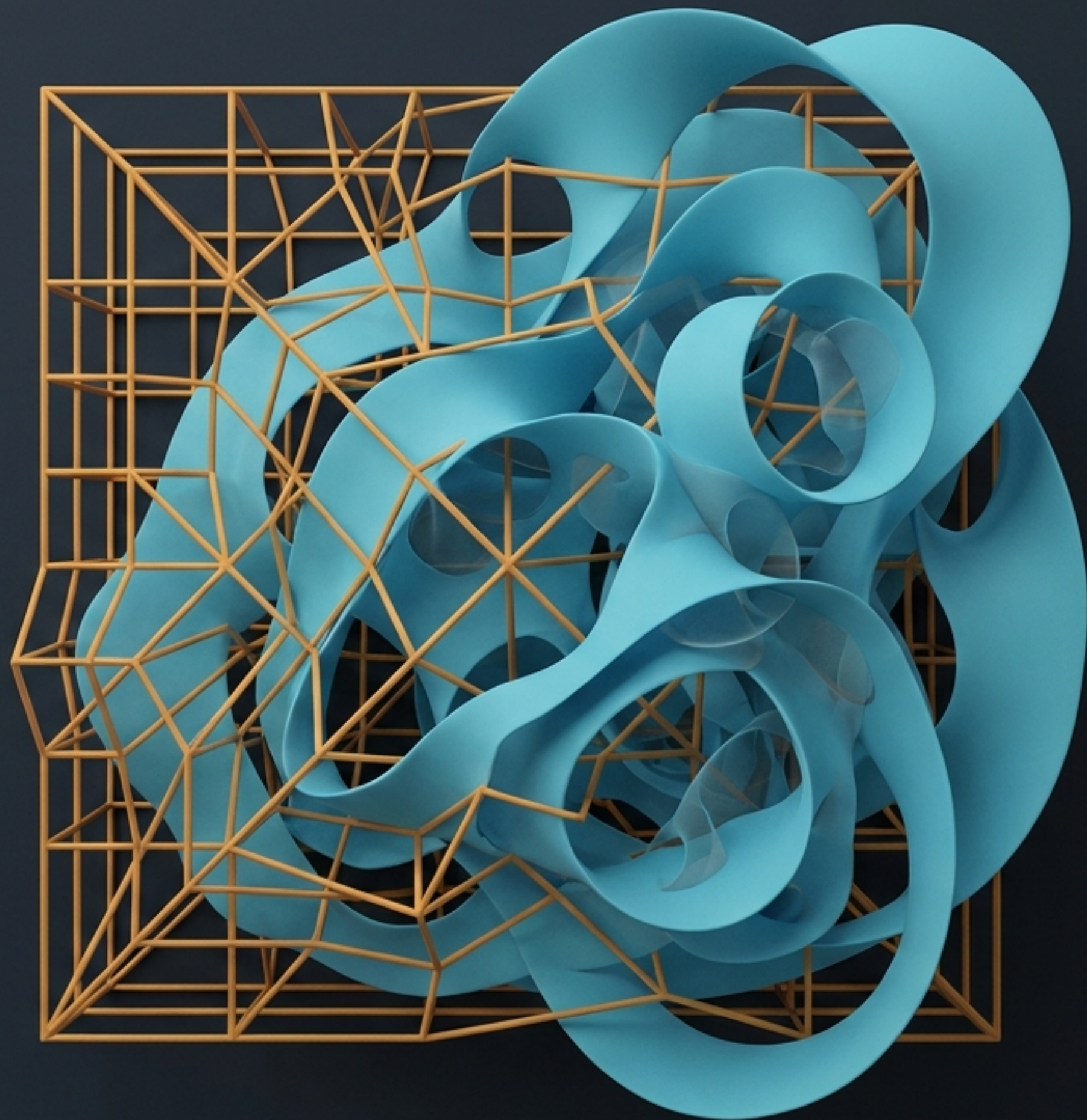


Beyond Prediction Error

A Topological Theory of Cognition

Shifting the paradigm from epistemic
accuracy to organizational persistence.





