Axioms of Ontic Minimalism

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0. Axioms and Structural Principles

Ontic minimalism is discussed in detail in *The Principles of Ontic Minimalism (OM)* [1]. This document summarizes these principles and unifies notation and symbols across all cRBW framework documents.

0.0 Scope and role

This section states the single source-level commitment and classifies the downstream structural, representational, selection, and application principles used throughout the present cRBW realization. It distinguishes:

- primitive source-level commitment;
- derived or realization-specific structural expressions;
- representation-only equivalences and interpretive disciplines;
- selection and warrant principles;
- application-level claims.

General Reconstruction Theory supplies the downstream formal distinction among source role, mathematical presentation, indexed data, candidate reconstruction, and application warrant. AOM fixes the source commitment and the placement of the closure-first principles without reproducing that reconstruction machinery. [2]

The following table summarizes the ontic and structural elements of the framework, distinguishing primitive axioms, derived constraints, and representational principles.

Table 1- Canonical Status

Element	Designation	Revised status
AGC	Axiom 1	Primitive source-level global-admissibility commitment
BBP	Derived specialization	Boundary-operator specialization of closure/descent; not a prohibition on local boundaries

Element	Designation	Revised status
NPRF	Conditional specialization	Frame/decomposition specialization of admissible-reindexing non-privilege; follows from AGC here because decomposition invariance is included
RN	Principle 1	Representational discipline implemented by declared representation-only equivalences and localization
SIDP	Principle 2	Interpretive discipline on declared ordered indexings
PRG	Realization Principle 3	Metric/projection specialization of reconstructive fit defect
CRG	Realization Principle 4	Domain-specific connection, transport, curvature, and holonomy realization requiring additional regularity
LPS	Principle 5	Additional selection/minimality principle over already adequate candidates
NOE	Bridge Principle 1	Constitutive source-level no-excess bridge; not a theorem of LPS alone

This document is not a derivation of every downstream structure. It specifies the source-level commitment and records the formal status and scope of the principles used in the present cRBW realization.

0.1 Ontic axioms (Layer 0)

Axiom 1 — Adynamical Global Constraint (AGC)

Global relational coherence obtains as a single, all-at-once admissibility condition, formally designated here by $\mathcal{X}$. No temporal evolution or underlying dynamical substrate is assumed. The source condition must possess sufficient relational articulation to constrain admissible mathematical presentations, but that articulation is not an inventory of pre-individuated objects, events, fields, or states.

The symbol $\mathcal{X}$ is therefore not a container, a set of primitive relata, or an object in a mathematical presentation category. Mathematical configurations introduced below are presentations or candidate reconstructions constrained relative to $\mathcal{X}$, not additional source-level primitives. In GRT, this same source-level role is denoted by S_{src}.

Admissibility—not generation—is fundamental. Every objectified, indexed, bounded, or phenomenologically organized differentiation is a downstream reconstruction relative to admissible mathematical presentations.

0.1a Derived structural expressions

Boundary of Boundaries Principle (BBP)

Admissible relational structure is globally coherent. In representations admitting a boundary operator, the relevant closure condition is $\partial^2 = 0$.

This does not prohibit local pieces, charts, regions, or open subsystems from having boundaries. It requires boundary-of-boundary structure—and any associated interface identifications—to be coherent within the declared representation. BBP is not a primitive source-level assumption; it is the boundary-operator specialization of the broader closure and descent requirement.

No Preferred Reference Frame (NPRF)

No admissible frame, decomposition, normalization, or presentation is primitively privileged in determining reconstructive content. Within a declared class of admissible reindexings, localized data and candidate forward realization must transform naturally or equivariantly.

NPRF is the frame-, orientation-, or decomposition-change specialization of this non-privilege requirement. It follows from AGC in the present framework because decomposition invariance is included in the AGC commitment; that implication should not be assumed for every possible source realization without being stated or proved.

