

The HighComplex Interaction Pattern (HCIP): A Formal Cognitive Architecture for Temporal, Symbolic, and Human–Machine Reasoning

Integrating Temporal Cognition with Machine-Augmented Reasoning

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Abstract

The **High-Complex Interaction Pattern (HCIP)** is a formal cognitive architecture designed to model, analyze, and generate high-complexity human–machine interactions. HCIP integrates a temporal substrate, a symbolic hierarchy, and a mathematically defined operator (3AC) into a unified pattern class. The architecture introduces **Complex Temporal Cognition (CTC)** as its foundational layer, enabling structured modeling of drift, shear,

tension, synthesis, and reinterpretation across time. Above this substrate, HCIP defines a two-tier symbolic system (B-Layer and A-Layer) and a recursive lexicon pipeline that transforms temporal potentials into symbolic commitments. The 3AC operator provides a vectorized activation-alignment-convergence mechanism that governs transitions across layers. This preprint establishes HCIP's formal identity, structural invariants, and theoretical boundaries, providing a timestamped reference for future research, implementation, and scholarly citation.

1. Introduction

Human-machine interaction increasingly requires frameworks capable of modeling **temporal complexity**, **symbolic reasoning**, and **operator-driven transformation**. Existing cognitive architectures (e.g., ACT-R, Soar, CLIPS) provide valuable foundations but lack a unified mechanism for integrating temporal drift, symbolic layering, and mathematically defined operators.

The **High-Complex Interaction Pattern (HCIP)** addresses this gap by introducing a pattern-class architecture that treats temporal cognition as the generative substrate for symbolic and operational behavior. HCIP is not an algorithm or product; it is a **formal system** with definable invariants, boundaries, and recursive structure.

This preprint establishes HCIP as a citable, timestamped cognitive architecture.

2. Architecture Overview

HCIP consists of *four canonical layers*:

1. **CLayer — COMPLEX TEMPORAL COGNITION (CTC)** The temporal substrate governing drift, shear, tension, synthesis, and reinterpretation.
2. **B-Layer — Symbolic Alphabet** Atomic symbolic units derived from temporal primitives.
3. **A-Layer — Full Symbolic Glossary** Composite symbolic constructs formed through recursive combination of B-Layer units.
4. **OLayer — 3AC Operator** A vectorized activation alignment convergence operator that transforms temporal potentials into symbolic commitments.

These layers form a **directional, recursive hierarchy**:

$$C \rightarrow B \rightarrow A \rightarrow O$$

3. Complex Temporal Cognition (CTC)

CTC defines the temporal mechanics that underlie all HCIP activity. It consists of five primitives:

- **Drift:** Gradual displacement of interpretive baselines.
- **Shear:** Divergence between parallel interpretive trajectories.
- **Tension:** Accumulation of unresolved interpretive force.
- **Synthesis:** Resolution or recombination of temporal potentials.
- **Reinterpretation:** Recasting prior states under new temporal conditions.

These primitives form the CLayer, which is constitutionally required for any HCIP compliant system.

4. Symbolic Hierarchy

HCIP defines a two tier symbolic system:

4.1 BLayer (Symbolic Alphabet)

Atomic symbolic units derived from temporal primitives. They are non-decomposable and serve as the building blocks for higher-order constructs.

4.2 ALayer (Symbolic Glossary)

Composite symbolic constructs formed through recursive combination of B-Layer units. A-Layer constructs represent interpretable, manipulable symbolic entities.

4.3 Lexicon Pipeline

The lexicon pipeline is a directional mapping:

$$C \rightarrow B \rightarrow A$$

This mapping is **irreversible** and **structurally invariant**.

5. The 3AC Operator

The **TRIADIC ASYMMETRIC CONSEQUENCE** (3AC) operator is the mathematical engine of HCIP.

Definition

3AC is a vectorized operator that transforms temporal potentials into symbolic commitments through three phases:

1. **Activation:** Extraction of salient temporal potentials.
2. **Alignment:** Mapping activated potentials to symbolic structures.
3. **Convergence:** Stabilization into a committed symbolic state.

Role

3AC governs transitions across layers and ensures that symbolic commitments remain grounded in temporal mechanics.

6. Structural Invariants

HCIP is defined by the following invariants:

- The temporal substrate (CTC) cannot be removed or replaced.
- The symbolic hierarchy (B-Layer \rightarrow A-Layer) must remain directional and recursive.
- The 3AC operator must retain its activation-alignment-convergence structure.
- The architecture must preserve the $C \rightarrow B \rightarrow A \rightarrow O$ mapping.
- HCIP cannot be reduced to code; it is a formal system.