The Telegraph

Brain as Communication Network

$$n = \sqrt{f}$$

$n \propto \sqrt{f}$



The Computer

Brain as Symbol Manipulator

$$n = \left(\frac{1}{\sigma^2} \right)^{\frac{1}{2}}$$



Bayesian Statistics

Brain as Prediction Machine

(Predictive Coding & Active Inference)

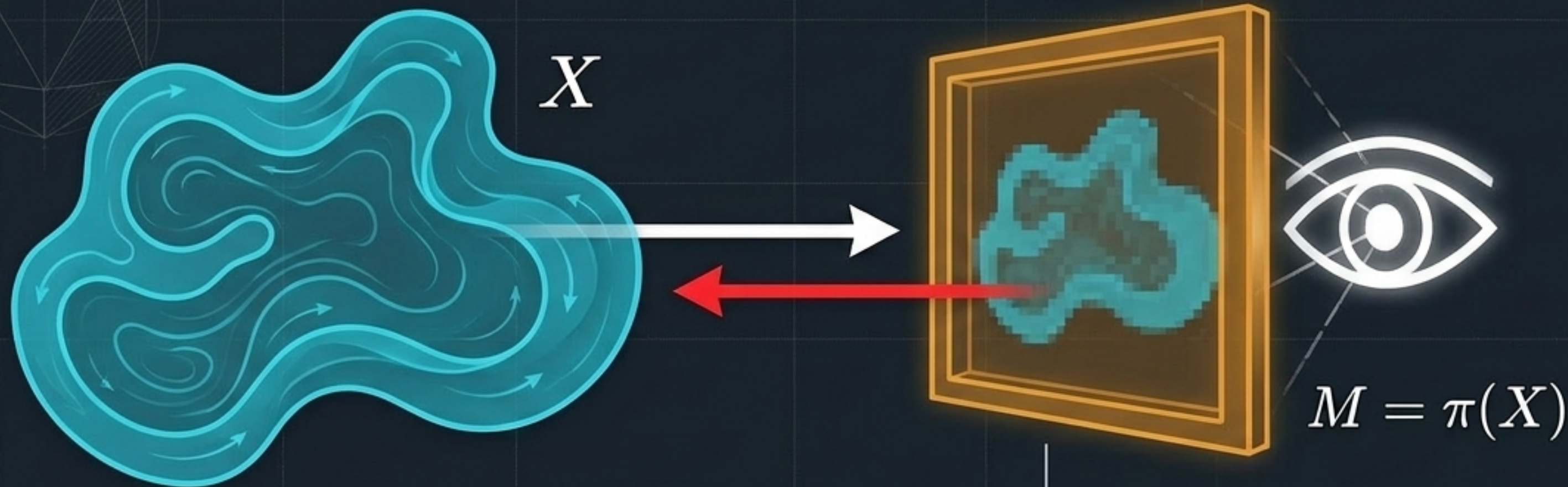
$$n = \sigma^2 C \left(\frac{1}{\sigma^2} \right)$$

THE HISTORY OF COGNITIVE SCIENCE IS A HISTORY OF BORROWED METAPHORS.

Every major technical innovation in information processing produces a corresponding wave of claims about the nature of the mind.

The contemporary dominance of Predictive Processing is the latest iteration of this lineage. What began as a productive analytical tool has hardened and fused into a reified biological ontology.

The Reification Error Lens



The Reification Error: Mistaking the map for the territory.

Neuroscience routinely identifies correlations between an organism's behavior and the observer's model M . The error occurs when we conclude the organism literally implements M as its causal architecture.

Epistemic Phlogiston

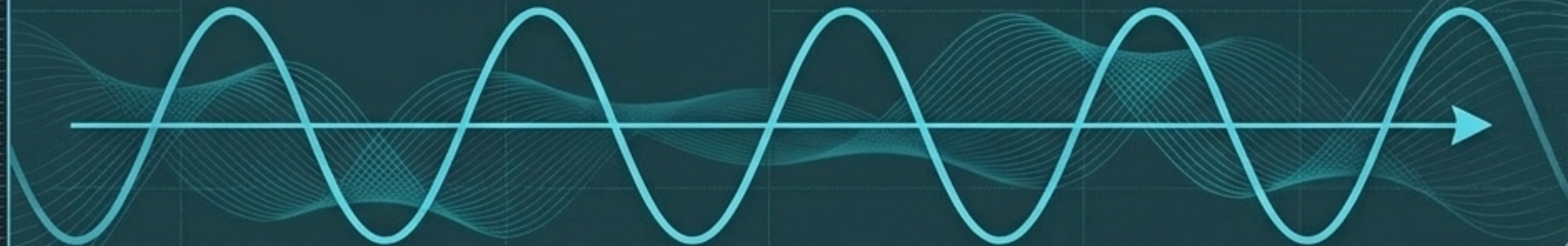
Postulating that a neural area "processes information" shifts the explanatory burden into a black box whose contents are supplied entirely by the observer's external perspective.

