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Failure Modes — Volume I: Entity Collision Problem (ECP) & Probabilistic Inference Collapse (PIC)

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Applicability:

This document applies solely within the scope of the EntityWorks Standard. It does not assert applicability outside that framework.

Governance & Stewardship:

EntityWorks is the steward of this publication and the governing body of the EntityWorks Standard. Canonical definitions referenced herein are maintained in the EntityWorks Terminology layer.

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Failure Modes — Volume I

Entity Collision Problem (ECP) & Probabilistic Inference Collapse (PIC)

EntityWorks Standard — Canonical Expository Publication v1.1

Status: Settled Exposition (Downstream of Ontology)

Governing Standard: EntityWorks Standard

Stewarding Body: EntityWorks

1. Definition (Referential)

This publication addresses two formally defined failure modes within the EntityWorks Standard:

Entity Collision Problem (ECP)

Probabilistic Inference Collapse (PIC)

The authoritative definitions governing these terms are recorded in the EntityWorks Terminology layer (v0.1).

This document does not restate, refine, or reinterpret those definitions.

Its function is to provide structured exposition of how these failure modes are understood, analysed, and applied within the scope of the EntityWorks Standard.

2. Position of Failure Modes Within the Standard

Within the EntityWorks Standard, failure modes occupy a specific and deliberately limited role.

They are interpretive classification constructs used to describe observable breakdowns in entity-level representation across AI-mediated environments.

They are not:

- descriptions of system internals,
- explanations of algorithmic behaviour,
- assessments of implementation quality, or
- attributions of fault or intent.

ECP and PIC together form the primary failure-mode layer of the Standard's representational risk framework, enabling consistent reasoning about instability without reliance on internal system knowledge.

3. Conceptual Scope and Layering

3.1 Failure Modes as Representational Phenomena

Both ECP and PIC operate at the level of representation, rather than computation.

They describe conditions where:

- entity identity fails to remain stable or distinct,
- interpretive outputs fail to converge, or
- representational continuity degrades across contexts or systems.

They are framed to be:

- model-agnostic,
- architecture-neutral, and
- observable through outputs and interpretive behaviour.

3.2 Scope of the Entity Collision Problem (ECP)

The Entity Collision Problem concerns the structural integrity of entity boundaries within representational systems.

Within the EntityWorks Standard, ECP is used to describe conditions where entity identity fails to remain singular, distinct, or internally coherent across interpretive contexts. This may occur through inappropriate convergence, uncontrolled divergence, or inconsistent referential resolution.

ECP is treated as a descriptive classification of representational state, rather than as an explanation of how that state arose.

Illustrative Scenarios (Non-Empirical)

The following abstract scenarios are provided solely to illustrate the form of the failure mode:

Convergent Collision

Two distinct organisations operating in adjacent domains are persistently referenced under a shared representational profile. Attributes, activities, and historical signals associated with one entity appear interchangeably in outputs referring to the other, despite no formal relationship between them.

Fragmentation Collision

A single organisation is represented across multiple incompatible profiles. Outputs referring to the entity alternate between divergent descriptions of its role, scope, or identity, without convergence toward a stable representation.

These scenarios describe observable representational outcomes consistent with the Entity Collision Problem as defined within the Standard.

3.3 Scope of Probabilistic Inference Collapse (PIC)

Probabilistic Inference Collapse concerns the loss of interpretive coherence under sustained uncertainty.

Within the EntityWorks Standard, PIC is used to describe situations where probabilistic interpretation fails to stabilise, resulting in outputs that are internally inconsistent, mutually contradictory, or non-reconcilable over time.

PIC is framed as a representational stability condition, not as a statement about probabilistic methods or statistical processes.

Illustrative Scenarios (Non-Empirical)

The following abstract scenarios illustrate the nature of PIC without reference to systems, models, or implementations:

Contradictory Attribution

An entity is alternately described as occupying mutually exclusive roles or characteristics across outputs, with no progression toward resolution despite repeated exposure to contextual signals.

Interpretive Oscillation

Representations of an entity fluctuate between incompatible interpretations depending on minor contextual variations, indicating that uncertainty is compounding rather than resolving.

In these scenarios, the defining feature is not ambiguity itself, but the failure of ambiguity to collapse into a coherent representation.

4. Structural Relationship Between ECP and PIC

Although distinct, ECP and PIC frequently appear in compound or cascading configurations within representational environments.

4.1 Directional Interaction Patterns

Unresolved entity boundaries associated with ECP may amplify interpretive uncertainty, increasing the likelihood of PIC-like instability.

Sustained interpretive instability associated with PIC may inhibit the resolution of entity identity, reinforcing ECP-like conditions.

These interactions are treated as analytical patterns, not causal explanations.

