**Absolute Relativity / Overall V2 Theory – v1.9**  
Document: (11) Experience Horizon (CE2)  
Author: Kent Nimmo – absoluterelativityproject@gmail.com

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**0. Document Metadata and Status**

**0.1 Purpose of this record**

This document is a record-level technical addendum that formalizes the “Experience Horizon / CE2” module (two-hop reach, three cones, modality submanifests, instrument mediation, and the qualia↔informean spectrum parameter) using only existing AR/V2 primitives (finite feature alphabets, hinge equality, feasibility gates including CRA, ratio-lex acceptance, ties-only PF/Born).

This record exists to preserve, in one place:

• The new definitions and minimal math introduced here (Ext₂ / CE2G cones, modal submanifests, α\_m, instrument mediation rule).

• The interpretive claims that are permitted under AR discipline (and explicit non-claims).

• Integration points with the rest of the AR stack (Context Level framework, V1/V2, and the newer band-manifest/CFD direction).

• Known ambiguity traps / wording guardrails to prevent drift into “signals from matter” ontology or overclaim.

• A clear “as-of” snapshot so revisions can be tracked as deliberate version changes.

Publication discipline (DP attachment):

• This document is intended to be included as an attached supporting record in the Defensive Publication bundle (record version).

• CE2/Ext₂ is treated here as a human-hinge effective horizon (not asserted as a universal constant across all centers).

• This module does not restate or depend on observable-universe metric conventions; outer-metric choices remain quarantined inside the gravity/χ track.

Creation date: December 13, 2025 (chat session date).

Record status: DP attachment / record version.

**0.2 Scope and non-goals**

**Scope (what this record covers):**

1. **Formalization of “extension-of-2”**
   * Turning the intuitive claim “each context level extends two layers” into explicit, checkable structure in the context-ladder model.
   * Expressing the rule in a way that is compatible with:
     + neighbor-only / no-skip coupling discipline (CRA-style),
     + 0-mediated seam constraints,
     + and “bands are roles” (not stacked substances).
2. **Experience-horizon construction from the seam + admissibility**
   * Defining “experience cones” (inner/interface/outer) as two-hop admissible paths:
     + (-2\to -1\to 0),
     + (-1\to 0\to +1),
     + (0\to +1\to +2).
   * Interpreting “body boundary” as an **admissibility cut** (a structural constraint on which band-sourced distinctions can become +1-stable tokens), not anatomy.
3. **Modal structure as a manifest decomposition**
   * Introducing **modal submanifests** ( \mathcal{M}\_0^{(m)} ) as the technical representation of “different qualities of experience.”
   * Introducing **source sets** (S(m)) for each modality and a **qualia↔informean weighting parameter** (\alpha\_m) as bookkeeping for how “boundary-like” vs “structure-like” the modality is.
4. **Instrument-mediated +3 access**
   * Formalizing “instruments give +3” as **re-encoding** (composition operators) that render higher-context constraints into +1-readable tokens without violating no-skip / relay discipline.
5. **Careful linkage to QM measurement language**
   * Framing “measurement/collapse” as hinge equality + feasibility + acceptance behavior (PF/Born randomness only on genuine ties), rather than “mind causes collapse.”
6. **Integration with the other new addition (“CFD / Band Manifests / CCLK”)**
   * Positioning this experience module as a specialization of the manifest object: it mainly lives in **CRA, Ξ partitioning, Struct profiles, Θ/κ windows, and acceptance priorities**.
   * Showing why this module improves the “unified story” of AR rather than adding a separate metaphysical layer.

**Non-goals (what this record explicitly does not attempt to do):**

1. **Not a neuroscience claim-set**
   * We are not claiming verified biological mechanisms or neural correlates.
   * We are not asserting “taste/smell/sound map exactly to these physical channels” in an empirical sense.
   * We treat modality language as *phenomenological labels* for manifest substructures, unless and until empirical mapping is developed.
2. **Not a full QM derivation**
   * We are not producing a complete replacement derivation of quantum formalism here.
   * The measurement linkage is constrained to what follows from your existing V2 selection mechanism (hinge equality → gates → ratiolex → ties-only PF/Born).
3. **Not a publication-ready DP chapter**
   * This record is intentionally expansive and diagnostic.
   * Publication packaging (tone, pruning, claims discipline) will come later, after internal stabilization.
4. **Not a simulation deliverable (yet)**
   * We identify toy-sim possibilities, but do not treat simulation results as prerequisites for *recording* the structure.

**0.3 Version notes**

This section records the key commitments and “new work outcomes” from the current development session so future edits can track what changed and why.

**0.3.1 New commitments introduced in this work**

1. **Neighbor-only / no-skip coupling discipline (CRA framing)**
   * Outward coherence and cross-band coupling are treated as **relay-mediated**, not direct skips across multiple context levels.
   * “Extension” is interpreted as **reachable via admissible seam composition**, not as direct causal influence.
2. **CE2 / Ext₂ formalization of “extension-of-2”**
   * Introduced a formal definition of “two-layer extension” as a two-hop closure / reach constraint on the context ladder (graph distance ≤ 2).
   * Used it to generate a clean, repeatable “experience cone” structure.
3. **Experience cones as admissible path templates**
   * Defined three canonical two-hop cones for human hinge (0):
     + inner cone: (-2\to -1\to 0),
     + interface cone: (-1\to 0\to +1),
     + outer cone: (0\to +1\to +2).
   * This is the mechanism by which “body vs environment vs meaning/world” is recast as structure of admissible coupling, not matter signal flow.
4. **“Skin/body boundary” reframed as an admissibility cut**
   * The boundary between “private bodily experience” and “public material world” is treated as a structural limit on what can become +1-stabilized shareable tokens, not anatomical skin as a primitive boundary.
5. **Modal submanifests ( \mathcal{M}\_0^{(m)} )**
   * Introduced the modality concept as a decomposition of the band manifest (rather than a “sense organ” story):
     + distinct sub-alphabets (\Xi^{(m)}),
     + distinct hinge maps (f^{(m)}, g^{(m)}),
     + distinct gate profiles (\Theta^{(m)},\kappa^{(m)},Struct^{(m)},CRA^{(m)}),
     + potentially distinct acceptance priorities.
6. **Modality source sets (S(m)) and qualia↔informean weights (\alpha\_m)**
   * Defined a bookkeeping structure:
     + (S(m)\subseteq \mathrm{Ext}\_2(0)) describes which bands can contribute separable structure to modality (m),
     + (\alpha\_m\in[0,1]) tracks where modality (m) lies on the qualia–informean spectrum (boundary-like vs structured meaning).
7. **Instruments as re-encoding operators (no-skip-compliant +3 access)**
   * “Extra +3” from instruments is formalized as re-encoding of higher-context constraints into +1-readable tokens, making them hinge-visible to 0 without skipping.
8. **Measurement linkage discipline**
   * Measurement is framed as the **hinge bottleneck + feasibility + ratiolex acceptance** story, with **PF/Born randomness only on true structural ties**.
   * Avoids “consciousness causes collapse” language; keeps it as a seam-selection phenomenon.

**0.3.2 Known “do-not-slip” language pitfalls (recorded as guardrails)**

* Avoid phrasing like “signals travel from environment into consciousness” as ontology.  
  Replace with: “a +1 outward representation is committed at the seam when it passes hinge equality + feasibility.”
* Avoid “skin is literally −2 boundary.”  
  Replace with: “body boundary is a stability/admissibility cut between inward constraints and +1-stabilized tokens.”
* Avoid “we directly experience +2/+3.”  
  Replace with: “+2/+3 constraints can be encoded into +1 tokens (especially via instruments) and thus become hinge-visible to 0.”

**0.3.3 Immediate next dependencies (what later sections must define precisely)**

* Exact mathematical form of:
  + the ladder graph and distance metric,
  + CE2/Ext₂ definition(s) (set-based vs grammar/path-based),
  + “must go through 0” mediation constraint in CRA terms,
  + the formal meaning of “source contributions” from band (n) into modality (m),
  + instrument map composition.

**1. Executive Summary**

**1.1 One-paragraph thesis**

This module proposes that what we ordinarily call “sensing an external material environment” is not an ontological inflow of signals from an independently-existing substrate, but a **representational outcome** of the AR/V2 present-act commit process at a chosen center band (here: the human hinge at **0**). In this framing, **experienced structure**—including the felt distinction between “my body,” “my immediate environment,” and “the wider meaningful world”—is generated by the **0↔+1 seam loop** (hinge equality → feasibility gates → acceptance) operating under a **cross-band admissibility grammar (CRA)** and finite coherence windows (Θ/κ). The key new move is to formalize the informal insight “each context level extends two layers” as a mathematically explicit reach/grammar rule (CE2 / Ext₂), and then show how this rule yields a natural **three-zone phenomenological partition** and a disciplined interpretation of “measurement-like” selection (ties-only PF/Born) without reintroducing materialist causation or “mind-as-force” collapse claims.

