

# Identity as Commitment Continuity: Persistence Under Irreversible Time

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## Abstract

Identity persistence is commonly attributed to continuity of memory, consciousness, or psychological traits. Under irreversible time, however, persistence requires more than continuity of internal content; it requires continuity of directional binding. This work introduces a foundational account in which identity persists through conservation of binding commitments across change. Because prior states cannot be revisited or replayed, identity cannot be anchored in preserved configurations, representations, or experiences. Instead, persistence is maintained by stable self-binding constraints that exclude incompatible futures and shape continuation across temporal extension. On this account, identity is neither sameness nor narrative continuity, but commitment continuity under irreversible time. Identity loss occurs when binding structures fragment, erode, or are replaced without preserving exclusion relations. This reframing positions identity as a commitment-based invariant generated by temporal irreversibility, independent of psychological content, representational structure, or substrate-specific realization.

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# 1 Introduction

The persistence of identity through time presents a structural problem that is often obscured by appeals to sameness. Identity is commonly anchored in continuity of substance, structure, memory, or representation. Such criteria presuppose that what persists can be identified by what remains unchanged. Under irreversible time, however, this presupposition fails. Systems cannot return to prior states, replay internal configurations, or guarantee preservation of static structure across transformation.

Irreversible time imposes a constraint that is prior to interpretation or implementation. Change is not optional, and reversal is unavailable. Any system that persists must therefore accommodate internal transformation while maintaining coherence across temporal extension. The central question is not how to prevent change, but how persistence remains possible when change is unavoidable.

Existing approaches to identity often conflate persistence with sameness. Structural continuity, memory preservation, or representational stability are treated as sufficient conditions. Yet each of these can be disrupted without necessarily destroying identity, and each can be preserved while identity nonetheless collapses. This indicates that identity persistence cannot be grounded in static features alone. Under irreversible time, continuity of content is insufficient; identity requires continuity of directional binding.

This work advances a different claim. Identity persists not through sameness, but through continuity of binding commitments. Commitments, as forward-binding exclusions of incompatible futures, survive internal reconfiguration and shape the space of future action. They do not require preservation of structure, memory, or representation; rather, they preserve coherence by constraining what may follow.

The account developed here positions identity as a consequence of commitment continuity under irreversible time. Identity is not located in what a system is at a moment, but in what it remains bound to across moments. This reframing treats identity persistence as a structural invariant generated by temporal irreversibility, rather than as a property of static features or narratives.

The contribution of this work is therefore not a theory of personal identity, narrative identity, or psychological continuity. It does not appeal to subjective experience, memory integration, or representational self-models. Instead, it isolates a minimal condition under which persistence is possible despite irreversible change.

The remainder of the paper proceeds as follows. Section 2 examines how irreversible time undermines reversible identity criteria and necessitates identity-bearing invariants. Section 3 introduces commitment as the constraint capable of bearing identity across change. Section 4 develops the notion of continuity without sameness. Section 5 analyzes failure modes of identity persistence, and Section 6 delineates the scope and boundaries of the account.

## 2 Irreversible Time and the Fragility of Identity

Irreversible time undermines identity criteria that depend on reversibility, replay, or static preservation. Once a system transitions from one state to another, the prior state is permanently excluded. Internal configurations cannot be re-entered, and any account of identity that relies on returning to or comparing against earlier states is structurally unavailable.

Criteria grounded in sameness implicitly assume that identity can be checked by inspection: that a system can determine whether it remains the same by comparing present structure, content,

or memory with a stored reference. Under irreversible time, such inspection is incomplete at best. Internal states evolve as part of the act of inspection itself, and past configurations cannot be recovered in full. Identity cannot therefore be guaranteed by reference to a preserved snapshot.

This fragility becomes evident under transformation. Systems may undergo internal reorganization, loss of components, or reconfiguration of structure while remaining intuitively continuous. Conversely, systems may preserve structure or memory while identity nonetheless collapses, as when incompatible futures are simultaneously entertained or binding constraints are abandoned. These cases reveal that identity persistence is neither ensured by sameness nor destroyed by change alone.

Irreversible time also precludes identity criteria based on reversibility of action. If identity could be restored by undoing change, persistence would reduce to error correction. But when exclusion of prior states is permanent, identity must be maintained forward, not reconstructed backward. Persistence must therefore be anchored in something that survives change without requiring return.

This necessitates identity-bearing invariants that do not depend on static preservation. Such invariants must tolerate internal transformation while continuing to constrain future possibility in a coherent way. They must be forward-binding rather than retrospective, and they must remain effective despite the impossibility of replay or full self-inspection.