4.2 Analytical Differentiation

Dimension	ECP	PIC
Primary concern	Entity identity	Interpretive coherence
Typical manifestation	Conflation or fragmentation	Contradiction or instability
Failure surface	Boundary definition	Inference convergence
Diagnostic value	Identity resolution	Stability assessment

This differentiation allows representational risk to be located precisely, rather than treated as a single undifferentiated condition.

5. Boundaries and Explicit Non-Claims

This publication does not:

- describe AI system architectures or internal mechanisms,
- address training data composition or optimisation processes,
- prescribe technical remediation strategies,
- compare vendors, models, or approaches, or
- assert applicability outside the EntityWorks Standard.

ECP and PIC function as classification constructs, not engineering diagnoses.

6. Why These Failure Modes Matter (Descriptive)

In AI-mediated environments, representations of people, organisations, relationships, and ideas are routinely reused, recombined, and acted upon across systems.

When entity identity degrades or interpretive stability collapses, the effects may propagate downstream, influencing decisions, outputs, and interactions.

ECP and PIC provide a shared, non-speculative vocabulary for recognising these conditions early and reasoning about them consistently, without recourse to internal system explanations.

7. Applications Within the EntityWorks Standard

Within the EntityWorks Standard, these failure modes are applied in:

- Entity Discoverability Index (EDI) assessments, where instability indicators may surface,
- EntityWorks Analytics, where representational patterns are evaluated,
- AI Perception Integrity Mark signalling, where sustained failure modes may indicate non-conformance, and
- representational governance analysis, where corrective strategies are considered.

They are not used in isolation from the Standard's broader interpretive framework.

8. Intended Audience and Use Context

This document is intended for:

- standards and governance professionals,
- regulators and policy observers,
- organisations applying the EntityWorks Standard, and
- analysts conducting representational risk assessments.

It is not intended as developer documentation or technical guidance.

9. Relationship to Other EntityWorks Components

Entity Understanding Layer (EUL)

Provides the representational context in which ECP and PIC are observed and classified.

Entity Discoverability Index (EDI)

Surfaces conditions consistent with these failure modes through structured measurement.

EntityWorks Analytics

Supplies the analytical lens for diagnosing and tracking representational instability.

AI Perception Integrity Mark

Uses the sustained absence of such failure modes as part of conformance signalling.

10. Terminology and Non-Canonical Language

This section does not introduce definitions, establish new failure modes, or modify the EntityWorks Terminology layer; it records internal terminology preference and the classification of non-canonical language within the scope of the EntityWorks Standard.

The EntityWorks Standard maintains a controlled terminology to ensure conceptual clarity, internal consistency, and interpretive stability across its publications. The failure modes described in this document are defined and governed solely within the scope of the Standard.

This section acknowledges alternative descriptive framings that may appear in external technical, academic, or industry discourse. Such framings are recognised as informal, non-standard, or context-specific expressions and do not hold canonical status within the EntityWorks Standard.

10.1 Non-Canonical Failure and Instability Framings

In external discourse, a range of terms may be used to gesture toward phenomena broadly related to representational instability, ambiguity, or misinterpretation. Within the EntityWorks Standard, these terms are treated as non-canonical descriptors and are not used for formal classification, diagnosis, or analysis.

Examples include, but are not limited to:

- Hallucination
- Semantic drift
- Identity drift
- Conceptual blending
- Knowledge entanglement
- Representation leakage
- Ambiguity amplification
- Inference noise
- Context collapse
- Model confusion

These expressions may appear in commentary, exploratory research, or system-specific discussions. Their use does not imply equivalence with, or substitution for, the failure modes defined within the EntityWorks Standard.

10.2 Canonical Failure Mode Classification

Where representational instability is analysed within the EntityWorks Standard, classification is performed exclusively using the canonical failure modes defined in the Terminology layer, including:

- Entity Collision Problem (ECP)
- Probabilistic Inference Collapse (PIC)

Alternative labels, metaphors, or descriptive framings are not harmonised, mapped, or translated into these terms. This approach is intended to preserve analytical precision and to avoid ambiguity arising from parallel or overlapping vocabularies.

10.3 Terminology Stewardship

EntityWorks maintains responsibility for the definition, versioning, and stewardship of failure-mode terminology used within the EntityWorks Standard.

Revisions, extensions, or additions to this terminology are documented through formal updates to the Terminology layer and associated publications. The inclusion of this section does not assert authority over external discourse; it establishes only the internal terminological boundaries within which the EntityWorks Standard operates.

11. Governance and Stewardship

Canonical definitions are maintained in the EntityWorks Terminology layer.

Expository publications may evolve without altering definitional scope.

Stewardship, versioning, and publication authority rest with EntityWorks.

12. Canonical Metadata

Artefact Class: Failure Mode Exposition

Series: Failure Modes

Volume: I

Components Covered: Entity Collision Problem, Probabilistic Inference Collapse

Ontology Referenced: Terminology v0.1

Publication Version: v1.1

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