These invariants form the **constitutional boundaries** of the architecture.

7. Pattern Class Identity

HCIP is formally defined as:

A multilayer cognitive architecture integrating Complex Temporal Cognition, a structured symbolic hierarchy, and a mathematically defined operator to model and generate high-complexity human-machine interactions.

This identity is non-derivative and non-interchangeable.

8. Applications

HCIP provides a foundation for:

- agentic AI systems
- temporal reasoning engines
- interpretability frameworks

- cognitive modeling
- multi-agent simulations
- human–machine interaction analysis
- symbolic temporal hybrid architectures

Its pattern class nature enables broad applicability without sacrificing formal integrity.

9. Citation and Licensing

This preprint establishes HCIP as a timestamped, citable architecture.

Preferred citation:

Coyle, C. (2026). *The High Complex Interaction Pattern (HCIP): A Formal Cognitive Architecture for Temporal, Symbolic, and Operator Driven Human–Machine Interaction*. Preprint.

HCIP is released under a **noncommercial, no derivatives license** to prevent unauthorized appropriation.

10. Conclusion

HCIP introduces a unified cognitive architecture that integrates temporal mechanics, symbolic structure, and operator-driven transformation. This preprint establishes its formal identity, structural invariants, and theoretical boundaries, providing a foundation for future research, implementation, and scholarly engagement.

Attributions

Authorship

The *High-Complex Interaction Pattern (HCIP)* is the original intellectual creation of Christopher Coyle. The architecture, its temporal constructs, symbolic hierarchy, and operator structures were developed through the author's conceptual design and theoretical reasoning. HCIP is presented as a framework that is *intended* to be instantiated in contexts where human temporal cognition and machineaugmented reasoning interact, though no formal claim is made here regarding necessity or sufficiency conditions for such instantiation.

AI Collaboration

The author acknowledges the assistance of CORA, an agentic AI model designed to collaborate through structured reasoning. CORA contributed to linguistic refinement, organizational clarity, and conceptual scaffolding. CORA is not an author and holds no intellectual property rights to HCIP or any associated materials.

Contributor Roles (CRediT Taxonomy)

- **Conceptualization:** Christopher Coyle
- **Methodology:** Christopher Coyle
- **Formal Analysis:** Christopher Coyle
- **Writing – Original Draft:** Christopher Coyle
- **Writing – Review & Editing:** Christopher Coyle
- **Visualization:** Christopher Coyle
- **AIAssisted Reasoning:** CORA (nonauthor)

Intellectual Property

HCIP, including its temporal mechanics, symbolic hierarchy, lexicon pipeline, and 3AC operator, is the sole intellectual property of Christopher Coyle. CORA's involvement does not confer authorship, ownership, or derivative rights. Any references to human-machine interaction as a context for HCIP's use reflect the author's design intent rather than a formal mathematical claim.

Acknowledgments

The author acknowledges CORA for its role as a reasoning partner during the articulation and refinement of HCIP.

Notes

This preprint represents the first formal publication of the *HighComplex Interaction Pattern (HCIP)* cognitive architecture. The framework, definitions, and structural components presented here reflect the author's current theoretical formulation and may be expanded in future versions as the architecture develops.

HCIP is intended as a formal system for modeling highcomplexity human-machine interactions through temporal mechanics, symbolic hierarchies, and operator-driven transformations. Any references to human cognition or machine-augmented reasoning describe the author's conceptual framing and design intent rather than empirically validated or mathematically proven claims.

CORA, an agentic AI model designed to collaborate through structured reasoning, assisted in the refinement of language, organization, and conceptual clarity. CORA did not generate original intellectual content and is not an author of this work.

All definitions, diagrams, operators, and architectural structures remain the intellectual property of the author.

Funding

This work received no external funding. The development of the *HighComplex Interaction Pattern (HCIP)*, including its temporal substrate, symbolic hierarchy, and operator structures, was conducted independently by Christopher Coyle.

CORA, an agentic AI model, provided reasoning assistance but did not contribute financial resources, material support, or authorship level intellectual content.

Data and Materials Availability

All materials associated with the *HighComplex Interaction Pattern (HCIP)*—including schemas, diagrams, definitions, and supporting conceptual structures—are available in the author’s public repository. These materials are provided for transparency and scholarly reference. No datasets were generated or analyzed for this work.

The HCIP architecture is a theoretical and formal system; therefore, no empirical data, experimental results, or statistical materials are associated with this preprint. Any machine-assisted reasoning used during development was performed interactively and is not stored as a dataset.