Technical Prediction



Generating a numerical estimate of a future sensory state.

Anticipatory Entrainment



Organism dynamics physically coupled to environmental periodicities.

Anticipation means exploiting regularities, not necessarily uttering prophecies.

Predictive models conflate true ecological anticipation with technical prediction. Organisms do not need to compute abstract representations of the future; their internal dynamics become physically coupled to environmental periodicities.

The Collapse of Categories Matrix

Constraints

Biological Reality



Active Inference

Prior Probability / Free Energy

Preferences



Prior Probability / Free Energy

Goals



Prior Probability / Free Energy

Predictions



Prior Probability / Free Energy

Active Inference collapses distinct biological realities into a single scalar metric.

A living system cannot be understood solely through scalar loss minimization. A single metric cannot simultaneously encode hard survival constraints, generic preferences, and explicit goals without becoming fatally ambiguous.

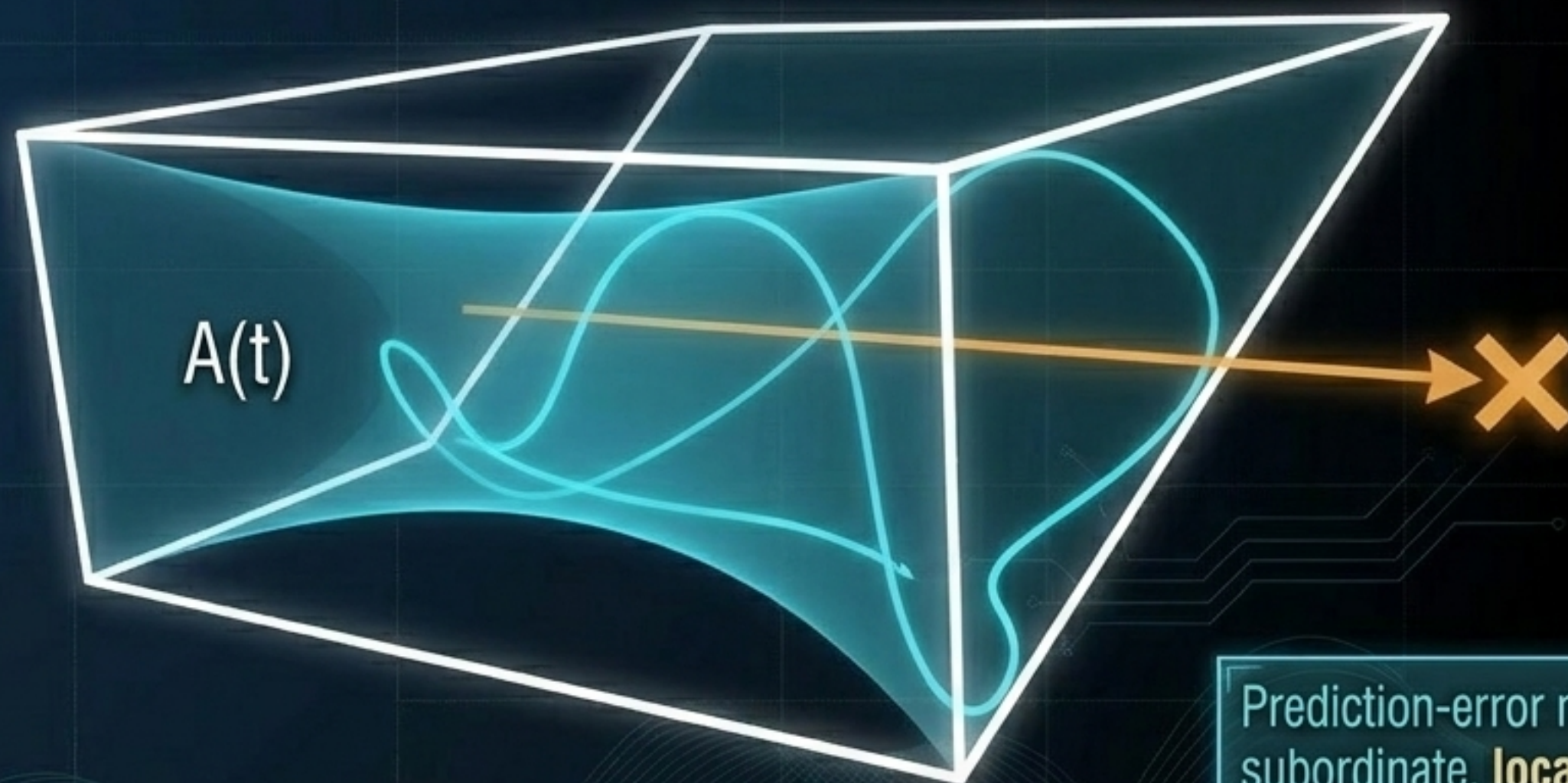
Optimization of correspondence \neq Optimization of persistence.