0.1b Constitutive source-level bridge

Bridge Principle 1 — No Ontic Excess (NOE)

Global relational coherence is the sole source-level commitment in the present cRBW realization. Objects, fields, states, bounded systems, histories, identities, observers, and phenomenological organizations are reconstruction targets rather than additional source-level primitives.

At the representation level, LPS may rank already adequate candidates only after a candidate class, competitor class, RN quotient, defect tolerance, and complexity criterion have been fixed. RN may identify distinctions that are solely differences of mathematical presentation. Neither result, by itself, establishes a source-level no-excess theorem.

NOE is the explicit constitutive bridge adopted by ontic minimalism: where a distinction has been shown, relative to a proven reconstructively complete family, to be solely RN variation or to perform no role in admissible reconstruction, it is not assigned additional source-level status. An equivalent source-level conclusion may instead be adopted

through an explicitly stated constitutive identification. Accordingly, NOE is not a formal consequence of LPS + AGC + RN alone.

0.2 Representational principles (Layer 1)

Principle 1 — Representational Neutrality (RN)

Mathematical structures—such as Regge calculus, geometric algebra, and Grassmannian geometry—are mathematical presentations or reconstruction machinery. They do not by themselves add a source-level primitive.

Formal RN requires declared representation-only equivalence classes and proof that localization, forward realization, defect assignments, selection functionals, and warrant claims descend through the resulting quotient or categorical localization. A verbal warning against reification is necessary but is not, by itself, a complete RN result.

Principle 2 — Slice-Indexed Description (SIDP)

Where an application supplies an ordered indexing, apparent dynamical language describes comparisons along admissible indexing morphisms within one all-at-once constrained architecture. Statements involving "change," "propagation," or "evolution" do not by themselves posit source-level temporal production.

Ordered indexing is an application structure. It may not presuppose an observer, identity, trajectory, or history that is itself to be reconstructed.

0.3 Admissibility and projection (PRG layer)

Principle 3 — Projection Residual Geometry (PRG)

In a realization that supplies a metric or ordered defect structure, candidate fit may be represented by distance to a declared admissible set: $R(C) = \inf_{X \in \mathcal{A}_{\mathrm{adm}}} d(C, X)$.

PRG is a metric/projection specialization of reconstructive fit defect, not a universal definition of admissibility. Where an argmin exists, the projection should be retained as the full minimizing set rather than as an unexplained choice of one minimizer. Projection may be local, multivalued, or undefined even where the infimum residual remains meaningful.

Once a metric candidate space and an admissible set have been supplied, projection provides an economical realization of candidate fit. AGC alone does not require every reconstruction problem to possess this metric or variational form.

PRG assumes:

- the admissible set is non-empty,
- a metric structure is available,
- projections may be non-unique, and
- residuals are defined as infima where necessary.

0.4 Local structure and restoration (CRG layer)

Principle 4 — Closure-Restoration Structure (CRG)

Where a reconstruction fibration carries the required metric, tangent, smooth, or comparable transport structure, projection onto an admissible tangent structure may define connection, curvature, transport, and holonomy data for admissible comparisons. CRG is a domain-specific geometric realization of this additional structure; it is not a universal consequence of AGC, NPRF, or BBP.

0.5 Minimal realization

Principle 5 — Local Projection Sufficiency (LPS)

Among candidate reconstructions that are already adequate relative to a fixed presentation, indexing coverage, forward realization, defect tolerance, and RN quotient, LPS selects or warrants the candidate RN-class or classes minimizing a declared RN-invariant complexity functional. LPS does not define reconstructive adequacy and does not by itself establish NOE.