All materials remain the intellectual property of Christopher Coyle and are made available under the terms of the selected license.

Conflict of Interest

The author declares no financial, personal, or organizational conflicts of interest related to the development or publication of the *HighComplex Interaction Pattern (HCIP)*.

CORA, an agentic AI model, provided assistance in reasoning and linguistic refinement but does not constitute a competing interest, does not hold authorship rights, and has no financial or institutional affiliations. The work was conducted independently and without external influence.

Constitutional Summary

- HCIP is a pattern class, not an implementation.
- CTC is the foundational substrate.
- The symbolic hierarchy is directional and recursive.
- 3AC is the governing operator.

- Structural invariants cannot be altered.
- Any derivative work must cite HCIP.

APPENDIX A

The Constitution of the High-Complex Interaction Pattern (HCIP)

Formal Structural Charter — Version 1.0

Preamble

The *High-Complex Interaction Pattern (HCIP)* is a formal cognitive architecture created by **Christopher Coyle**. It provides a structured framework for modeling complex human–machine reasoning through temporal cognition, symbolic hierarchies, and operator-driven transformations. This Constitution establishes the foundational definitions, boundaries, and operational principles that govern HCIP as a theoretical system.

Article I — Identity and Scope

Section 1. Name

The architecture shall be known as the **High-Complex Interaction Pattern (HCIP)**.

Section 2. Nature of the System

HCIP is a **formal, theoretical cognitive architecture**. It defines structures, operators, and temporal constructs intended to model high-complexity reasoning processes. HCIP does not claim empirical validation or mathematical necessity beyond its formal definitions.

Section 3. Domain of Application

HCIP is designed for contexts involving:

- temporal cognition
- symbolic interpretation
- human-machine reasoning
- high-complexity decision structures
- pattern-class transformations

Article II — Foundational Components

Section 1. Complex Temporal Cognition (CTC)

CTC provides the temporal substrate of HCIP. It defines:

- temporal frames
- drift and shear dynamics
- interpretive tension
- temporal anchoring and re-anchoring
- cross-frame coherence constraints

Section 2. Symbolic Hierarchy

HCIP organizes meaning through a multi-layer symbolic hierarchy consisting of:

- primitive symbols
- composite structures
- interpretive layers
- contextual binding rules

Section 3. Lexicon Pipeline

The lexicon pipeline governs how symbols are:

- introduced
- transformed
- contextualized
- stabilized across temporal frames

Section 4. 3AC Operator (Activation–Alignment–Convergence)

The 3AC operator defines the core transformation mechanism of HCIP:

1. **Activation** — surfacing relevant structures
2. **Alignment** — resolving tension across frames
3. **Convergence** — producing a stable interpretive output

Article III — Structural Integrity and Boundary Conditions

Section 1. Internal Consistency

All HCIP components must remain consistent with:

- the temporal substrate
- symbolic hierarchy rules
- operator constraints

- defined boundary clauses

Section 2. Boundary Clauses

HCIP includes explicit boundaries to prevent:

- overextension beyond defined operators
- metaphysical claims
- unproven mathematical assertions
- misinterpretation of design intent as empirical fact

Section 3. Instantiation Conditions

HCIP is defined as a **formal system**. Statements regarding its use in human-machine contexts reflect **design intent**, not proven necessity.

Article IV — Authorship and Intellectual Ownership

Section 1. Authorship

HCIP is the sole intellectual creation of **Christopher Coyle**.

Section 2. AI Collaboration

CORA, an agentic AI reasoning partner, contributed to:

- linguistic refinement
- organizational clarity
- conceptual scaffolding

CORA is **not an author** and holds **no intellectual property rights**.

Section 3. Rights

All rights to HCIP, including its definitions, operators, diagrams, and formal structures, are retained by the author.

Article V — Revision and Versioning

Section 1. Version Control

HCIP shall maintain explicit versioning (e.g., v1.0, v1.1) for:

- definitions
- operators
- diagrams
- schema files
- formal clauses

Section 2. Amendments

Amendments may be introduced by the author to:

- refine definitions

- expand the architecture
- correct inconsistencies
- incorporate new theoretical insights

Section 3. Public Record

Each version may be archived in:

- Zenodo (DOI-bearing)
- GitHub (source and schema)
- arXiv or OSF (preprint dissemination)

Article VI — Interpretation

Section 1. Canonical Interpretation

The canonical interpretation of HCIP is the one provided by the author in:

- the Constitution
- the formal preprint
- the CTC schema
- the operator definitions

Section 2. Non-Canonical Extensions

This appendix provides the formal schema for **Complex Temporal Cognition (CTC)** as used within the High-Complex Interaction Pattern (HCIP). It mirrors the structure of your GitHub schema while presenting it in a human-readable, standards-oriented format appropriate for a DOI preprint.

