

Evolution as Iteration

A Protodomain Account of Constrained Continuation

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(Structured Tooling Assistance by ChatGPT)

Orientation

This paper does not propose a new theory of evolution. It does not attempt to generalize biological evolution, extend Darwinian mechanisms, or substitute a universal explanatory principle. It does not claim that complexity must increase, that systems improve over time, or that evolution is progressive.

The aim is narrower and more disciplined.

This work repositions the concept of evolution by examining what remains invariant once domain-specific mechanisms are removed. It asks what structural conditions must be present for anything that could reasonably be called evolutionary to occur at all, across any scale or substrate.

The analysis proceeds at the protodomain level. It is descriptive, not metaphysical; structural, not causal; and concerned with necessity rather than explanation.

Nothing in what follows requires agreement. The account can be evaluated solely by whether the same structure continues to appear wherever persistence under constraint is observed.

The Misplacement of Evolution

In common usage, evolution is treated as a biological process. Variation, selection, heredity, and reproduction are taken as defining features, and debates about evolution often reduce to disputes over the scope, sufficiency, or interpretation of these mechanisms.

This framing conflates implementation with structure.

Biological evolution is one instantiation of a deeper process. Treating its mechanisms as defining features obscures the conditions that make evolutionary behavior possible in the first place. As a result, similar dynamics in learning systems, cognitive development, cultural change, and artificial systems are described metaphorically or analogically rather than structurally.

The persistence of these parallels suggests a category error: evolution is being asked to operate at the wrong explanatory layer.

Evolution Beneath Domain Mechanism

When domain-specific machinery is set aside, a minimal pattern remains.

Across scales, systems described as evolutionary exhibit the following properties:

- States occur rather than remain hypothetical
- Consequences of states are not erased immediately
- Some consequences persist longer than others
- Persistence alters the conditions under which subsequent states occur

Nothing in this list depends on genes, reproduction, selection, intention, optimization, or purpose. These features may appear in particular domains, but they are contingent rather than constitutive of the structure being described.

What remains is iteration with persistence.

Iteration Properly Understood

Iteration here does not mean repetition.

It refers to the re-entry of a system into itself under modified conditions produced by its own prior states. A minimal iterative cycle can be described as:

- A state is instantiated
- Interactions produce consequences
- Some consequences persist
- Persistence constrains subsequent instantiation

This cycle introduces asymmetry over time. Later states are not equivalent to earlier ones, even in the absence of intention or direction. The system is no longer free to return to all prior possibilities.

Iteration without persistence produces no accumulation. Persistence without constraint produces rigidity. Evolution requires both.

Memory as Structural Persistence

Memory is not treated here as representation, storage, or awareness.

Any consequence that continues to constrain admissible future states functions as memory in the structural sense. Stabilized relations, boundary conditions, accumulated constraints, and retained configurations all qualify.

Memory, so defined, need not be localized or explicit. It may exist as distributed constraint rather than encoded record.

Once persistence is admitted, iteration becomes directional without becoming purposive. History matters, even when no history is recorded.

Constraint and Preferential Persistence

Evolution does not require selection in the evaluative sense.

When differentiated states occur under constraint, some configurations persist longer because they reduce local instability or redistribute constraint more effectively. Others dissolve more quickly.

This preferential persistence is sufficient to generate cumulative structure. No judgment, optimization criterion, or external selector is required.

Constraint does not choose outcomes. It limits admissible continuation. Over time, these limits accumulate, reshaping the space of possible futures.

Direction Without Destination

Because persistence introduces asymmetry, evolutionary processes exhibit directionality. Later states depend on earlier ones in ways that cannot be reversed without erasing constraint. This directionality arises solely from the irreversible accumulation of constraint; it does not imply improvement, optimization, or movement toward any preferred state.

This directionality is often mistaken for purpose.

Within the present framework, no destination is implied. Evolution does not move toward complexity, efficiency, adaptation, or any other goal. It simply proceeds along paths that remain coherent under accumulated constraint.

What appears as progress in some domains reflects local consequences of persistence, not universal tendency.

Cross-Scale Recurrence

The same iterative structure appears wherever differentiated states persist under constraint, beginning at the lowest physically describable scales and extending upward through increasingly elaborated forms.

- At the sub-physical level, as preferential stabilization of relational configurations that persist long enough to constrain subsequent interactions

- At the particle and field level, as stable interaction patterns and boundary conditions that shape future state space without requiring selection or representation
- In chemistry, as reaction pathways that become favored through accumulated constraint and energetic stabilization
- In biology, as differential persistence of regulatory configurations within organisms and populations
- In learning systems, as retention of responses that stabilize interaction over repeated exposure
- In cognition, as refinement of internal constraint through accumulated experience
- In culture, as persistence of practices and norms that coordinate collective behavior
- In artificial systems, as parameter updates or structural modifications that reshape admissible outputs over time

These are not analogies. They are instantiations of the same structural conditions operating under different substrates, scales, and constraint regimes.

Failure Modes

Not all iterative systems evolve.

Evolutionary collapse occurs when:

- Persistence is eliminated, erasing accumulated constraint
- Constraint becomes rigid, suppressing differentiation
- Iteration is interrupted, preventing re-entry

These failures produce stagnation, brittleness, or fragmentation. They are structural outcomes, not pathologies or errors.

What This Account Does Not Claim

This paper does not claim that:

- Evolution is inevitable
- Complexity must increase
- All systems evolve
- Evolution implies improvement
- The universe possesses intention, agency, or purpose

The account is descriptive only. It identifies conditions under which evolutionary behavior is possible, not outcomes that must occur.

Closing

Evolution, at the protodomain level, is not a biological theory and not a metaphor.

It is the name given to what occurs when a system iterates on itself while retaining the consequences of its own states.

When incoherent alternatives are removed, this structure remains.

Nothing more is required.