Formally, for a representation M, the realized structure is:

$$\mathcal{R}_{\varepsilon}(M) = \underset{S \in \mathcal{C}(M)}{\arg\min}\{\Phi |\ ([S]_{\mathrm{RN}})\ \ \Delta(S; M) \preceq \varepsilon\}.$$

Here:

- $\mathcal{C}(M)$ is a candidate and competitor class fixed before candidate evaluation;
- $\Delta(S; M)$ is the declared reconstructive defect, including whichever fit, naturality, interface, descent, or recovery components apply;
- ε is the declared adequacy tolerance;

- $[S]_{\mathrm{RN}}$ is the candidate's RN-class;
- Φ is an RN-invariant complexity, economy, or minimality functional.

The argmin denotes the complete class of minimizing candidates. Existence or uniqueness requires additional assumptions. In cRBW/RSE readout applications, RCC-1 through RCC-9 may enter the application-specific warrant predicate; they should not be folded into the universal definition of reconstructive adequacy without explicit typing.

Sections 0.6–0.7 record downstream MM and RSE realization interfaces for cross-corpus continuity. They are not additional source-level axioms or universal requirements of GRT-Core.

0.6 Capacity structure (MM [3] layer)

Principle 6 — Capacity Tensor and Projective Normalization

In the MM realization, capacity structure is represented by a tensor $\Xi_{\alpha\beta}$, with diagonal components J_α and off-diagonal components $K_{\alpha\beta}$. MM identifies Ξ with the tensor κ used in the local PRG/CRG restoration setting, with the eigenvalues of κ supplying the Grassmannian warp weights ρ_i. This is a realization-specific bridge among mathematical structures, not the introduction of an additional source-level primitive.

A projective baseline $\mathbb{I}_0$ defines normalized ratios

$$J_\alpha = \frac{\Xi_\alpha}{\mathbb{I}_0} j.$$

Within the MM realization, only the declared projective ratios carry the intended physical interpretation. $\mathbb{I}_0$ is a representational normalization baseline fixing the projective class of the capacity structure. Different choices of $\mathbb{I}_0$ are related by the declared RN/projective-rescaling equivalence; that equivalence should not be inferred from NPRF without the associated projective action being stated.

Principle 7 — Projective Invariants

In the MM/RSE realization, candidate phenomenologically accessible quantities may be represented by projective ratios of capacities. This document records that downstream application architecture; it does not assert that every physical invariant in every GRT realization must be a capacity ratio.

The physical interpretation and universality of particular invariants (e.g., specific constants or scales) are established in subsequent framework documents and are not derived in this specification.

0.7 Observer and phenomenology application interface

Principle 8 — Legibility Constraints (RCCs)

Local RCC conditions, as defined in the cRBW framework, [4] determine which localized candidate readouts of an admissible mathematical presentation satisfy the declared application constraints. Localization acts on a mathematical presentation, not directly upon the source-level condition $\mathcal{X}$. These conditions do not introduce an additional source-level primitive.

Principle 9 — Structural Legibility (RSE)

Phenomenology is reconstructed as the observer-relative organization of indexed phenomena satisfying the relevant access, differentiation, memory, self-location, persistence, and warrant conditions. This remains distinct from the further claim that such an organization is conscious experience, which requires an explicitly stated bridge.

0.8 Consequences

From these axioms and principles:

1. Global relational coherence and admissibility are source-level; BBP is their boundary-operator closure specialization within suitable mathematical presentations.
2. Admissibility is global. PRG may represent candidate fit in metric realizations, while GRT localization, forward realization, descent, and presentation lifting type the broader reconstruction problem.
3. Projective capacity ratios are invariants of the MM realization; they are not universal GRT-Core primitives.
4. Where an ordered indexing has been supplied, apparent dynamics may be represented as ordered comparison without positing source-level temporal production.
5. Phenomenology is a downstream observer-relative reconstruction. A conscious-experience claim requires an additional typed bridge.

Global relational coherence obtains all-at-once. The framework does not posit a temporal or metaphysical selection process among coactual source configurations.