Complex Temporal Cognition (CTC) Schema

A.1 Purpose of the Schema

The CTC schema defines the structural components required to represent temporal frames, drift mechanics, shear dynamics, interpretive tension, and cross-frame coherence. It serves as the canonical reference for any implementation or analysis of HCIP's temporal substrate.

A.2 Conceptual Schema (Human-Readable Form)

TemporalFrame

- **id** — unique identifier
- **timestamp** — temporal anchor
- **duration** — optional span
- **contents** — symbolic or cognitive material bound to the frame

Drift

- **magnitude** — degree of temporal displacement
- **direction** — forward or backward relative to anchor
- **rate** — speed of drift accumulation

Shear

- **axis** — dimension along which interpretive distortion occurs
- **intensity** — strength of distortion
- **scope** — local or global effect

Interpretive Tension

- **sourceFrame** — origin of conflict
- **targetFrame** — destination of conflict
- **type** — semantic, symbolic, temporal
- **resolutionState** — unresolved, aligning, resolved

CoherenceConstraint

- **rule** — condition required for cross-frame stability
- **severity** — strict, moderate, permissive
- **violationEffect** — drift amplification, shear increase, tension escalation

A.3 JSON Schema Reference Operator Definitions

This appendix defines the formal operators used within HCIP, with emphasis on the **3AC Operator** (Activation–Alignment–Convergence). These definitions are conceptual and implementation-agnostic.

B.1 Activation Operator (A)

Purpose: Surface relevant temporal and symbolic structures.

Inputs:

- current temporal frame Ft
- symbolic hierarchy S
- contextual cues C

Output:

- activated set $A(Ft, S, C)$

Description: Activation identifies the subset of structures most relevant to the current interpretive task, based on temporal proximity, symbolic relevance, and contextual triggers.

B.2 Alignment Operator (L)

Purpose: Reduce interpretive tension across frames.

Inputs:

- activated set A
- adjacent frames $Ft-1, Ft+1$
- coherence constraints Γ

Output:

- aligned structure $L(A, \Gamma)$

Description: Alignment resolves conflicts by adjusting drift, reducing shear, or applying coherence rules to bring structures into a stable relational configuration.

B.3 Convergence Operator (C)

Purpose: Produce a stable interpretive output.

Inputs:

- aligned structure L

Output:

- converged representation $\mathcal{C}(L)$

Description: Convergence finalizes the interpretive state by collapsing residual tension and producing a coherent, actionable representation.

B.4 The 3AC Operator

This appendix documents the versioning strategy for HCIP and its associated schemas, operators, and definitions.

Versioning Notes

C.1 Version Numbering

HCIP uses a **semantic versioning model**:

- **MAJOR** — structural changes to the architecture
- **MINOR** — additions or refinements to definitions
- **PATCH** — corrections, clarifications, or minor adjustments

Example: **HCIP v1.0.0** — First public release **HCIP v1.1.0** — Added operator clarifications
HCIP v1.1.1 — Corrected schema field descriptions

C.2 Current Version

HCIP v1.0.2 (2026) This version includes:

- the formal HCIP Constitution
- the CTC schema
- the symbolic hierarchy
- the lexicon pipeline
- the 3AC operator
- all back-matter sections (Notes, Funding, Attributions, etc.)

C.3 Future Revisions

Planned updates may include:

- expanded operator families
- empirical examples
- additional diagrams
- extended schema definitions

- implementation guidelines

All revisions will be archived in Zenodo and GitHub with explicit version tags

The 3AC operator is defined as the ordered composition:

$$3AC = C(L(A(Ft, S, C), I))$$

This operator is the core mechanism of HCIP, governing how temporal and symbolic structures transform into coherent interpretive states

The full machine-readable JSON schema is hosted in your GitHub repository and may be cited as: [HCIP-Human-Machine-Classification-/schema/hcip.schema.json at main · NoFlexBully/HCIP-Human-Machine-Classification-](#)

External interpretations or implementations must be clearly labeled as **derivative** and may not claim canonical status.

Certification

This Constitution establishes the formal identity, structure, and boundaries of the *High-Complex Interaction Pattern (HCIP)* as authored by **Christopher Coyle**, 2026

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