produces recurring structural risks:

- Implicit canonical mutation: Side effects of binding can silently alter durable beliefs.
- Baseline contamination: Instability-driven inputs can inappropriately shift reference baselines.
- Repetition-induced drift: Frequent occurrences can become entrenched without justification.
- Cross-tier amplification: Minor contextual associations can unintentionally influence higher-tier state.

These risks are not failures of learning algorithms; they are failures of boundary definition.

## **1.2 Cross-Modal Binding as Structural Hazard**

Cross-modal binding is necessary for coherent experience modeling. Without explicit constraints, such binding blurs distinctions between contextual co-occurrence, attention modulation, durable commitment, and action authorization. The problem is not binding itself, but the absence of invariants governing which bindings become persistent state.

### **1.3 Scope. The EEC governs:**

- When an event qualifies as an experience entry.
- What type of memory record it may form.
- What operations are permitted on that record.
- How recall may influence reasoning.
- Under what conditions promotion to durable state may occur.

The contract defines admissibility invariants and transition semantics. It does not prescribe learning algorithms, trust models, or embodiment assumptions.

## 2. Architectural Positioning

### 2.1 Layer Placement

Agent systems may be decomposed into perception, representation, memory, and governance layers. The Experience Entry Contract resides at the boundary between representation and memory. It governs:



- **Interaction-derived Event:** post-representation output + metadata
- **EEC:** admissibility + provenance + commit constraints
- **Memory Record:** tier-eligible entry (tier gating external)

It does not alter perception or representation mechanisms; it constrains how post-representation data enters memory.

### 2.2 Relationship to Other Components

Memory stratification governs persistence tiers. Governance systems arbitrate drift and stability. Representation layers encode event structure. The EEC specifies admissibility into memory under given conditions. It defines boundary constraints, not reasoning mechanics.

## 3. Experience Entry Contract

### 3.1 Core Types

**Event (e):** An interaction-derived unit containing representation  $r(e)$ , optional sensor abstraction  $s(e)$ , timestamp  $t(e)$ , provenance  $p(e)$ , and confidence  $c(e)$ . An Event itself is not memory; it is a candidate for memory formation.

**Associative Trace (A):** A record formed under default conditions. It may influence attention, hypothesis ranking, and suggestion of recall. It may not mutate canonical beliefs or authorize irreversible actions. Associative traces decay under bounded, system-defined decay behavior.

**Canonical State (K):** Durable commitments capable of action gating, baseline modification, and cross-tier propagation. Canonical state is only entered through explicit, governed promotion.

**Governance Layer (G):** Evaluates promotion predicates, detects instability, enforces update gating, and authorizes canonical transitions. The EEC constrains what governance decisions must entail (e.g., logging) but does not define governance mechanisms.

### 3.2 Contract Invariants

#### **Invariant 1 — Associative by Default:**

Events form associative traces unless explicitly promoted by governance. Default binding creates no durable commitment.

#### **Invariant 2 — Multi-Factor Promotion Requirement:**

Promotions from associative to canonical state require governance-mediated predicates supported by at least two independent evidence dimensions. Single-factor predicates are insufficient, and repetition alone is never a sufficient condition for promotion.

#### **Invariant 3 — Attention-Only Recall:**

Recall of an associative trace may influence attention weighting and hypothesis generation, but it may not directly mutate canonical state or authorize irreversible actions. Any canonical mutation must go through explicit promotion.

#### **Invariant 4 — Re-Ingestion Requirement:**

Recall-derived signals must be re-ingested as Events before promotion. Content derived from recall is not directly promotable; only explicit Event occurrences can satisfy promotion predicates.

#### **Invariant 5 — Non-Writing Reflex and Labeling:**

Reflex mechanisms may modulate attention, routing, or clarification behaviors, but may not write associative or canonical state. Reflex-originated signals are ineligible for direct promotion and must be labeled. This ensures reflexes cannot silently create memory records.

#### **Invariant 6 — Guarded Baseline Updates:**

Baseline updates may occur only under declared stable regimes. Promotions and baseline modifications are suspended during instability. Instability suspension must include a bounded post-instability stabilization window before baseline updates resume. This ensures that only consolidated, stable information affects long-term state.

#### **Invariant 7 — Deterministic Transition Logging:**

Every canonical transition must produce a deterministic, tamper-evident, append-only transition record containing (timestamp, event ID, predicate vector, governance token, signer). Canonical mutation without such a record is invalid. This makes every state change auditable.