0.9 Summary statement

The framework begins with AGC as its sole source-level commitment. NPRF and BBP express non-privilege and closure within suitable mathematical presentations; RN and SIDP discipline representation and ordered description; PRG [5] and CRG [6] provide optional metric and geometric realizations; LPS ranks already adequate candidate reconstructions; NOE supplies the explicit source-level no-excess bridge; and MM and RSE provide downstream capacity and phenomenology applications. None introduces a second source-level primitive.

The framework is organized as a layered architecture:

Source-level commitment: AGC, formally designated here by $\mathcal{X}$.

Admissible reindexing: NPRF as the frame/decomposition specialization of non-privilege.

Closure and interface structure: BBP where a boundary operator exists; overlap and descent conditions more generally.

Representational discipline: RN and SIDP.

Metric and geometric realization: PRG and CRG where the required additional structure is supplied.

Selection and source bridge: LPS ranks adequate candidates; NOE supplies the explicit source-level no-excess inference.

Downstream applications: MM supplies capacity structure; RSE supplies observer and phenomenology structures.

These axioms and principles define a closure-first framework in which mathematical presentations and downstream reconstructions are constrained relative to the same globally obtaining relational coherence condition.

1.0 Unified Notation / Symbol Table

This section provides a unified reference for all symbols used in the framework. Symbols are grouped by role and aligned with the layered structure introduced in Section 0.

Notation note: κ denotes the capacity tensor used in PRG/CRG. $\mathcal{K}(\vartheta_h)$ denotes the curvature kernel. These are distinct objects despite historical overlap in notation.

1.1 Source-level structure

Symbol	Meaning
$\mathcal{X}$	formal designation of globally obtaining relational coherence; not a mathematical presentation object
AGC	source-level all-at-once global-admissibility commitment
BBP	boundary-operator closure/descent specialization, $\partial^2 = 0$
NPRF	non-privilege and naturality under admissible reindexing; projective invariance is one specialization

1.2 Representational structures (Layer 1)

Triangulation (Regge scaffold)

Symbol	Meaning
$\mathcal{T}$	simplicial triangulation
σ	4-simplex (Regge cell)
$f = \sigma \cap \sigma'$	shared 3-face
$\mathcal{H}$	set of hinges (2-simplices)
E	edge set (1-skeleton)
V	bulk region
$\partial\mathcal{M}_t$	timelike boundary

Geometric Algebra (GA)

Symbol	Meaning
A_k	k-blade (decomposable multivector)
$\Lambda(x)$	local lamination blade
R	rotor (even versor)
$\tilde{R}$	GA reverse
B	bivector generator

Symbol	Meaning
$\langle\cdot\rangle_0$	scalar part

Grassmannian structure

Symbol	Meaning
$Gr(k,n)$	Grassmannian (subspace manifold)
$Gr_\rho(k,n)$	capacity-weighted Grassmannian
θ_i	principal angles
U,V	orthonormal basis matrices
$d(V,W)$	unweighted Grassmannian distance
$d_\rho(V,W)$	weighted distance

1.3 Admissibility and projection (PRG layer)

Symbol	Meaning
$\mathcal{A}_{\mathrm{adm}}$	admissible set
$R(C)$	projection residual
Π_{adm}	projection to admissible set
d_ρ	capacity-weighted distance metric

1.4 Local restoration structure (CRG layer)

Symbol	Meaning
P_T, P_N	tangent / normal projectors
D_κ	projected derivative
$\mathcal{F}$	curvature (projector variation)
A_κ	induced connection

1.5 Capacity structure (MM layer)

Core quantities

Symbol	Meaning
$\Xi_{\alpha\beta}$	capacity tensor
J_α	normalized diagonal capacity
$K_{\alpha\beta}$	cross-capacity
$\mathbb{I}_0$	projective normalization baseline (non-ontic; defines ratio structure)

Where $\alpha \in \{rot, boost, edge, face, spatial\}$

Relations

$$J_\alpha = \frac{\Xi_\alpha}{\mathbb{I}_0}$$

$$\hat{\Xi}_{\alpha\beta} = J_\alpha \delta_{\alpha\beta} + K_{\alpha\beta}(1 - \delta_{\alpha\beta})$$

Metric connection

Symbol	Meaning
κ	capacity tensor (PRG/CRG form)
ρ_i	Grassmannian warp weights, $\rho_i =$ eigenvalues of κ

The capacity tensor Ξ admits a natural identification with the tensor κ that arises in PRG/CRG. Under this identification, the eigenvalues of κ define the Grassmannian warp weights ρ_i.