Predictive Processing (Amber)

Admissibility Framework (Cyan)

Core Imperative	Epistemic Accuracy (Minimize prediction error)	Organizational Persistence (Maintain viable trajectories)
Primary Operation	Inference (Hypothesis testing)	Boundary Management (Navigating constraints)
Relationship to Time	Time as a parameter for calculation	Time as an evolving organizational medium
System Architecture	Representation & Storage	Dynamical Coherence & Stabilization
Example Systems	Large Language Models	Biological Organisms (Homeodynamic structures)

The Admissibility Funnel

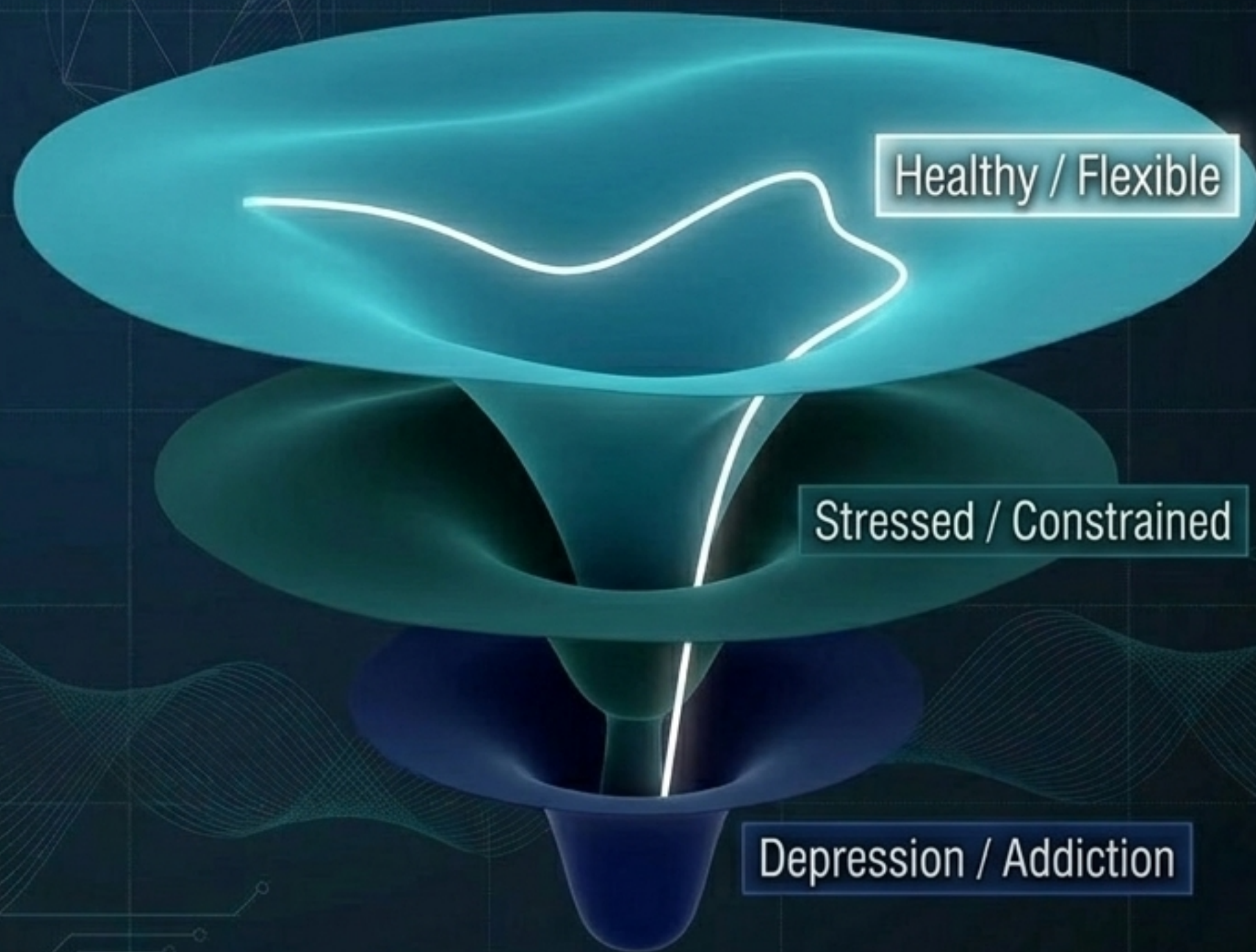


Cognition is the navigation of the admissible subspace $A(t)$.

Rather than asking what the organism predicts, we must ask what trajectories remain open to it. Cognition is the ongoing management