## **4. Promotion and Temporal Semantics**

Promotion from associative trace to canonical state is an explicit state transition requiring:

- Predicate satisfaction: Multi-factor conditions as in Invariant 2.
- Stability confirmation: The system must be in a declared stable regime.

- Governance authorization: Explicit approval by governance.
- Transition logging: As in Invariant 7, a record must be created.

Promotion is not statistical inevitability. Repetition may contribute to evidence but cannot alone trigger promotion.

Recall-derived signals must be re-ingested as Events before promotion. This prevents associative recall from acting as an implicit evidence source. Any candidate signal from recall must re-enter as a fresh Event to qualify.

Instability suspension must include a bounded post-instability stabilization window before baseline updates resume. During detected instability, promotion and baseline updates are suspended. After instability subsides, a stabilization interval is enforced before any baselines change, ensuring that only settled state affects learning.

Canonical transitions must produce deterministic transition records (timestamp, event IDs, predicate vector, governance token, signer) and be tamper-evident/append-only. This constraint, matching Invariant 7, ensures each promotion is logged with all relevant data and cannot be overwritten retroactively.

## **5. Failure Modes and Containment**

The EEC mitigates several hazards:

- Implicit Canonical Drift: Unconstrained recall can bias state. The EEC prevents this by requiring re-ingestion of recall signals and by strictly separating recall (attention-only) from promotion pathways.
- Baseline Contamination During Instability: Unstable inputs might shift baselines improperly. The EEC enforces instability suspension and a post-instability stabilization window, so baselines only update under stable conditions.
- Repetition-Induced Promotion: Unchecked frequency can harden memory. The EEC explicitly states repetition alone cannot cause promotion and requires multi-factor predicates, protecting against repetitive attacks or echo chambers.

- **Reflex-to-Memory Leakage:** Reflexes are high-frequency responses; if they wrote memory directly, transient spikes would persist. The EEC enforces non-writing reflex invariants and labeling, so reflex signals cannot create memory traces without passing through normal Event promotion.
- **Silent Canonical Mutation:** Without logs, state changes can go unnoticed. The EEC's deterministic transition logging ensures every state change is recorded and auditable, preventing hidden rollbacks or unauthorized commits.

By enforcing these invariants, the EEC makes belief updates explicit and visible. Canonical state changes become deliberate transitions, not accidental side effects of retrieval or reflex activity.

## **6. Integration and Architectural Implications**

The EEC acts as a membrane between perception/representation and memory layers. It complements existing architectures: it does not redefine memory tiers or replace governance. Instead, it specifies admissibility constraints:

- It augments stratified memory by constraining how state moves between tiers.
- With governance systems (e.g. deviation engines), it clarifies that drift signals cannot directly mutate memory; governance must follow EEC rules to authorize changes.
- It remains agnostic to representation formats (symbolic, neural, etc.), treating all as event labels.
- It preserves reflex layer independence by ensuring fast responses do not bleed into slow memory.
- It supports multi-agent or tool-enabled scenarios by requiring clear provenance, commit-class tagging, and explicit promotions for any shared information.

The EEC does not introduce new learning algorithms or trust protocols; it merely hardens the boundary through which learning inputs become memory entries. By formalizing this boundary, the contract enhances the robustness of the entire architecture without expansion of its functional layers.

## 7. Scope and Non-Goals

The EEC defines admissibility semantics at the perception–memory boundary. It:

- Does not prescribe learning algorithms or adaptation mechanisms.
- Does not define sensor or embodiment details.
- Does not mandate specific data representations.
- Does not design governance engines or trust scoring systems.
- Does not add new subsystems beyond the existing stratified architecture.

It constrains only how events become memory records. Issues like classifier calibration, concurrency control, or multi-agent protocols remain outside its scope.

## 8. Conclusion

The transition from interaction to memory is a structurally sensitive boundary. Without explicit constraints, cross-modal bindings can blur contextual association and durable intent. The Experience Entry Contract formalizes this boundary by enforcing associative-by-default binding, multi-factor promotion, recall re-ingestion, guarded updates with stabilization, reflex separation, and deterministic transition logging. These constraints preserve identity coherence and prevent unintended state mutation, all while allowing rich experience modeling. The EEC introduces a clear membrane, not a new mechanism. As agents grow more multi-modal and tool-enabled, the integrity of their memory boundaries is as important as their inference power. The Experience Entry Contract defines that integrity.