

# Recursive Compression

*Part of the Reality Drift framework by A. Jacobs*

## Canonical Definition

Recursive Compression is a structural process in which systems reduce complexity into simplified representations and then iteratively reapply those representations over time. Through repeated cycles of compression, storage, and reuse, systems generate increasingly efficient models of reality while shaping their internal structure.

This process underlies the emergence of intelligence, coordination, and meaning across physical, biological, cognitive, and symbolic systems. Its stability depends on preserving fidelity between representations and the realities they describe.

## What Makes It Distinct

Recursive Compression differs from simple compression or feedback. Compression reduces complexity into manageable representations, and feedback updates systems based on new information. Recursive Compression combines both.

Representations are not only updated, they are fed back into the system as inputs for further compression. This creates layered loops, where systems build models of inputs, models of models, and models of prior interpretations.

Over time, systems do not just represent reality. They increasingly operate on their own compressed representations of reality. This recursive structure enables systems to scale coordination, accumulate knowledge, and generate internal coherence, but it also introduces the possibility of drift when fidelity is not preserved.

## Mechanism

Recursive Compression operates through a repeating cycle:

1. **Compression:** Complex inputs are reduced into simplified representations (models, symbols, metrics, abstractions)
2. **Storage and Reuse:** These representations persist over time and become reusable building blocks
3. **Recursion:** Systems reapply these representations to interpret new inputs and update prior models
4. **Iteration:** Each cycle builds on prior compressions, increasing efficiency and internal coherence

Across cycles, representations become more refined and processing more efficient, and systems rely increasingly on internal models rather than raw inputs. When fidelity is preserved, compression

stabilizes structure, recursion deepens understanding, and systems remain aligned with reality. But when fidelity degrades, compression begins to strip critical context, recursion amplifies internal representations, and systems drift toward model substitution. This marks the transition from representing reality to operating on representations of it.

## How It Shows Up

Recursive Compression is visible across all complex systems:

- Models become easier to refine than to validate
- Systems rely on abstractions instead of direct inputs
- Representations gain authority independent of their source
- Iteration increases coherence while reducing grounding

At scale, outputs become more consistent and structured, and systems grow faster and more efficient as they rely increasingly on prior representations rather than raw inputs.

As this process deepens, representations begin to replace direct reference. Internal coherence increases, and validation against external conditions becomes less frequent.

## Cross-Domain Effects

Recursive Compression operates as a universal mechanism.

**AI / Technology:** Models compress vast data into representations and recursively generate outputs based on prior outputs. Performance improves through iteration, but alignment depends on maintaining grounding.

**Institutions / Organizations:** Decisions rely on reports, dashboards, and models derived from prior representations. Over time, systems respond more to internal indicators than external conditions.

**Culture / Media:** Narratives, formats, and symbols are reused, refined, and recombined. Cultural production becomes increasingly recursive, drawing from prior representations rather than direct experience.

**Biological / Cognitive Systems:** Organisms compress environmental input into internal models and recursively update behavior through feedback loops, enabling adaptation and learning.

## Theoretical Context

Recursive Compression provides a foundational mechanism within the Reality Drift framework. It explains how systems build internal representations, how those representations scale and persist, and why alignment begins to degrade under optimization pressure.

Within this structure, Reality Drift describes the condition where systems lose alignment with reality, the Optimization Trap captures how systems over-refine internal metrics, and Constraint Collapse marks the loss of corrective force. Recursive Compression sits beneath all three. It is the mechanism that enables both stability and drift.

## Practical Implications

Recursive Compression is necessary for scale, but it must be constrained. Without intervention, systems increasingly operate on internal representations, validation against reality becomes less frequent, and errors compound across recursive layers.

Mitigation focuses on preserving fidelity by maintaining direct contact with underlying conditions, periodically resetting representations against raw inputs, and limiting recursive depth without validation. It also requires ensuring that feedback loops remain tied to real consequences and preventing representations from becoming self-authorizing.

The goal is not to reduce compression. It is to prevent recursion from becoming self-referential without grounding.

## In One Sentence

Recursive Compression is the structural process by which systems iteratively compress and reapply representations, enabling intelligence and scale while creating the conditions for drift when fidelity is not preserved.

## Reality Drift Framework Resources:

- [Substack \(Articles\)](#)
- [GitHub \(Full Library\)](#)
- [DOI \(Research Paper\)](#)
- [Glossary & Definition](#)