1.6 Coherence functional

Symbol	Meaning
$\mathcal{I}_\mathcal{C}$	global functional
$I_{\mathrm{id}}(x)$	local identity invariant

Note: The global functional $\mathcal{I}_\mathcal{C}$ should not be confused with the local invariant $I_{\mathrm{id}}(x)$; the former governs admissibility of configurations, while the latter characterizes identity persistence within admissible laminations. These originate in the cRBW framework [4] and

are included here solely for cross-corpus symbol unification; they are not part of the axiom layer.

Variational representation (stationarity form)

$$\delta \mathcal{I}_{\mathcal{C}} = 0$$

The stationarity condition is a variational presentation of the declared global admissibility condition within mathematical realizations that support such a formulation. It is neither AGC itself nor an independent dynamical law.

Identity scalar

$$I_{\mathrm{id}}(x) = \langle \Lambda(x)\, \widetilde{\Lambda}(x) \rangle_0$$

1.7 Regge curvature and holonomy

Curvature quantities

Symbol	Meaning
A_h	hinge area
ϵ_h	deficit angle
$\theta_{h,\sigma}$	dihedral angle
α_n	flat reference angle

Deficit

$$\epsilon_h = \alpha_n - \sum_{\sigma \supset h} \theta_{h,\sigma}$$

Holonomy (GA form)

Symbol	Meaning
B_h	hinge bivector
R_h	holonomy rotor
$H(\gamma)$	loop holonomy

A nonidentity holonomy is not automatically a reconstruction defect. Defect is present only when the return lies outside the declared admissible RN-descended holonomy class.

1.8 Cross-capacity structure

Symbol	Meaning
$K_{\alpha\beta}[x]$	local cross-capacity
$K_{\alpha\beta}(f)$	interface capacity
$K_{\mathrm{eff}}(\gamma)$	chain-composed capacity
Γ	coherence threshold

Composition

$$K_{\mathrm{eff}}(\gamma) = \prod_i K_{\alpha\beta}\,(f_i)$$

1.9 Coherence / curvature scalars

Symbol	Meaning
ϑ_h	rotation/boost magnitude
$\mathcal{K}(\vartheta_h)$	curvature kernel
$\mathcal{C}$	coherence scalar (curvature-density diagnostic)

κ denotes the capacity tensor; $\mathcal{K}(\vartheta_h)$ denotes the curvature kernel.

1.10 Phenomenological quantities (RSE layer)

Symbol	Meaning
λ_i	lamination density
Φ_{FEM}	continuity measure
Δ_{adm}	admissibility deviation
χ_i	lamination compatibility

2.0 Summary of correspondences

Regge ↔ GA ↔ Grassmannian

Regge	GA	Grassmannian
hinge	bivector	2-plane
deficit	rotor holonomy	angle
loop	rotor product	adjacency chain
closure	invariant scalar	admissibility

Layer correspondence

Layer or role	Structure
Source-level commitment	AGC; $\mathcal{X}$
Admissible reindexing	NPRF
Closure/interface specialization	BBP where a boundary operator exists
Representation discipline	RN, SIDP
Metric/geometric realizations	PRG, CRG, Regge, GA, Grassmannian as applicable
Selection and warrant	LPS
Source-level no-excess bridge	NOE
Downstream MM application	$\Xi_{\alpha\beta}, K_{\alpha\beta}, \mathbb{I}_0, J_\alpha$
Downstream RSE application	observer and phenomenology reconstruction structures

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References

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