Stated compactly: **the environment is what the seam can commit and stabilize as outwardly shareable structure; the body boundary is an admissibility/stabilization cut; and modality differences reflect submanifest profiles within the same commit pipeline.**

**1.2 What’s new vs what already existed**

This work did not introduce new primitives (no new ontological “stuff”), but rather introduced **new structure over existing primitives** (especially over CRA and band manifests) to make a phenomenology mapping explicit and testable.

**What already existed in the AR stack (pre-module)**

1. **Context ladder roles (… −2, −1, 0, +1, +2, +3 …)**
   * Bands are roles relative to a chosen vantage, with a human hinge at 0 and canonical role assignments (quantum seam, cellular, organism/UGM, Earth surface, galactic, cosmic shell).
2. **V2 present-act engine contract**
   * Candidate acts are committed by:
     + hinge equality in a finite alphabet (f(w)=g(q)),
     + feasibility gates (Θ, κ, Struct, ParentGate, CRA),
     + ratiolex acceptance,
     + and PF/Born randomness only as a tie-break on genuine structural ties.
3. **Qualia vs informean (finite/infinite spectrum framing)**
   * A standing conceptual distinction between:
     + qualia (now-bound “what it is like”),
     + informean structure (meaning/memory/relational scaffolding),
     + and the idea that experience lies along a spectrum between these poles.
4. **“No skipping” intuition and mediation discipline**
   * The theory’s general tendency to forbid arbitrary cross-band shortcuts and to treat coherence as relay-mediated through intermediate bands/centers (especially through the seam).
5. **The newer addition direction (CFD / band manifests / CCLK)**
   * The idea that “context = constraints” and feasibility is the operational enforcement of context structure, with manifests as band-level configuration objects.

**What is new in this module (this record)**

1. **Explicit formalization of “extension-of-2”**
   * The informal claim “each context level extends two layers” is made into an explicit mathematical object:
     + a two-hop reach closure (Ext₂) and/or a two-hop admissibility grammar (CE2) over the context ladder.
2. **Experience cones derived from CE2/Ext₂**
   * A clean set of canonical two-hop paths (“cones”) is defined:
     + inner: (-2\to -1\to 0),
     + interface: (-1\to 0\to +1),
     + outer: (0\to +1\to +2).
   * These are treated as structural channels by which constraints become hinge-visible at 0.
3. **“Body boundary” reframed as an admissibility/stabilization cut**
   * The body/environment divide is treated as a band-coupling and stabilization property:
     + inward constraints can shape the committed present at 0,
     + but cannot, by default, become stable +1 public tokens without mediation and outward stabilization.
4. **Modal submanifests ( \mathcal{M}\_0^{(m)} )**
   * “Modality” is defined as a substructure of the 0-manifest:
     + its own subalphabet (\Xi^{(m)}),
     + its own hinge maps (f^{(m)}, g^{(m)}),
     + its own Θ/κ coherence profile and Struct/CRA gate profile.
   * This turns “different qualities of experience” into a configuration-level claim rather than a “sensor realism” claim.
5. **Source sets (S(m)) and spectrum weights (\alpha\_m)**
   * For each modality (m), define:
     + which bands can contribute separable structure: (S(m)\subseteq \mathrm{Ext}\_2(0)),
     + where the modality lies on the qualia↔informean continuum: (\alpha\_m\in[0,1]).
6. **Instruments as re-encoding operators enabling +3 access without skipping**
   * “We get +3 because of instruments” is formalized as:
     + higher-context constraints are re-encoded into +1-readable tokens via an operator (I),
     + so 0 never needs direct +3 coupling to “see” +3-influenced structure.
7. **A disciplined measurement linkage statement**
   * “Measurement” is cast as seam selection under hinge equality + feasibility + acceptance, with PF/Born ties-only, rather than “observer causes collapse.”

**1.3 Key results in one list**

Below is the “results list” for this module—i.e., the minimal set of definitions and consequences that constitute the new work.

1. **Context ladder as a coupling graph with a distance metric**
   * Bands (n\in\mathbb{Z}) are nodes; admissible couplings are governed by CRA and (in the simplest version) are neighbor-mediated.
2. **Two-hop extension formalization (CE2 / Ext₂)**
   * Define a two-hop reach set:  
     [  
     \mathrm{Ext}\_2(n) := {m:\mathrm{dist}(n,m)\le 2}.  
     ]
   * For human hinge (0):  
     [  
     \mathrm{Ext}\_2(0)={-2,-1,0,+1,+2}.  
     ]
   * Interpret “extension” as **reachable via admissible seam composition**, not as direct causal influence.
3. **Three canonical two-hop experience cones (path templates)**
   * Inner cone: (-2\to -1\to 0)
   * Interface cone: (-1\to 0\to +1)
   * Outer cone: (0\to +1\to +2)
   * These are the structural routes by which inward constraints, boundary/interface constraints, and outward container constraints enter the 0 act.
4. **Body/environment split as a structural cut**
   * Under a strict two-hop discipline, (-2) does not directly participate in +1 objectification (it is not directly +1-stabilized).
   * The “body boundary” is therefore stated as:
     + **private inward constraints** shaping the 0 commit,
     + versus **shareable outward tokens** stabilized in +1/CS.
5. **Environment-as-representation statement (seam ontology)**
   * “Material environment” is defined as what the 0↔+1 seam can repeatedly commit and stabilize as outwardly shareable structure under the +1 manifest, not as a substrate that sends signals into experience.
6. **Modal submanifests and source sets**
   * Introduce modalities (m\in\mathsf{Mod}) and define:  
     [  
     \mathcal{M}*0 = \bigoplus*{m\in\mathsf{Mod}}\mathcal{M}\_0^{(m)},\quad  
     S(m)\subseteq \mathrm{Ext}\_2(0).  
     ]
   * Working mapping (hypothesis-level):
     + interoception/body: (S\approx{-2,-1,0})
     + interface senses: (S\approx{-1,0,+1})
     + vision/meaning: (S\approx{0,+1,+2})

**Qualia↔informean spectrum parameterization**  
Assign a spectrum parameter (αₘ ∈ [0,1]) to each modality m as a bookkeeping summary of where that modality lies on the qualia↔informean continuum:

(αₘ ≈ 0): qualia-heavy / boundary-immediate / private / minimally contrast-tokenized  
(αₘ ≈ 1): informean-heavy / structured / meaning-rich / publicly communicable

Operational interpretation:  
αₘ is a descriptive diagnostic intended to be computed post-hoc from logs (e.g., symbol richness of Ξ^(m), tie/ambiguity rate at the hinge, and the strength/depth of structural stabilization predicates). αₘ is not used as a continuous control weight inside feasibility gates or acceptance.

1. **Instrument-mediated +3 access via re-encoding**
   * Model an instrument as an encoding operator:  
     [  
     I:;W^{(+3)}\rightarrow W^{(+1)}\quad \text{or}\quad I:;W^{(+3)}\rightarrow \Xi^{(m)}.  
     ]
   * The instrumented readout is:  
     [  
     f^{(m)}\_{\text{instr}} = f^{(m)}\circ I,  
     ]  
     allowing +3 constraints to be present *as +1-visible tokens* without breaking no-skip discipline.
2. **Measurement linkage as seam selection under ties-only randomness**
   * Define “measurement-like selection” as:
     + hinge equality + feasibility gates reduce candidates to a finite set,
     + acceptance is ratiolex,
     + PF/Born enters only when true structural ties remain.
   * This yields a disciplined observer/measurement framing that stays internal to V2 mechanics.
3. **Integration claim with CFD / manifests**

* This phenomenology module is not separate from the new addition; it is a **specialization of the manifest architecture**:
  + primarily a statement about CRA (admissibility), Ξ partitioning (modal channels), and Struct/Θ/κ profiles (coherence windows and stabilization constraints).

**Transition note to next section:**  
Section 2 will document the *origin story* for this module (book phenomenology → context ladder → seam loop) and precisely how the “extension-of-2” insight arose as a candidate rule inside the CRA/manifest layer.

**2. Origins and Motivation**

**2.1 The narrative origin in the book**

This module began as an attempt to **tighten and formalize a narrative insight** that already exists in the book’s philosophical layer: the idea that consciousness can be understood as spanning a **spectrum** between two poles:

* an **infinite / immediate / “what-it’s-like”** pole (qualia, the pure “now” aspect), and
* a **finite / structured / meaningful** pole (the relational scaffold that gives experience recognizable content, continuity, and communicability).

In the book framing, this spectrum is not treated as a psychological add‑on to physics; it is treated as **a direct consequence of how “Now” functions** in AR: the present is singular and “infinite” in the sense of being the immediate ground of experience, yet it can still be related to itself through finite distinctions (structure, identity, memory, meaning). In other words, the spectrum isn’t “different substances,” but **different balances of boundary‑immediacy vs structured relationality**.

The new step we took here was: instead of leaving that spectrum as purely philosophical, we asked:

Can the qualia–structure spectrum be **mapped onto the context ladder** in a disciplined, engine-consistent way?

This is motivated by a very specific gap: the book’s qualitative spectrum is compelling as an interpretive story, but without a ladder/engine mapping it can feel “detached” from the rest of the theory’s machinery (V1 formalism, V2 engine, context ladder and hinge). The goal of this module is to create a bridge such that:

* the **philosophical spectrum** becomes a *readout* of how context levels constrain representability and admissibility, and
* the **context ladder** gains a new interpretive payoff: it explains why the felt world partitions into “inside me,” “near me,” and “world-out-there” without requiring a materialist “signals in” ontology.