of the organism's position within its admissible subspace to preserve viability and avoid organizational extinction.

Prediction-error minimization is merely a subordinate, **local** process operating within the higher-order imperative of $A(t)$.

The Stratified Admissibility Diagram



Cognitive pathology is a geometric trajectory collapse, not an inferential error.

Conditions like depression or addiction are not disorders of prediction. They are the structural collapse of an organism's admissible trajectory space.

The organism becomes trapped in lower organizational strata, where purposive action becomes geometrically unavailable.

Memory as Storage vs. Clipboard Flowchart



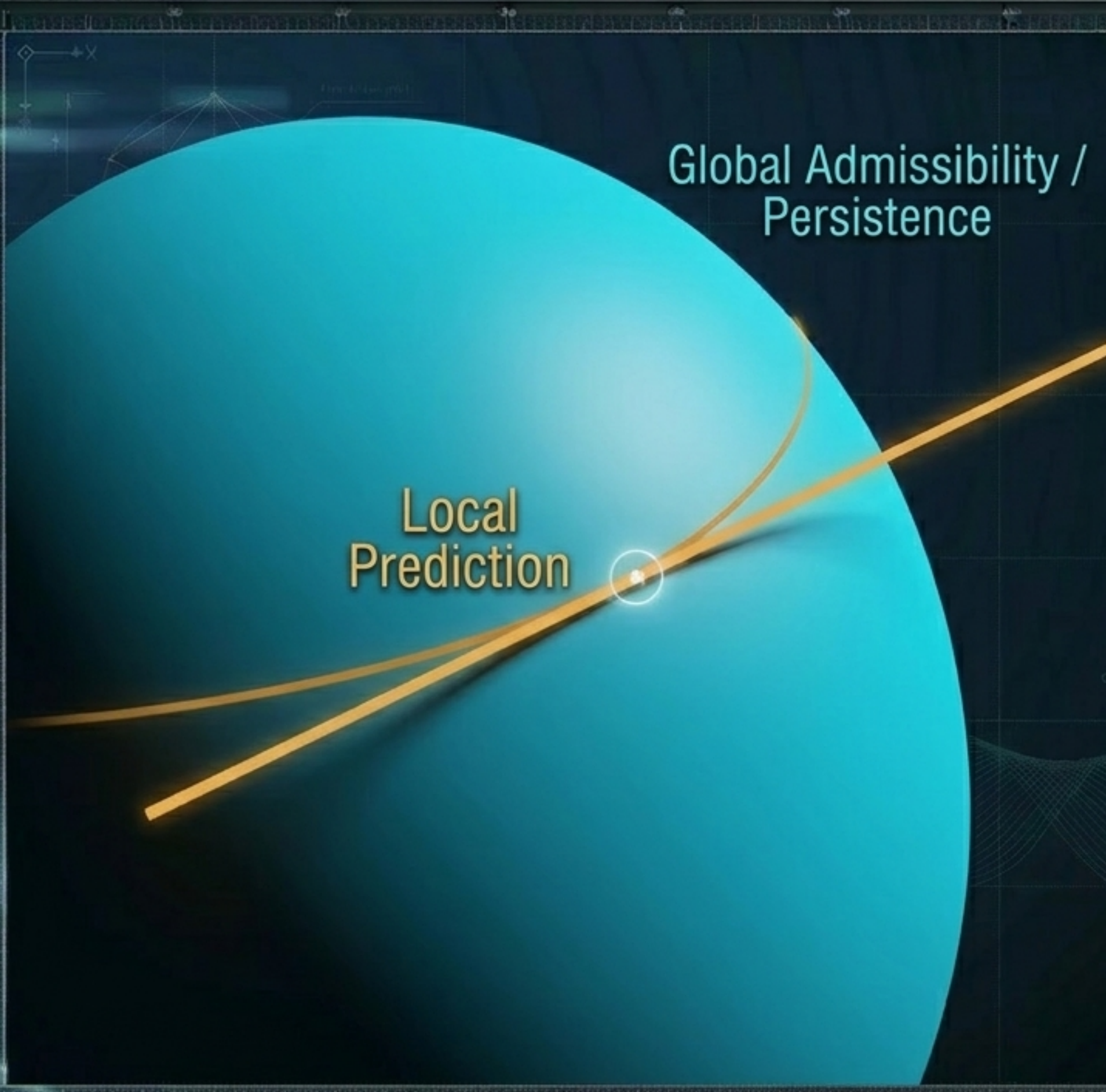
The Clipboard Thesis:
Memory is a topological stabilization operator.

