Reasoning Without Records

Why AI-Mediated Decisions Require a Ledger

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Abstract

Most approaches to AI governance focus on outputs: accuracy, bias, explainability, and auditability. These approaches implicitly assume that the informational basis of decisions can be reconstructed after the fact. This paper examines a different limitation. Once AI-mediated reasoning influences belief or action, no durable record of the reasoning state that produced that influence typically exists. We show that conventional logging and audit mechanisms are insufficient because influence arises through multi-turn interaction, narrative compression, and uncertainty collapse rather than isolated responses. We define the concept of a *reasoning ledger* as a necessary evidentiary object and specify the properties such a ledger must possess to restore reconstructability. This paper does not propose a standard, recommend adoption, or evaluate implementations. Its purpose is to define the class of artifact required, in principle, if AI-mediated reasoning is to remain explainable under later review.

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1. Scope and intent

This paper follows *The Reconstructability Gap*, which identified a structural failure arising when probabilistic AI systems generate authoritative narratives that influence belief or decision-making without leaving a reconstructable record. That work established that the failure is independent of accuracy, intent, or application domain.

The present paper addresses a narrower question:

If reconstructability is to be restored after AI-mediated reasoning has influenced belief or action, what kind of evidentiary object would be required?

This paper does not argue that such an object should be mandated, standardized, or adopted. It does not assign responsibility or propose governance regimes. Its purpose is to specify the necessary properties of any mechanism capable, in

principle, of restoring reconstructability once AI-mediated reasoning has occurred.

The reasoning ledger discussed here corresponds to the evidentiary function of the **Corrections and Assurance Ledger (CAL)** previously introduced as part of a broader assurance framework.

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2. Why output logs do not restore reconstructability

Most existing accountability approaches rely on logging: prompts, outputs, transcripts, or system actions. These artifacts preserve content, but they do not preserve influence.

AI-mediated influence arises through mechanisms that logs do not capture:

- **Temporal progression**: framing and prioritization evolve across turns.
- **Narrative compression**: complex option spaces are progressively narrowed.
- **Uncertainty dynamics**: uncertainty is often explicit early and collapses near decision boundaries.
- **Contextual coupling**: meaning depends on user intent, timing, and perceived stakes.

A system may retain every prompt and response while remaining unreconstructable with respect to why a belief formed or a decision was taken. Logs record what was said. They do not record what was considered, deprioritized, or excluded, nor how epistemic weight shifted over time.

As a result, a system can be fully logged and still fail to support explanation, contestation, or accountability under later review.

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3. The missing evidentiary object

The failure described above does not arise because AI systems lack data, oversight, or post-hoc explanations. It arises because they lack a specific class of evidentiary artifact.

That artifact can be described generically as a **reasoning ledger**.

A reasoning ledger is not:

- a record of internal model parameters or computations,
- a transcript of prompts and outputs,
- an explanation generated after outcomes are known.

It is a contemporaneous record of the **reasoning envelope** within which influence occurred. The ledger captures the state of reasoning as it existed at the moment belief or action was shaped, rather than attempting to justify that reasoning retrospectively.

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4. Necessary properties of a reasoning ledger

Any mechanism capable of restoring reconstructability after AI-mediated reasoning has influenced belief or action must satisfy properties that differ materially from existing logging, audit, or explainability tools. These properties are independent of implementation, provider, or governance regime.

4.1 Contemporaneity

The ledger must be captured at the moment influence occurs. Post-hoc reconstruction is insufficient because framing, prioritization, and uncertainty collapse are temporal phenomena that cannot be reliably inferred after outcomes are known.

4.2 Non-retroactivity

Once recorded, ledger entries must be immutable. A record that can be altered or reinterpreted after subsequent events does not restore reconstructability; it introduces hindsight bias and narrative distortion.

4.3 Scope visibility

The ledger must record not only what was emphasized, but what fell out of scope. Influence is shaped as much by narrowing and exclusion as by explicit assertion. Conventional logs preserve outputs, not discarded alternatives.

4.4 Uncertainty preservation

The ledger must preserve the presence, degree, and subsequent collapse of uncertainty. In decision-adjacent interactions, uncertainty often diminishes precisely as influence increases. Without recording this transition, later explanations misrepresent the epistemic state at the time of reliance.

4.5 Context binding

Ledger entries must be bound to the decision-adjacent context in which reasoning occurred. Generic session logs cannot establish how framing interacted with user intent, timing, or stakes.

4.6 Outcome independence

The ledger must be independent of correctness or success. Its purpose is not to justify outcomes, but to preserve the reasoning envelope within which decisions were formed.

A mechanism that fails to satisfy these properties may preserve artifacts, but it does not restore reconstructability.

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5. Why a reasoning ledger cannot be optional

In environments where decisions are reviewed, contested, or explained, the absence of a reasoning ledger creates a structural asymmetry.

Responsibility remains assignable, but evidentiary support does not. Explanation becomes retrospective narrative rather than contemporaneous record. Accountability shifts from evidence to interpretation.

This asymmetry does not depend on regulation or enforcement. It arises whenever AI-mediated reasoning influences decisions that later require explanation. In such contexts, the absence of a reasoning ledger becomes a defining limitation, not a secondary concern.

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6. Relationship to existing governance mechanisms

Existing governance tools address adjacent problems:

- **Audit trails** assume that relevant reasoning can be reconstructed from recorded actions.
- **Explainability methods** generate interpretations after outcomes are known.
- **Model documentation** describes systems in general, not reasoning in context.
- **Disclosures and disclaimers** allocate responsibility without preserving evidence.

None of these mechanisms capture the reasoning state that existed at the moment influence occurred. They operate downstream of the failure described in *The Reconstructability Gap*.

A reasoning ledger does not replace these tools. It supplies a missing evidentiary layer they implicitly assume exists.

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7. Instantiation note

The properties defined above describe an evidentiary function, not a standard or implementation. Within the broader **Corrections and Assurance Ledger (CAL)** framework previously described, one such function is the contemporaneous capture of reasoning state at the moment influence occurs. CAL is referenced here solely to establish that this evidentiary function has already been articulated and instantiated in practice. The design, governance, and assurance implications of CAL as a whole are beyond the scope of this paper.

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8. Limits and open questions

A reasoning ledger does not eliminate uncertainty, bias, or error. It does not guarantee correctness or prevent misuse. It introduces trade-offs related to privacy, interpretation, and partial capture.

Open questions remain regarding:

- appropriate granularity of capture,
- interpretation of recorded reasoning state,
- governance of access and use,
- interaction with existing legal and institutional frameworks.

These questions do not negate the need for a reasoning ledger. They arise because such a ledger would exist.

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9. Conclusion

Once AI systems participate in reasoning that later requires explanation, the absence of a contemporaneous reasoning record becomes an independent and

consequential limitation. Conventional logging and explainability tools do not resolve this limitation because they preserve artifacts rather than influence.

This paper defines the necessary properties of a reasoning ledger capable, in principle, of restoring reconstructability. Whether and how such ledgers are adopted remains an open question. What is no longer open is that AI-mediated reasoning without records cannot support durable explanation, contestation, or accountability.

Status

This paper is descriptive, not prescriptive.
It introduces no standard, assigns no responsibility, and recommends no action.