So the book supplied the motivating question and language (“infinite vs finite”; “qualia vs meaning”). This record’s role is to translate those ideas into **explicit technical objects** already present in the AR stack (manifests, hinge equality, CRA, Θ/κ windows, acceptance rules), so the mapping is not rhetorical but structurally grounded.

**2.2 The technical origin in V2**

The second origin point is not philosophical; it is **mechanical**.

V2’s core move is that “experience-like” structure is not something that arrives from outside; it is something that is **committed** by a discrete selection process. In V2 terms, the center band (here: human hinge at 0) commits each present-act by the same general pipeline:

1. candidate generation / proposal,
2. hinge equality (inner/outward matching in a finite feature alphabet),
3. feasibility filtering (Θ, κ, structural predicates, ParentGate, CRA),
4. acceptance (ratiolex ordering; ties-only PF/Born when genuinely indistinguishable survivors remain),
5. commit and update of records.

The important point for this module is what that pipeline implies:

* “Sensing” is not ontologically “environment → signals → mind.”
* “Sensing” is **0↔+1 seam coherence**: the outward side of reality becomes the “material environment” only insofar as it can be *represented* (in the feature alphabet) and *admitted* (by feasibility and admissibility) into the committed present.

This becomes especially salient once you reframe the “material world” as a **+1 outward description**: a stable, shareable structure stabilized across many centers (CS), not a separate substrate that causes experience. Under that discipline:

* “body” and “environment” are not primitive categories; they are **products of how seam coherence is allowed to happen** and what can be stabilized outwardly as +1 tokens.

This is also why this module naturally touches quantum measurement language. In the V2 contract, indeterminism is not an extra postulate; it’s a boundary case of the commit mechanism:

* where multiple candidates survive hinge + gates in genuine structural equality,
* and a ties-only PF/Born rule provides a tie-break.

So the “observer/measurement” idea becomes: not “mind collapses matter,” but “the seam commit event forces a single outwardly coherent tokenization under the admissibility grammar.” That is compatible with the theory’s core anti-materialist stance and avoids introducing a new causal primitive.

In short: V2 provided the core technical motivation:

If the environment is a seam representation, then the *felt partitioning* of experience (inside body vs near-world vs far-world/meaning) should be explicable as a property of the seam’s admissibility structure—i.e., CRA + Θ/κ + symbolization—rather than as a property of “incoming signals.”

That is exactly what this module attempts to formalize.

**2.3 The prompt insight: “extension of 2”**

The immediate spark for this module was the “extension-of-2” insight you articulated:

* Each context level extends to its context and its context’s context (two layers outward).
* The extra +3 is not “intrinsic to perception,” but is accessed because instruments exist within +1 and effectively extend outward reach (via encoding).
* Critically: **−2 reaches 0 but does not reach +1**, so it “hits the loop” only on the 0 end, not the +1 end.

This is the piece that converts the phenomenological story into a candidate **formal constraint**.

Your narrative mapping (which we then sought to make technical) was:

* **−2 extension node → “body boundary”**  
  Because −2 terminates at 0 under the two-layer reach, it can shape the committed present from the inward side, but it cannot directly become part of the outward +1 “material environment” tokenization. This yields a principled explanation for why certain experiences feel “inside me” and not part of the shared outer world.
* **−1 extension node → “interface band” (proximal environment)**  
  Because −1 reaches +1 (via mediation through 0), it lives at the seam interface: it is where “the world as near-environment” can modulate the present in a way that is still tightly tied to the boundary.
* **0 extension node → “meaning/visual world”**  
  Because 0 reaches outward into the next two layers (through +1 to +2), it is able to host an outwardly structured world: stable objects, spatial meaning, and “seeing the stars” as a coherent outward representation—again without asserting literal direct access to +2/+3 as a primitive sense.
* **Instruments → apparent +3**  
  Instruments do not violate no-skip/relay discipline; they **re-encode** farther context constraints into +1-readable tokens. That makes +3 influence present without requiring a direct “0→+3” coupling.

What made this insight worth formalizing (rather than leaving it as story) is that it promises three major benefits:

1. **It explains a basic feature of lived experience** (body/world boundary + modality partition) *using only existing AR machinery*, instead of requiring a separate “mind module.”
2. **It aligns with and reinforces the new “CFD / band manifest” addition**, because it interprets experience differences as differences in manifest structure (CRA reach, symbolization, gating profiles).
3. **It provides a disciplined bridge to measurement talk**, because the “boundary termination” idea gives a clear internal reason why some distinctions do not become outwardly stable without a commit bottleneck.

So the prompt insight wasn’t “a new claim about biology.” It was a candidate **structural rule about context coupling**, whose phenomenological consequences are exactly what you wanted to put on record: *the environment is not sensed; it is represented by context constraints.*

**3. Placement in the Overall Theory Stack**

**3.1 Where this sits in the core bundle**

This “Experience Horizons from Context Extension” module is **cross‑cutting**: it is not a new foundational axiom layer, and it is not (by itself) a new simulation sector. It is best understood as a **formalization + interpretive bridge** that takes existing AR commitments and makes one specific payoff explicit:

why experience reliably partitions into *body / near‑environment / world‑meaning* **without** treating “signals from matter” as the fundamental ontology.

Practically, the module “lives” across several document roles, with the cleanest internal organization being: **philosophical meaning → ladder roles → V1 compression → V2 commit pipeline → manifest packaging**.

Below is the intended placement map (document labels are your bundle; the “homes” are where the definitions belong, not necessarily where the prose should be expanded).

**(A) Philosophical / ontology layer**

**Primary home:** *Volume 0 – Philosophical Underpinnings*  
**What we take from it (dependencies):**

* The PMS/CS framing and the idea that “objectivity” is a CS phenomenon (shared metrics arise via synchronization), which underwrites why +1 “world” looks public rather than private.
* The relational core: ticks have meaning only by relations to other ticks (supporting the “meaning is structured relational scaffolding” side of the spectrum).

**What this module adds back (contribution):**

* A concrete mapping from the qualia–structure spectrum into **band‑indexed representability/admissibility**, so the philosophical spectrum becomes operationally “about manifests,” not only about interpretation.

**(B) Context ladder / role mapping layer**

**Primary home:** *Context Level framework* (and any CL cluster mapping docs)  
**What we take from it (dependencies):**

* “Bands are roles relative to a chosen vantage (0), not stacked substance layers.”
* The canonical human hinge mapping (−2..+3), plus hinge anchors:
  + UGM ~ 0.1–0.12 mm,
  + Θ ~ 0.1 s,  
    interpreted as coherence windows required for “one act” at 0.

**What this module adds back (contribution):**

* A precise **reach/grammar rule** (CE2 / Ext₂) that makes “two‑layer extension” explicit and usable as a CRA constraint.

**(C) V1 formal layer (ladder geometry + kernels)**

**Primary home:** *V1 – Formal Framework*  
**What we take from it (dependencies):**

* The structural picture: band index + dimension profile D(n), pivot weighting g(D(n)), and collapse/reproduction kernels across seams.
* The hinge fact that collapse at D≈2 acts like strong compression (rank‑1 projector / angular averaging), meaning most distinctions do not survive hinge crossing as separable features.

**What this module adds back (contribution):**

* A “V1‑face” justification for why an **experience‑separability horizon** is naturally short‑range (and why farther‑context structure must be re‑encoded to become hinge‑visible).

**(D) V2 engine layer (commit pipeline)**

**Primary home:** *V2 – Present‑Act Engine* and the formal “record V2 math” spec  
**What we take from it (dependencies):**

* The non‑negotiable contract:
  + hinge equality in a finite alphabet,
  + gates Θ/κ + structural + ParentGate + CRA,
  + ratiolex acceptance,
  + PF/Born invoked **only** on true structural ties.
* The requirement that the run is fully specified by a manifest (including CRA, ParentGate, Θ/κ ladders, audits), and that diagnostics never leak into control.

**What this module adds back (contribution):**

* A disciplined interpretation of “sensing” as seam feasibility:
  + the 0↔+1 seam is where outward “material world” tokens become committed as coherent with the inward record under manifests.
* The modality decomposition as a structured refinement of the same commit pipeline (submanifests rather than “senses as signal channels”).

**(E) Bridge layer (two‑face discipline)**

**Primary home:** *Bridge (V1–V2)*  
**What we take from it (dependencies):**

* Method rule: every new claim must be expressible in both V1 and V2 language, with an explicit mapping table.
* The explicit interpretive mapping: V1 boundary projection / consistency is read as V2 hinge equality in a finite alphabet.

**What this module adds back (contribution):**

* A new entry (or small block) in the Bridge dictionary:
  + **“phenomenal horizons / extension-of-2”** ↔ **CRA path grammar + Ξ partition + Struct profiles** (engine‑side operational form).