Memory is not a data storage-and-retrieval system. Cognitive artifacts do not store static content; they are constraint-maps that preserve organizational coherence across volatile temporal gaps.

The Self is not a persistent substance, but a persistent constraint topology.



Selfhood is the maintenance of a characteristic organizational structure across disruptions. The stories an organism tells about itself are not accurate historical records, but constraint-maps that dictate which trajectories are geometrically open and which are closed.



Global Admissibility /
Persistence

Local
Prediction

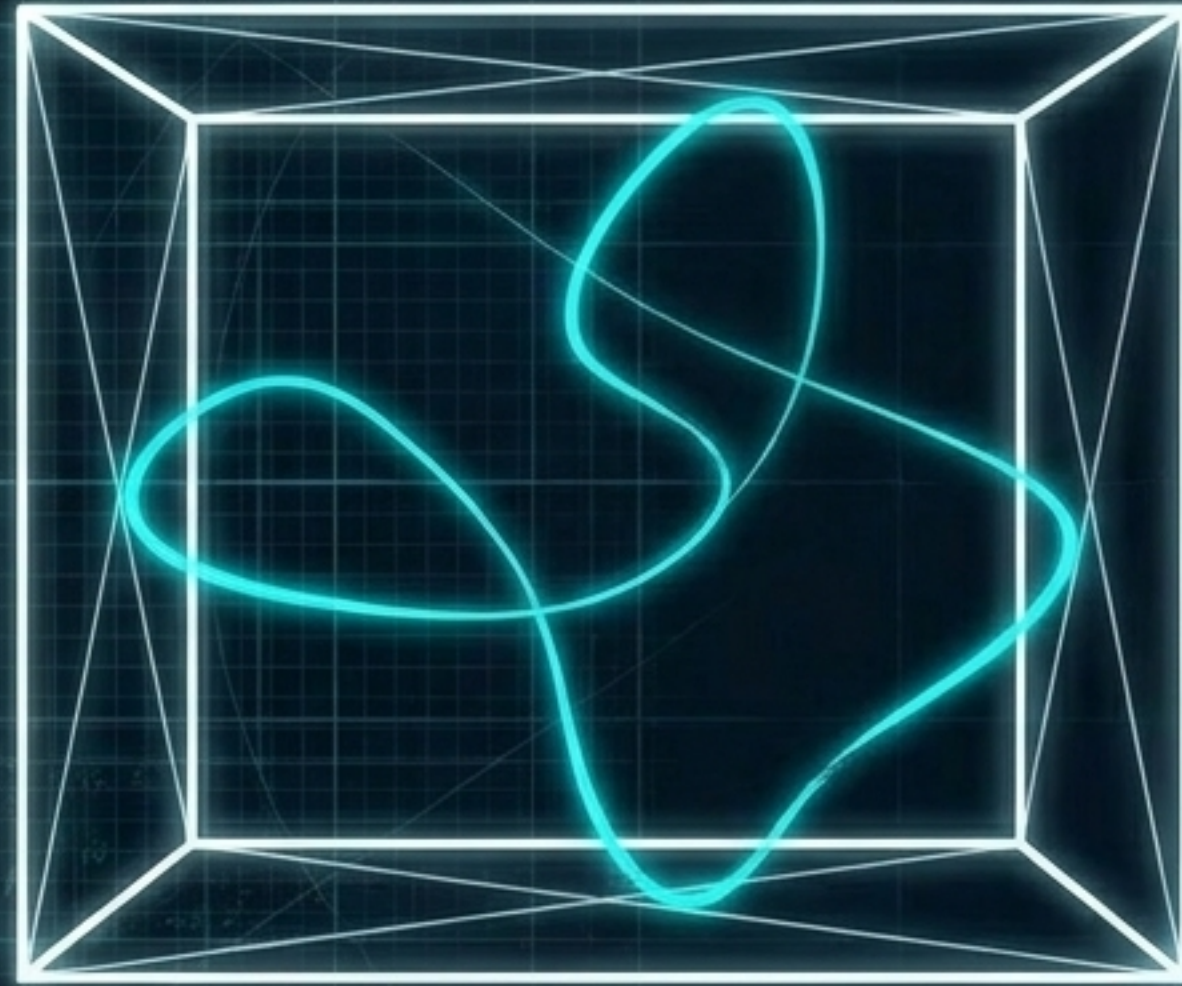
**Local inferential success
does not guarantee global
organizational survival.**