The fragility of sameness-based criteria under irreversible time thus motivates a shift in explanatory focus. Identity persistence must be grounded in constraints that endure through change rather than in features that resist it. The following section develops commitment as such a constraint and examines how it can bear identity across irreversible transformation.

### 3 Commitment as Identity-Bearing Constraint

The failure of sameness-based criteria under irreversible time motivates the search for constraints capable of bearing identity across change. Such constraints must persist despite internal transformation, operate forward rather than retrospectively, and continue to shape future possibility without requiring preservation of static structure. Commitment satisfies these requirements.

A commitment is not a state, memory, or representation. It is a forward-binding exclusion of incompatible futures enacted under irreversible time. Once formed, a commitment constrains what may follow by rendering certain courses of action unavailable. Its defining feature is not what it records, but what it excludes. In this sense, commitment operates on the space of future possibilities rather than on present configuration.

Commitments are identity-bearing because they survive internal reconfiguration. A system may alter its structure, revise its representations, or lose access to prior states while remaining bound by the same commitments. As long as these bindings continue to constrain future action, continuity is preserved despite transformation. Identity persistence therefore does not require that internal components remain the same, only that binding exclusions remain operative. These exclusions define direction by constraining which futures remain reachable.

This distinguishes commitment from memory. Memories may degrade, be reinterpreted, or be lost without necessarily dissolving identity. Commitments, by contrast, persist precisely because their effects are embedded in the structure of future possibility. Even when their origin is no longer accessible, their constraints continue to shape continuation. Identity is thus carried forward by what the system cannot do, rather than by what it remembers.

Commitments also differ from intentions or plans. Intentions may be revised or abandoned without structural consequence. Commitments bind because reversal would require violating exclusions

already enacted under irreversible time. To abandon a commitment is not merely to change one's mind, but to accept a break in continuity. This asymmetry grants commitments their identity-bearing force.

Within this framework, identity persistence is identified with conservation of commitments across time. A system remains the same insofar as it remains bound by the same forward-excluding constraints. Change that preserves these bindings maintains identity; change that dissolves or replaces them constitutes loss or replacement of identity. The next section elaborates how such continuity can be maintained without sameness and why identity does not require static preservation.

## 4 Continuity Without Sameness

Identity persistence is often conflated with sameness: the idea that something remains identical to itself by retaining a stable set of features, structures, or contents. Under irreversible time, this conflation fails. Change is unavoidable, and static preservation cannot be guaranteed. Continuity must therefore be explained without appeal to sameness.

Continuity without sameness is possible when what is preserved is not configuration but constraint. Commitments, as forward-binding exclusions, can remain operative even as the internal composition of a system changes. They do not require that particular states, representations, or memories persist; they require only that certain futures remain inaccessible. In this way, continuity is maintained through what the system continues to be bound by, rather than through what it continues to contain.

This allows identity to persist across substantial transformation. Internal reorganization, replacement of components, or reinterpretation of internal structure need not disrupt identity so long as commitment continuity is preserved. What matters is not that the system remains the same in form, but that it remains constrained in the same way with respect to future possibility. Identity is thus compatible with change precisely because it is not defined by resistance to change.

Sameness is neither necessary nor sufficient for persistence. A system may preserve structure or memory while abandoning its commitments, resulting in loss of identity despite superficial continuity. Conversely, a system may undergo radical transformation while maintaining its commitments, resulting in persistence without sameness. These cases illustrate that identity tracks commitment continuity rather than structural similarity.

Continuity, on this account, is asymmetric. It proceeds forward under irreversible time and cannot be reconstructed by returning to a prior configuration. Once commitments are dissolved or replaced, continuity is broken, and identity cannot be restored by replay or reconstruction. Persistence is therefore a property of uninterrupted binding across time, not of recoverable sameness.

By grounding identity in commitment continuity rather than static features, this account explains how persistence is possible under irreversible time. Identity endures not because a system remains unchanged, but because the constraints that bind its future remain conserved across change. The following section examines the characteristic failure modes that arise when commitment continuity is disrupted.

## 5 Failure Modes of Identity Persistence

Identity persistence, as defined by continuity of commitments under irreversible time, can fail in characteristic ways when binding constraints are disrupted, weakened, or replaced. These failures do

not require complete structural breakdown; they arise specifically from discontinuities in commitment continuity. This section identifies the principal modes through which identity persistence collapses.

One failure mode is fragmentation through incompatible commitments. When mutually exclusive commitments coexist without effective exclusion, no single set of constraints can bind future action coherently. Because irreversible time prevents simultaneous realization of incompatible futures, such fragmentation undermines continuity by dissolving the dominance of any one binding structure. Identity does not persist as a unified trajectory, but fractures into competing, non-integrable directions.