**(F) Simulation + evidence layer**

**Primary home:** *V1 Simulations*, *V2 Simulations*, *Core Evidence Narrative*  
**Role for this module:**

* Not required for first‑pass internal coherence.
* Later, it can motivate either:
  + a **toy sim** demonstrating “private inward constraints vs outward public tokens,” or
  + formal metrics (tie rates, admissibility violations, stability under manifest swaps) that illustrate modality‑like separation as a manifest effect.

**3.2 Dependency graph**

This subsection records **what must already be true** for the module to make sense, and what it constrains in return. The intent is to prevent drift: if we later revise one dependency, we can see which parts of this module are affected.

**3.2.1 High-level dependency diagram (conceptual)**

Volume 0 (qualia / informean spectrum, PMS/CS)

|

v

CL ladder roles (−2..+3) + hinge anchors (UGM, Θ)

|

v

V1: hinge compression + kernels (why distinctions don’t survive crossing)

|

v

Bridge: two-face mapping discipline (V1 constraints ↔ V2 procedures)

|

v

V2 engine: hinge equality + gates + ratiolex + ties-only PF/Born

|

v

Band manifests 𝓜\_n (CFD): context described as feasibility constraints

|

v

THIS MODULE:

- CE2 / Ext₂ reach rule as CRA grammar

- experience cones as admissible path templates

- modalities as submanifests (Ξ partitions + gate profiles)

- instruments as re-encoding operators into +1-visible tokens

Two points in this diagram matter most:

1. **The “no extra ontology” constraint**  
   The base primitives are present-acts + PMS/CS, and bodies/brains/hardware are outward (+1) appearances of stable IN/ON patterns, not causal primitives.  
   This module must never require adding “sensors as ontological input channels” as a new primitive.
2. **The “engine discipline” constraint**  
   The experience story must be expressible using only:

* finite symbolization (Ξ),
* hinge equality,
* feasibility gates,
* ratiolex ordering,
* PF/Born ties-only on true structural ties.

**3.2.2 Immediate technical dependencies (hard prerequisites)**

* **Band manifest object exists and is the operational meaning of “context.”**  
  The manifest packages what is representable, feasible, and preferred at a band.  
  This module depends on the manifest fields being explicit:
  + (\Xi\_n), (f\_n), (g\_n), (\Theta\_n), (\kappa\_n), (\mathrm{Struct}\_n), (\mathrm{ParentGate}\_n), (\mathrm{CRA}\_n), (\mathrm{Accept}\_n).
* **“Sensing” is already defined as feasibility at the 0↔+1 seam.**  
  The new module leverages this directly; it doesn’t invent a new “experience mechanism.”
* **Hinge compression is real in the formalism (V1) and must reflect in V2 representability.**  
  The module’s “experience horizon” intuition depends on the hinge being a genuine compression point (rank‑1 style behavior) so that many distinctions cannot survive multiple seam crossings as separable features.

**3.2.3 What this module constrains downstream (new constraints we must honor later)**

Once we accept this module, it imposes constraints on later writing and later formalization:

* **CRA must be capable of expressing path/grammar constraints**, not just “allowed pairings.”  
  That is, it must be able to encode “no‑skip / relay” behavior and “must go through 0” style mediation constraints.
* **Modal talk must become manifest talk**  
  If we speak of “interoception vs vision,” we must be able to identify it as a submanifest difference (Ξ partition + gate profile + acceptance priority), not as an external material input channel.
* **Instruments must be represented as re-encoding**  
  Any claims of “+3 access” must be implementable as an encoding operator into +1-visible tokens (so the 0 hinge still reads +1), rather than implying direct +3 sense contact.

**3.3 Relationship to the other new DP addition (CFD / Band Manifests / CCLK)**

This section records how the “experience horizons” module relates to the other major addition currently planned for the DP (the CFD + band manifests + CCLK extension work).

**3.3.1 The short version: this module is a specialization of CFD**

The CFD work formalizes that **“context level is not a separate layer of stuff; it is the manifest; feasibility is the operational face of context structure.”**

Under that worldview, the experience-horizons module is best seen as:

* **a claim about CRA structure (admissibility grammar),**
* **a claim about Ξ structure (representable distinctions),**
* **a claim about Struct/Θ/κ profiles (what counts as coherent in one act),**
* and a claim about **Accept ordering** (how the engine prefers outward coherence vs inward continuity).

So this module does not “compete” with the CFD/manifest addition; it *uses it as the technical home.*

**3.3.2 Exact attachment points inside the manifest schema**

The manifest schema explicitly includes CRA as “context-resolved admissibility rules… legal context pairings / seam grammars.”

That gives clean placement for the new objects:

* **CE2 / Ext₂**  
  Lives primarily as a refinement of **CRA₀** (and possibly CRA across neighboring seams):
  + encode two-hop reach as a permitted path grammar,
  + encode “must go through 0” mediation as a forbidden skip pattern.
* **Experience cones**  
  Are best recorded as **CRA path templates** (inner cone, interface cone, outer cone), optionally referenced by name in an audit log: “this act used cone template X.”
* **Modal submanifests**  
  Live as a refinement of **Ξ₀, Struct₀, Θ₀/κ₀, Accept₀**:
  + modalities are different partitions of representability and stabilization, not new sensors.
* **Instrumental +3 access**  
  Lives as an additional encoding layer inside the outward map (f) (or as a preprocessor before (f)), consistent with the principle that the engine commits only what is hinge-visible in Ξ and passes gates.

**3.3.3 How this module strengthens the CFD/CCLK addition (and vice versa)**

**How experience horizons strengthens CFD/CCLK:**

* CFD can otherwise feel like “just engine plumbing.” This module gives CFD a direct interpretive payoff: it explains why a feasibility-defined +1 world naturally appears as a coherent external environment to a 0 vantage, rather than as arbitrary constraint checking. The “sensing is feasibility at 0↔+1” statement makes that explicit.
* It also reinforces the ontology guardrail: no “material agents” language. The extension explicitly flags the need to avoid treating hardware as primitive cause.

**How CFD/CCLK strengthens experience horizons:**

* The manifest object is the correct technical home for modalities and admissibility grammars, and it is explicitly designed to unify “what V1 constrains” with “what V2 enforces.”
* CCLK (context compression as learned kernel) provides a natural future explanation for why modality partitions can be stable and reusable across time (stable hinge maps and stable manifest configurations). The extension’s own roadmap states that the compressive nature of the manifests and stable low-dimensional modes is exactly what CCLK is meant to capture.

**3.3.4 Documentation hygiene: keep this module “attached,” not floating**

A practical integration lesson from the CFD/CCLK extension notes is to avoid letting extensions become free‑floating essays. The recommended hygiene is:

* treat the addition as a self-contained “Extension Module,”
* cross-reference it from the Bridge doc, V2 engine doc, and (if needed) book narrative sections,
* rather than rewriting core documents and creating drift.

This record follows that same approach: this experience-horizons module should be kept as an explicit add‑on that is **auditable** (i.e., you can point to “which manifest field caused this act to be allowed/forbidden” as a design rule).

**Transition note to next section:**  
Section 4 will introduce the canonical notation and definitions we will use everywhere (band indices, ladder graph/distance, Ext₂/Reach sets, and the manifest component symbols), so the rest of the record can be written without ambiguity or symbol collisions (e.g., g(D) vs g as a qualia feature map).

**4. Notation and Definitions**

This section fixes the notation we will use throughout the rest of this record. The primary goal is to eliminate ambiguity between:

* **band/ladder objects** (context levels, reach, admissibility),
* **engine objects** (records, feature alphabets, hinge maps, gates, acceptance),
* **manifest objects** (band-level “contracts” that define what is representable/feasible),
* and **modal objects** (submanifests used to model qualitative channels).

**4.1 Band indexing and vantage definition**

**4.1.1 Band index set and chosen center**

* Let context bands be indexed by integers:
* Fix a chosen “center vantage” as:

In this record, **0 is the human hinge vantage** (the “UGM/organism band” in your canonical mapping).

**4.1.2 Band roles are relative, not absolute**

* The integer index is **not an absolute physical layer**; it is a **role label relative to the chosen center**.
* When the center changes (e.g., a different hinge/vantage), the same absolute physical scale may correspond to a different index.

**4.1.3 Canonical role map used in this record**

For the human hinge (centered at 0), we will use the working role-map:

* : “nano/quantum seam” role
* : “cell / microtissue” role
* : “UGM hinge / organism present” role
* : “Earth-surface material environment” role
* : “galactic-scale container” role
* : “cosmic shell / outer context” role

**Working hinge anchors (used later as context):**

* UGM spatial hinge:
* Temporal hinge window:

These anchors are not required for the *pure* math below, but they help interpret which bands correspond to which phenomenological “horizons.”

**4.2 Ladder graph model**

To make “extension” and “no skipping” precise, we model the context ladder as a graph.

**4.2.1 Base ladder graph**

* Define the base context ladder graph:

where:

* + (one vertex per band index),
  + contains edges only between adjacent bands (neighbor-only base):
* Intuition: “primitive coupling” (direct seam relation) is only between neighbors.