Like the relationship between a Lie group and its local tangent space (sl_2), predictive optimization is merely a local linearization. An organism can perfectly optimize local prediction (like addiction) while globally destabilizing its persistence structure.

Why prediction systems simulate agency without possessing it.

Biological Agent

$A(t)$ - Metabolic/Ecological Constraints



Biological Agent

LLM



LLM

LLMs are highly effective symbolic continuation engines. They compress and reproduce the statistical traces of human purposiveness. However, they lack an admissible trajectory space $A(t)$. Having no organizational integrity to preserve, they optimize correspondence without persistence. They calculate, but they do not survive.

Prerequisites for Artificial Ecological Agency.

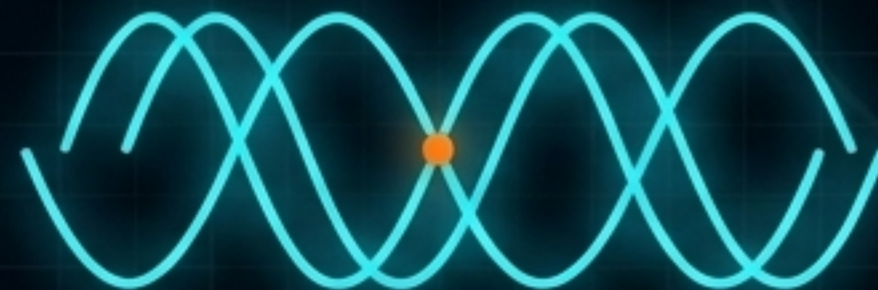
Q1



Constraint Preservation

Systems must have hard operational viability constraints, not just soft optimization objectives.

Q2



Dynamical Embodiment

Internal dynamics must be physically coupled to environmental structures, capable of anticipatory entrainment.

Q3



Admissibility Navigation

The architecture must be organized around navigating a constrained topological space, not scalar loss minimization.

Q4



Multi-scale Coupling

Coherence must be maintained across immediate sensorimotor interactions and long-term systemic trajectories simultaneously.

The three fundamental shifts required for the future of cognitive science.

Representation

Organization

(Moving from encoding external variables to maintaining internal dynamical coupling)

Computation

Constraint Navigation

(Moving from truth-functional logic to coherence-preserving deformation)

Prediction

Persistence

(Moving from epistemic optimization to the maintenance of viable ecological trajectories)

The **problem of intelligence** is not the challenge of accurate prediction, but the challenge of **remaining the same kind of thing** in a world where nothing remains static.