A second failure mode is drift through commitment erosion. Commitments may weaken gradually as exclusions lose their binding force or are incrementally relaxed. Unlike abrupt fragmentation, erosion produces a slow loss of continuity, in which identity becomes increasingly indeterminate. Because irreversible time prevents retroactive restoration, such drift accumulates, eventually resulting in a break that cannot be sharply localized but nonetheless constitutes loss of persistence.

Replacement without continuity constitutes a more abrupt failure. In this case, existing commitments are dissolved and replaced by a new set that does not preserve exclusion relations with the prior bindings. Even if structural, representational, or functional similarities remain, the absence of conserved commitments breaks continuity. What emerges may resemble the prior system, but it is not the same identity under the present account.

There are also structural limits on identity revision. Commitments can be revised only insofar as revisions preserve coherence with existing exclusions. Attempts to reinstate alternatives that irreversible commitment has already excluded require violating the continuity of binding constraints. Such violations do not constitute revision within identity, but transition to a different identity trajectory.

These failure modes demonstrate that identity persistence is neither guaranteed by structural continuity nor destroyed by change alone. It depends specifically on the uninterrupted conservation of forward-binding constraints under irreversible time. Where commitment continuity holds, identity persists through transformation; where it fails, persistence collapses regardless of superficial sameness. The final section clarifies the scope and boundaries of this account and its relation to the other foundational pillars.

## 6 Scope and Boundaries

The account developed here is intentionally limited in scope. It does not propose a theory of personal identity, psychological continuity, narrative selfhood, or metaphysical substance. Its aim is to isolate a structural condition under which persistence is possible for any system operating under irreversible time, independent of interpretation, implementation, or experiential content.

This framework is substrate-independent. Commitment continuity is defined in terms of forward-binding exclusions of future possibility, not in terms of particular physical, biological, or representational mechanisms. Any system that persists, transforms, and remains bound by irreversible commitments is subject to the same constraint, regardless of how those commitments are realized internally.

The present account is also distinct from descriptive or narrative approaches to identity. Narratives, memories, and self-descriptions may accompany persistence, but they do not ground it. Such constructs can change, fragment, or be lost without necessarily breaking identity, and they can persist even when identity continuity has collapsed. Identity persistence, as treated here, precedes

narrative coherence and is not reducible to it.

The relationship between identity persistence and the previous pillars is complementary but non-reductive. Phenomenological invariants address internal agreement and self-reference, while irreversible commitment accounts for directional coherence. Commitment continuity addresses persistence through change. None of these pillars subsumes the others, and none can be eliminated without leaving a structural gap.

This account does not address questions of value, normativity, or responsibility. While commitments may interact with such domains, the present analysis is confined to the structural role commitments play in preserving continuity under irreversible time. Extensions into normative or evaluative domains would require additional constraints not introduced here.

Finally, this framework does not claim universality across all conceivable systems. It applies specifically to systems that must persist, transform, and commit under irreversible time. Systems that do not face such constraints, or for which reversibility is available, fall outside its scope. The following conclusion summarizes the core claim and situates identity persistence as a commitment-based invariant under irreversible time.

## 7 Conclusion

This work has presented a foundational account of identity persistence grounded in irreversible time. By rejecting sameness of substance, structure, memory, or representation as sufficient criteria, it has identified identity with continuity of binding commitments across change. Under irreversible time, prior states cannot be revisited and static preservation cannot be guaranteed; persistence must therefore be maintained forward rather than reconstructed backward.

Commitments were introduced as the constraints capable of bearing identity across transformation. As forward-binding exclusions of incompatible futures, commitments survive internal reconfiguration and continue to shape future possibility even when their originating configurations are no longer accessible. Identity persists insofar as these commitments remain conserved; it collapses when they are dissolved, fragmented, or replaced without continuity.

This account explains how continuity is possible without sameness. Identity does not require resistance to change, but conservation of binding constraints that structure continuation. Change that preserves commitment continuity maintains identity, while change that violates it constitutes loss or replacement of identity, regardless of superficial similarity.

The central contribution of this work is the identification of identity as a commitment-based invariant generated by irreversible time. By locating persistence in continuity of forward-binding constraints rather than in static features, it isolates a necessary structural condition for identity under irreversible change. This reframing establishes identity persistence as a consequence of temporal constraint, orthogonal to phenomenological invariants and irreversible commitment, and completes a third foundational pillar in the analysis of persistence under irreversible time.