**4.2.2 Directed vs undirected interpretation**

* For most reach definitions we treat as **undirected** (adjacency is symmetric).
* For “experience cones” we will use **directed paths** (outward/inward direction matters), which we represent by the ordered sequence of indices:

**4.2.3 CRA as a grammar over paths (not just edges)**

* CRA (Context-Resolved Admissibility) will be treated as a **grammar** that constrains which cross-band couplings are legal.
* Important: CRA can constrain:
  1. which adjacent steps are legal, and/or
  2. which multi-step **path templates** are legal (e.g., “must mediate through 0,” “no skipping,” “only two-hop outward reach”).
* This record will later propose specific CRA constraints (e.g., CE2 / Ext₂) as part of the new module.

**4.3 Distance and reach**

We now define “extension-of-two” in terms of distance and reachable sets.

**4.3.1 Graph distance**

* Define the graph distance as the length of the shortest path in :
* In the neighbor-only ladder graph, this reduces to:

**4.3.2 k-hop reach set**

* Define the k-hop reach set from band as:

**4.3.3 Two-hop extension set (Ext₂)**

* Define the two-hop extension set:
* For the chosen center:
* **Interpretation discipline:**  
  expresses **reachability by two hops** in the ladder graph. It does *not*, by itself, assert “direct causal influence”; it is a structural bound on what can be mediated in two neighbor steps.

**4.3.4 Two-hop cones (path templates)**

When we say “experience cones,” we mean specific **directed two-hop path templates** relevant to the human hinge:

* Inner cone (inward → center):
* Interface cone (inner boundary → outward boundary):
* Outer cone (center → outward container):

These will later be interpreted as canonical “routes” by which constraints from different bands can become hinge-visible at 0.

**4.4 Core V2 objects referenced**

This module must be fully expressible in V2 engine terms. We define the minimum objects here.

**4.4.1 Tick index and records**

* Let discrete time / act-index be:
* Let:
  + denote the **world record** at tick (outwardly readable description state),
  + denote the **qualia record** at tick (inner/lived state at the boundary-now).

We do not fully specify internal structure of here; we only require that each can be mapped into a finite feature alphabet at each band.

**4.4.2 Feature alphabets and band-indexed symbolization**

* For each band , define a finite feature alphabet:
* The engine’s “what it can commit” at band is mediated by ; if a distinction is not representable in , it cannot appear as a committed band-level token.

**4.4.3 Hinge maps (outward and inward reads)**

At each band , define:

* an **outward read map**:
* an **inward read map**:

**Notation warning (important):**

* The symbol here is an inward hinge map.
* If we later reference the V1 “pivot weighting” function usually written , we will denote it explicitly as:

to avoid collisions.

**4.4.4 Hinge equality**

* A candidate pair is hinge-consistent at band if:
* When equality holds, we denote the common feature token as:

This is the “meeting point” between inner and outward descriptions at the seam.

**4.4.5 Feasibility gates (band-indexed)**

At each band , define feasibility gates (as predicates or filters) including:

* : temporal coherence / window constraint
* : spatial coherence / granularity constraint
* : structural predicate(s) (coherence, invariants, pattern rules)
* : container/outer-context feasibility geometry gate
* : admissibility grammar across bands (legal couplings / legal path templates)

We will treat each gate as a boolean-valued predicate that can depend on:

* the candidate pair ,
* the candidate feature token ,
* and (for CRA) the band indices/path templates involved.

**4.4.6 Acceptance ordering and ties-only randomness**

* After hinge equality and feasibility gating, the engine applies an acceptance procedure:

which we treat as producing a **ratiolex / lexicographic ordering** on the surviving candidates.

* Deterministic selection is used unless a genuine structural tie remains; only in the tie case does PF/Born sampling occur:
  + **PF/Born is invoked only on true structural ties**, not as a general weighted scoring rule.

(We do not restate the full ratiolex residual vector here; the later section that formalizes Accept will point back to the existing V2 spec.)

**4.5 Band manifest schema**

This module’s central claim is that “experience horizons” are constraints on manifests—especially CRA, symbolization, and stabilization gates. So we formalize manifests now.

**4.5.1 Canonical manifest object**

Define the band manifest:

Interpretation:  
is the “contract” that determines:

* what distinctions exist at band (),
* what counts as a hinge match (),
* what counts as feasible (),
* and how the band selects among feasible survivors (, ties-only PF/Born).

**4.5.2 Modal submanifests (qualitative channels)**

To represent “qualities of experience” without introducing new primitives, we define a set of modality labels:

Then we represent the 0-band manifest as a structured composition of submanifests:

Notes:

* “” here is conceptual: in implementation it may be a partition of into disjoint subalphabets , or a set of overlapping feature-views with disambiguation rules.
* Each submanifest has the same *type signature*:
* The module’s phenomenology claims will be expressed as constraints on:
  + the modality partition of ,
  + modality-specific CRA templates (which cones feed which modalities),
  + and modality-specific coherence windows ().

**4.5.3 Modality source sets and spectrum weights**

For each modality , define:

* a band-source set:

indicating which bands can contribute *experience-separable* structure into modality at the 0 hinge under the admissibility rules.

* a spectrum weight:

interpreted as a bookkeeping parameter for where modality lies on the qualia↔informean continuum:

* + : qualia-heavy / boundary-like / private / minimally structured
  + : informean-heavy / structured / meaning-rich / communicable

Operational note:

* is not a new physical constant; it is a shorthand for manifest properties such as:
  + symbol richness of ,
  + depth of internal relational scaffolding required for stable tokens,
  + strictness/shape of and ,
  + and the acceptance profile in .

**Transition note to next section:**  
Section 5 will state the **core postulates and constraints** specific to this module (neighbor-only/no-skip discipline, mediation-through-center constraint, and the CE2/Ext₂ rule as a CRA schema), and it will begin to formalize what exactly counts as “legal reach” vs “experience-separable reach.”

**5. Core Postulates and Constraints for This Module**

This section states the **working postulates** that make the “experience horizons from context extension” module mathematically well-defined and internally consistent with the rest of AR/V1/V2. These are not all claimed as eternal laws of nature; rather, they are the *minimal structural assumptions* we are adopting in order to (i) pin the idea down, (ii) prevent drift into ambiguous language, and (iii) make sure the module can be implemented as constraints inside the **band manifest** (especially CRA / Struct / Θ / κ).

A recurring theme throughout this module is the need to keep two notions distinct:

* **Legal coupling reach**: what cross-band interactions are *admissible* (CRA grammar).
* **Experience‑separable reach**: what cross-band structure can survive seam crossings as *distinct symbols* in the local alphabet (\Xi\_0).

The “extension-of-2” idea will ultimately be expressed in both senses:

* as a CRA grammar limit (legality), and/or
* as an experience-separability horizon (compression/representability).

**5.1 Neighbor-only / no-skip discipline**

**5.1.1 Statement (base ladder coupling)**

**Postulate NNS (Neighbor-Only / No-Skip):**  
Primitive context coupling is **neighbor mediated**. In the ladder graph (G=(\mathbb{Z},E)), the only primitive edges are between adjacent bands:  
[  
(n,n+1)\in E,\quad \forall n\in\mathbb{Z}.  
]  
Equivalently, any allowed cross-band interaction between (a) and (b) must factor through an adjacent-step path:  
[  
a=v\_0 \to v\_1 \to \cdots \to v\_\ell=b,\quad |v\_{i+1}-v\_i|=1.  
]

This postulate is the “structural hygiene rule” that prevents accidental introduction of hidden teleconnections (“direct” −2→+2 jumps, etc.). It’s also the cleanest way to enforce the theory’s existing relay/mediation intuition: outward relations are not skip connections; they are **seam compositions**.

**5.1.2 Interpretation (what this does *not* claim)**

NNS is not a claim that “long-range correlations don’t exist.” It is a claim about **how correlations can become hinge-visible and stable inside the AR engine**:

* Even if far-context constraints matter, they matter by being *relayed* and *re-encoded* through intermediate context structures (and their manifests), not by bypassing intermediate feasibility grammars.

So NNS is ultimately a claim about **representation and admissibility**, not about classical propagation speed.

**5.1.3 Operational meaning (how it appears in the engine)**

In V2 terms, NNS means:

* You never admit a candidate act at 0 by referencing a “direct” constraint from +2 or +3 without also satisfying the intermediate +1 constraints, because +1 is the seam that defines outward objectivity for the 0-vantage.
* In manifest terms, NNS is encoded as a CRA rule that rejects any coupling that cannot be expressed as neighbor seam composition.

This supports auditable implementations: if every effect is a chain of seam relations, then **every effect has an audit trail** (“which seam, which gate, which manifest field?”).

**5.2 Mediation-through-center constraint**

Neighbor-only alone is not enough to pin down the phenomenology story. We also need a center-mediation rule that captures your repeated insistence:

certain cross-band relations must be mediated through the chosen “center” (here: 0), and cannot bypass it.

**5.2.1 Statement (center mediation)**

Fix the chosen center vantage (0). Define a path (p=(v\_0,\dots,v\_\ell)) as **center-mediated** if it contains 0:  
[  
0 \in {v\_0,\dots,v\_\ell}.  
]

**Postulate CMC (Center-Mediation Constraint):**  
Any admissible coupling that crosses the sign boundary (negative ↔ positive bands) must be center-mediated. Formally, for any (a<0<b),  
[  
\text{If coupling}(a,b)\text{ is admissible, then every admissible path }p:a\to b\text{ must include }0.  
]

This postulate is the engine-level version of the intuition “0 is the seam interface where inward and outward are rendered mutually legible.”

**5.2.2 Why we need CMC (beyond neighbor-only)**

Under neighbor-only, the shortest path from −1 to +1 is already ((-1\to 0\to +1)), so CMC may look redundant there. But CMC becomes crucial when we later allow **any** richer ladder structure (e.g., optional shortcut edges, or non-linear band graphs in other contexts), and it clarifies what “must go through 0” means *conceptually*:

* The 0-vantage is the **only** place where “inward record” and “outward record” are required to satisfy hinge equality in (\Xi\_0).
* Therefore any coupling that purports to connect “inner” bands to “outer” bands must be reflected as a coherence event at 0.

CMC is essentially the formal guardrail against accidentally turning the model into “hidden channels” that bypass the seam.

**5.2.3 Consequences (immediate phenomenology payoff)**

Two critical distances appear immediately:

* (\mathrm{dist}(-2,+1)=3)
* (\mathrm{dist}(0,+3)=3)

Those are the two “hard edges” that we repeatedly use:

* **−2 cannot reach +1 in two hops**, so inward-most constraints can shape the committed present at 0 without directly objectifying into the +1 public world.
* **0 cannot reach +3 in two hops**, so access to +3 must be mediated by re-encoding structures (instruments) that live in the outward bands.

CMC supports reading these as meaningful *structural boundaries* rather than as arbitrary numerical facts.

**5.3 CE2 / Ext₂ definition**

This is the core step: formalize “each context level extends to 2 layers.” In this record we use CE2 as a **human-hinge effective admissibility horizon** (centered at 0), not yet asserted as a universal constant across all possible centers/bands.

We introduce two closely related versions—one set-based (reach) and one grammar-based (admissible path templates)—because they serve slightly different purposes. In practice, we may use both and treat them as two faces of the same idea.

**5.3.1 CE2‑R (Reach-based two-hop extension)**

Define the two-hop reach set from band :

For the human hinge center:

**CE2‑R (working claim):**  
For the human hinge vantage, **experience-separable contributions** into the 0‑band committed content are primarily restricted to bands in . Structure beyond two hops may still constrain reality, but it will not typically appear as **distinct, directly separable content at 0** without intermediary encoding/re-encoding.

This form is best for:

* quick sanity checks (“is +3 outside direct experience horizon?” yes),
* defining modality source sets ,
* expressing “two-layer extension” as a bounded horizon without claiming direct causal influence.

**5.3.2 CE2‑G (Grammar-based two-hop extension)**

Reach sets do not, by themselves, encode mediation and “must-go-through” structure. For that we define a path grammar.

Let be the set of all finite directed paths on the ladder graph . Define a CRA admissibility predicate:

**CE2‑G (two-hop grammar):**  
For the human hinge vantage, CRA admits only the canonical **two-hop** templates as “direct phenomenological channels,” namely paths of length 2 that match one of the following forms:

* inward-to-center:
* boundary seam:
* outward-to-container:

Specialized to , these are the three cones:

Everything else must either:

* be rejected by CRA as inadmissible for **direct** act commitment, or
* be treated as requiring **re-encoding** into admissible tokens (instrumentation), or
* collapse into indistinguishable summaries at 0 (inference / informean structure rather than direct modality content).

This form is best for:

* implementing the module as a manifest constraint (a literal grammar),
* preserving the “no skipping” intuition explicitly,
* preventing accidental drift where someone says “0 couples to +2 directly.”

**5.3.3 Directional “outward extension” notation (optional helper)**

Sometimes “extends outward by two” is easier to express directionally than as a symmetric reach set. If useful, define:

* One-step outward:
* Two-step outward:

Then the verbal claim “each context extends to two layers outward” becomes:

Important: is shorthand for **two seam steps under admissibility**, not a direct coupling edge.

**5.4 CRA² schema options**

We now record the plausible “CRA implementations” of CE2, because different versions have different strengths and failure modes. This is where we explicitly note what version we’re currently adopting for the module and why.

**5.4.1 Option A: Strict two-hop cutoff (hard radius)**

**CRA²-A (hard cutoff):**  
Declare any coupling inadmissible unless it lies within two hops:  
[  
\mathrm{CRA}\_0(p)=\text{false}\quad \text{for any path }p\text{ whose endpoints have }\mathrm{dist}(\mathrm{start}(p),\mathrm{end}(p))>2.  
]

Pros:

* very simple; enforces the horizon cleanly.

Cons:

* can be too strong if we later want to treat far-context constraints as real but compressed (i.e., present but not separable).

**5.4.2 Option B: Template grammar (recommended for this module)**

**CRA²-B (template grammar):**  
Permit only the three phenomenological cone templates (and their obvious variants anchored at other (n)), while still allowing indirect influence by requiring re-encoding into admissible tokens.

Pros:

* aligns precisely with the three-zone phenomenology,
* naturally supports “instruments give +3” via re-encoding,
* makes “must go through 0” explicit and auditable.

Cons:

* requires careful language: far-context can still matter, but not as “direct modality input.”

**Current working choice:**  
For the *first pinned-down version* of this module, we adopt **Option B** as the cleanest and least ambiguous interpretation of your extension-of-2 insight.

**5.4.3 Option C: Soft horizon (legal but non-separable)**

**CRA²-C (soft horizon):**  
Allow longer paths legally, but enforce that after two seam crossings, distinctions collapse into coarse summary tokens in (\Xi\_0). This can be implemented as:

* a structural gate that collapses fine distinctions,
* or an acceptance/tie mechanism that treats far-source differences as ties at 0.

Pros:

* closer to the idea “far context matters but is not experienced as separable detail.”
* easier to unify with V1 hinge compression intuition (“distinctions die under repeated projection”).

Cons:

* can be misread as “0 directly experiences +3” if not written carefully.
* requires more formal machinery to define what “non-separable” means.

**Status:** keep Option C as an extension path; do not rely on it for the initial stable write-up.

**5.5 Interpretation discipline**

This subsection is intentionally “meta”—it records the language constraints and conceptual commitments that must be obeyed to keep this module aligned with AR.

**5.5.1 “Extension” is representational and admissibility-based, not material propagation**

Allowed phrasing:

* “Two-hop extension bounds what can become hinge-visible as separable symbols at 0.”
* “Far-context influence must be mediated and/or re-encoded.”

Disallowed phrasing (for this module):

* “Signals travel from the environment into the mind.”
* “The environment is out there and we receive it.”

Translation rule:

* Replace “signal” language with “encoding into (\Xi)” and “seam commit under manifest feasibility.”

**5.5.2 “Body boundary” is not anatomy; it is a stability/admissibility cut**

Allowed phrasing:

* “The body boundary is where inward constraints terminate as private modulation of the 0 act without direct +1 tokenization.”
* “Private inward distinctions do not automatically become public +1 objects.”

Disallowed phrasing:

* “−2 literally ends at the skin” (sounds like an anatomical claim).

Translation rule:

* Use “public token stability (+1/CS)” vs “private constraint influence (inward cone)” language.

**5.5.3 “Modality” means submanifest profile, not an input channel**

Allowed phrasing:

* “A modality is a subalphabet + hinge map + gate profile within (\mathcal{M}\_0).”
* “Different qualitative channels correspond to different feasible symbolizations.”

Disallowed phrasing:

* “This is the physical pathway of smell/sound/etc.” (unless explicitly marked as later empirical mapping work).

Translation rule:

* Use (\mathcal{M}\_0^{(m)}), (S(m)), (\alpha\_m) and gate profiles to speak about modality differences.

**5.5.4 Measurement linkage must stay in-engine (no “mind causes collapse”)**

Allowed phrasing:

* “Measurement-like selection occurs when hinge equality + feasibility leaves a tied survivor set; PF/Born resolves ties only.”
* “Observer is the seam commit constraint for a center band.”

Disallowed phrasing:

* “Consciousness collapses the wavefunction.”

Translation rule:

* Recast “observer” as “center-band commit rule,” and “collapse” as “selection under gates.”

**5.5.5 A quick compliance checklist for future writing**

When drafting later sections (or book/DP prose), run each paragraph through this checklist:

1. Did I accidentally imply **incoming signals** as ontology?
2. Did I treat “skin/body” as a literal physical boundary rather than a token-stability boundary?
3. Did I treat modalities as biological sensors rather than manifest substructures?
4. Did I let “measurement” slip into mind‑as‑force language?
5. Did I allow an implicit **skip connection** (0→+2 or 0→+3) without explicit mediation or re-encoding?

If any answer is “yes,” rewrite using the manifest/seam vocabulary.

### 5.6 CE2 / Ext₂: Two-hop phenomenological horizon (extension-of-2 made explicit)

We model the context ladder as a neighbor-only graph indexed by integers, centered at the chosen vantage:

[

n \in \mathbb{Z}, \quad \text{with the human hinge centered at } 0.

]

Base (neighbor-only) distance is:

[

\mathrm{dist}(a,b)=|a-b|.

]

Define the two-hop extension (reach) set:

[

\mathrm{Ext}\_2(n) := \{m\in\mathbb{Z}:\mathrm{dist}(n,m)\le 2\}.

]

In particular, for the human hinge center:

[

\mathrm{Ext}\_2(0)=\{-2,-1,0,+1,+2\}.

]

Interpretation discipline:

Ext₂ expresses “reachable by two seam steps under admissibility,” not “direct causal influence” and not “signals arriving from a material substrate.”

This record treats CE2/Ext₂ as a human-hinge effective horizon (centered at 0), without asserting it as a universal constant across all possible centers/bands.

### 5.7 CE2G: Three canonical experience cones (CRA grammar) + boundary cut

Reach sets alone do not encode mediation / no-skipping. So we state CE2 in its grammar form (CE2G) as a constraint inside CRA.

Let a “path” p be a finite directed sequence of adjacent band steps on the ladder graph.

For the human hinge center, the three canonical two-hop cone templates are:

[

t\_{\text{inner}}:\ -2\to -1\to 0,

\quad

t\_{\text{interface}}:\ -1\to 0\to +1,

\quad

t\_{\text{outer}}:\ 0\to +1\to +2.

]

CE2G (template grammar form) is encoded as a CRA admissibility condition for direct phenomenological support:

[

\mathrm{CRA}\_0(p)=\text{true}\ \Longrightarrow\ p\in\{t\_{\text{inner}},t\_{\text{interface}},t\_{\text{outer}}\}

\quad(\text{for direct phenomenological support}).

]

Everything else must either:

(i) be rejected by CRA as inadmissible for direct act commitment,

(ii) require re-encoding into admissible +1-readable tokens (instrumentation),

or (iii) collapse into indistinguishable summaries at 0 (inference / informean structure rather than direct modality content).

Immediate corollary (boundary cut):

Since |-2-(+1)|=3, CE2 implies that inward-most constraints (−2) can shape the committed present at 0 via the inner cone,

but do not, by default, become stable +1 public/world tokens without explicit legal mediation and outward stabilization.

So the “body boundary” here is defined as a public-token objectification cut, not a literal anatomical edge inside raw feeling.

### 5.8 Modal submanifests + the qualia↔informean spectrum parameter (qualia to meaning)

A band manifest packages what it means (engine-side) to be at a context band:

[

\mathcal{M}\_n =

(\Xi\_n,\ f\_n,\ g\_n,\ \Theta\_n,\ \kappa\_n,\ \mathrm{Struct}\_n,\ \mathrm{ParentGate}\_n,\ \mathrm{CRA}\_n,\ \mathrm{Accept}\_n).

]

Hinge equality at band n is:

[

f\_n(w)=g\_n(q)\in\Xi\_n.

]

Feasibility gates at band n are bundled as:

[

\mathrm{Feas}\_n := \Theta\_n \wedge \kappa\_n \wedge \mathrm{Struct}\_n \wedge \mathrm{ParentGate}\_n \wedge \mathrm{CRA}\_n.

]

Now define “modalities” (qualities/channels of experience) as submanifests of the 0-band manifest, not as material sensors:

[

\mathcal{M}\_0 \approx \bigoplus\_{m\in\mathsf{Mod}} \mathcal{M}\_0^{(m)}.

]

Each modality submanifest \mathcal{M}\_0^{(m)} includes (at minimum):

a subalphabet \Xi\_0^{(m)}, modality hinge maps (f\_0^{(m)}, g\_0^{(m)}), and modality-specific gate/accept profiles

(\Theta\_0^{(m)},\kappa\_0^{(m)},\mathrm{Struct}\_0^{(m)},\mathrm{CRA}\_0^{(m)},\mathrm{Accept}\_0^{(m)}).

For each modality m, define its direct admissible source set:

[

S\_{\text{dir}}(m)\subseteq \mathrm{Ext}\_2(0).

]

Careful interpretation:

S\_dir(m) does not mean “bands send signals into modality m.”

It means: distinctions originating in those bands can participate as experience-separable constraints/tokens in the modality’s seam commitment,

under the admissibility grammar and the modality’s symbolization profile.

Finally, pin down the “qualia ↔ meaning” spectrum with a bookkeeping parameter per modality:

[

\alpha\_m\in[0,1].

]

Interpretation:

(\alpha\_m\approx 0): qualia-heavy, boundary-immediate, private, minimally contrast-tokenized

(\alpha\_m\approx 1): informean-heavy, structured, meaning-rich, communicable/shareable

This is not an additional physical law; it is a summary of how the modality submanifest stabilizes committed tokens.

Operational factors that tend to increase \alpha\_m include: richer \Xi\_0^{(m)}, stronger structural stabilization (Struct), higher cross-center stability of outward tokens, and deeper relational scaffolding.

Factors that tend to decrease \alpha\_m include: low articulation/coarse \Xi\_0^{(m)}, stronger dependence on inward-only sources (including −2 which terminates at 0 under CE2), lower public stabilizability, and higher tie/ambiguity rates at the seam.

**Transition note to next section:**  
Section 6 will use these postulates to explicitly construct the **experience horizon** at the human hinge: compute (\mathrm{Ext}\_2(0)), define the three cones, derive the admissibility-cut interpretation of the body boundary, and state the “environment-as-representation” claim in precise seam/manifest terms.

**6. The Experience Horizon Construction**

This section is the first “build step” that takes the postulates from Section 5 and produces the core structural objects of the module:

1. the **two-hop experience horizon** around the chosen center (0),
2. the **three canonical two-hop cones** (inner / interface / outer),
3. the **body boundary** as an admissibility/stabilization cut (not anatomy), and
4. the **environment-as-representation** statement in seam/manifest terms.

Throughout, we maintain the discipline established earlier:

* **legal coupling reach** is governed by CRA (a grammar over paths), and
* **experience-separable reach** is governed by which distinctions can survive relay and become **distinct tokens** in (\Xi\_0).

In the first pinned-down version of this module, we treat these as aligned via the CE2/Ext₂ discipline.

**6.1 Reach sets from the human hinge**

**6.1.1 The two-hop horizon at the chosen center**

With the chosen center band (0) (human hinge), and with the neighbor-only ladder distance  
[  
\mathrm{dist}(a,b)=|a-b|,  
]  
the two-hop extension set (Section 4) is:  
[  
\mathrm{Ext}\_2(0)={m:\mathrm{dist}(0,m)\le 2}={-2,-1,0,+1,+2}.  
]

This set is the **experience horizon** in the reach-based (CE2-R) sense:

* If a band index (m) lies in (\mathrm{Ext}\_2(0)), then in principle constraints sourced at (m) can be **relayed** through neighbor seams and become **hinge-visible** at 0 within two seam steps.
* If (m\notin \mathrm{Ext}\_2(0)), then any influence from (m) on the committed content at 0 must be:
  + (i) mediated by longer seam chains, and therefore
  + (ii) either compressed into coarse summaries (not separable as distinct symbols), or
  + (iii) re-encoded by outward structures (e.g., instruments) into +1-visible tokens.

**6.1.2 Two “hard edges” of the horizon**

Two distances matter immediately:

* (\mathrm{dist}(0,+3)=3) ⇒ (+3\notin \mathrm{Ext}\_2(0))
* (\mathrm{dist}(-2,+1)=3) ⇒ (-2) and (+1) are not mutually reachable within two hops

These two “3-step separations” are what create the most important interpretive payoffs:

1. **Why +3 is not directly present to the human hinge**
   * It cannot become hinge-visible at 0 as separable content without mediation and re-encoding.
   * This is the disciplined version of “we don’t directly experience the cosmic shell; we require instruments.”
2. **Why inward-most structure feels private and “inside”**
   * Because −2 cannot directly participate in +1 objectification within the two-hop grammar, its distinctions can influence the present at 0 but do not naturally stabilize as public +1 tokens.
   * This becomes the structural core of the “body boundary” interpretation.

**6.1.3 Outward two-step extension map (intuition helper)**

Sometimes it helps to explicitly list the “two-step outward reach” (with the understanding it is *mediated*, not a direct edge):

[  
\mathrm{Out}^2(n)=n+2.  
]

Applying this to the bands around the hinge gives the four key relations you were using intuitively:

* (\mathrm{Out}^2(-2)=0)
* (\mathrm{Out}^2(-1)=+1)
* (\mathrm{Out}^2(0)=+2)
* (\mathrm{Out}^2(+1)=+3)

This is the formal backbone of the verbal picture:

* −2 “reaches” to 0 and terminates there,
* −1 “reaches” to +1 (via 0),
* 0 “reaches” to +2 (via +1),
* +1 “reaches” to +3 (via +2), which is why *instruments* (stable +1 objects) can make +3 constraints readable as +1 tokens.

**6.2 Three canonical two-hop cones**

The reach set (\mathrm{Ext}\_2(0)) tells us what bands are within two hops, but it does not yet tell us **which two-hop paths** are the structurally privileged channels. For that we move to the grammar-based (CE2-G) reading: the module is not merely “distance ≤ 2,” but “the admissible two-hop templates are these three cones.”

We therefore define three canonical **directed two-hop path templates** anchored at (0).

**6.2.1 Cone definitions (as admissible path templates)**

We call a directed length-2 path (p=(v\_0\to v\_1\to v\_2)) a **cone path** at the human hinge if it matches one of:

1. **Inner cone**  
   [  
   p\_{\text{inner}}:\quad -2 \to -1 \to 0  
   ]
2. **Interface cone**  
   [  
   p\_{\text{interface}}:\quad -1 \to 0 \to +1  
   ]
3. **Outer cone**  
   [  
   p\_{\text{outer}}:\quad 0 \to +1 \to +2  
   ]

In CRA terms, CE2-G is the claim that these templates (and their obvious analogs anchored at other (n)) are the primary **phenomenological coupling routes** for a 0-centered experience.

**6.2.2 What a “cone” means in engine terms**

A cone is not a physical signal path. It is a constraint on how the 0-band manifest is allowed to:

* admit cross-band couplings (CRA), and
* incorporate cross-band constraints as part of feasibility and stabilization.

Operationally, when the engine at band 0 evaluates candidate acts, the CRA predicate is allowed to reference cross-band structure only through these templates. Put differently:

* A candidate act at 0 is not “allowed” to be justified by a direct relation between −2 and +1 (for example), because that would violate the cone grammar.
* Any influence from −2 must arrive through a legal inner-cone mediation (−2→−1→0).
* Any influence from +2 must arrive through legal outward mediation (0→+1→+2).

This is precisely how the cone structure becomes “experience geometry”: it dictates which constraints can co-determine the committed present while still producing a coherent outward world.

**6.2.3 Interpreting the cones as three phenomenological zones**

The module’s intended mapping is:

* **Inner cone (−2→−1→0):** inward/private constraint channel
  + “inside-body” structure that can shape the present but does not naturally become public +1 object tokens.
* **Interface cone (−1→0→+1):** boundary/seam channel
  + where the commit event is most tightly coupled to both inward microstructure and outward material tokenization; this is the natural home of “boundary modalities” (proximally environmental but still “close to the body”).
* **Outer cone (0→+1→+2):** distal/meaning channel
  + where outward structure is stabilized by larger containers; this is the natural home of spatial, object-like, meaning-rich experience—what we ordinarily call the “world out there.”

These are not empirical claims about anatomy; they are structural claims about how constraints can enter the 0 commit pipeline under a two-hop admissibility grammar.

**6.3 “Body boundary” as an admissibility/stabilization cut**

This subsection pins down the “body boundary” story as a disciplined consequence of the cone grammar and two-hop horizon, while remaining consistent with the phenomenology described in Chapter 18 (raw feeling can be seamless and non-boundary-carving).

**6.3.1 The key structural inequality**

Under the neighbor-only ladder distance:

Under CE2/Ext₂, a two-hop admissibility grammar cannot admit a **direct** channel from −2 to +1 for the 0-centered experience. In cone terms:

* there is no allowed cone template that starts at −2 and ends at +1 in two hops.

This is the mathematical kernel of the phrase:

“−2 hits the loop at the 0 end, but not at the +1 end.”

**6.3.2 How this produces “private inward vs public outward”**

To translate this into AR/V2 language, we introduce a minimal notion of **public stabilization**:

* call a +1 token “public” if it is **CS-stable**—i.e., it can be repeatedly committed as outward structure across many centers without depending on one center’s private inward constraints.

Now apply the distance constraint:

* −2 can influence the 0 commit via the inner cone because is admissible.
* But −2 cannot directly become a +1-stable public token within the two-hop admissibility because there is no admissible channel that respects the cone grammar.

Therefore:

* −2-sourced distinctions can appear as **private modulation** of the committed present (qualia-heavy, boundary-like, inside-me),
* while +1 tokens represent what can be stabilized as a **public outward world** (informean-heavy, structured, shareable).

**Clarification (aligns with Chapter 18 phenomenology):**  
This “body boundary” is **not** claiming that raw bodily feeling contains a sharp line (e.g., a crisp “skin edge”). In the interoceptive channel, the felt field can be continuous and non-partitioned. The “boundary” in this module is a **tokenization/stabilization cut**: which distinctions can become **public +1 objects** (shareable tokens) versus which remain **private inward modulation** of the 0 act.

**6.3.3 Why this is not “dualism”**

This claim is **not** saying there are two substances (mind-stuff and matter-stuff). It is saying there are two **modes of stabilization** of one commit process:

* inward constraints shaping the commit without becoming public tokens,
* outward tokens stabilized across centers and therefore appearing as a “world.”

So the “boundary” is not metaphysical; it is a **stabilization/admissibility cut** created by CRA + symbolization + cross-center stability.

**6.3.4 Relation to measurement language (structural bridge only)**

This boundary-cut structure makes it coherent (within AR) to say:

* micro/inward distinctions (−2) can co-determine which candidate acts are admissible at 0,
* but they do not automatically become fixed public facts at +1 without a commit bottleneck,
* so underdetermination / tied survivors can arise at the seam, requiring the ties-only PF/Born resolution rule.

This is a structural alignment statement (a disciplined bridge), not yet a full QM derivation.

**6.4 Environment-as-representation statement**

This subsection states the module’s key re-interpretation of “environment.”

**6.4.1 Definition: environment as the +1-stabilized outward record**

We define “material environment” (for the 0-centered experience) as:

the subset of outward tokens that can be repeatedly committed under the +1 manifest and remain stable across CS, and that are hinge-visible to the 0 commit as coherent with the inward record.

In notation terms, one minimal way to express “environment tokens” is:

* Let the outward record after committing a 0 act be (W\_{k+1}).
* The 0-band experience token is:  
  [  
  x\_{k+1} = f\_0(W\_{k+1}) = g\_0(Q\_k)\in \Xi\_0.  
  ]
* The corresponding +1 representation token is:  
  [  
  y\_{k+1} = f\_{+1}(W\_{k+1})\in \Xi\_{+1}.  
  ]

Then the “environment” (as lived and navigated) is not a separate substrate behind (y); it is the stable pattern of (y)-tokens that:

* survive +1 feasibility and stabilization over time, and
* remain compatible (via the seam constraints encoded in CRA/Struct) with the 0-band committed acts.

So the environment is *literally* a representational surface: a stable outward description that the engine can keep committing.

**6.4.2 What “sensing an environment” means under this definition**

Under the seam/manifest view, “sensing” is simply:

* the requirement that the 0-band commit yields outward tokens that are admissible and coherent under the manifest constraints, and that maintain hinge equality with inward record at the center.

So we record the translation rule:

* “I sense X in the environment”  
  ⇢ “The commit pipeline at 0 repeatedly produces outward tokens (y) that remain feasible and stable under ( \mathcal{M}\_{+1}), and whose corresponding 0 tokens (x) remain hinge-consistent with the inward record under ( \mathcal{M}\_0).”

This eliminates the ontological “signal inflow” story and replaces it with a **commit-and-stabilize** story.

**6.4.3 Why the environment appears external (and why this is expected)**

Once +1 tokens stabilize across CS, they naturally appear:

* external, because they are **not dependent** on one center’s private inward constraints, and
* persistent, because they recur as feasible under the +1 manifest.

So the theory’s “world out there” is an emergent property of **shared feasibility and stable outward encoding**, not a primitive that experience passively receives.

**6.4.4 Immediate implication: why instruments matter (foreshadow only)**

Because (+3\notin \mathrm{Ext}\_2(0)), constraints from +3 cannot be hinge-visible as separable content at 0 unless they are first **re-encoded** into +1-readable tokens. Instruments are precisely such re-encoding structures. This will be formalized later (Section 8), but the horizon construction already shows *why* instrumentation is structurally necessary for “cosmic access.”

**Transition note to next section:**  
Section 7 will refine the “quality of experience” claim by introducing **modal submanifests** (\mathcal{M}\_0^{(m)}), defining the modality source sets (S(m)\subseteq \mathrm{Ext}\_2(0)), and formalizing how the qualia↔informean spectrum is parameterized by (\alpha\_m) and manifest profiles (Ξ richness, Θ/κ windows, Struct/CRA strictness, and acceptance priorities).

**7. Modal Submanifests and the Qualia–InformeAN Spectrum**

This section formalizes the idea that “qualities of experience” (your spectrum of consciousness) can be represented **inside the AR/V2 engine** without introducing any new ontology.

The core move is:

* **A modality is not a sensor.**
* A modality is a **submanifest profile**: a particular symbol alphabet + hinge-readable mapping + gate/acceptance profile that determines what counts as a coherent committed feature in that “channel.”

This makes the phenomenology mapping compatible with the rest of the stack:

* it’s manifest-based (CFD-aligned),
* it’s seam-based (0↔+1 loop),
* it’s admissibility-based (CRA / cones),
* and it stays inside finite symbolization + hinge equality + feasibility + ratiolex acceptance (+ ties-only PF/Born).

We will make the Chapter 18 “two faces” language operational here by treating:

* **finite/contrast-heavy modes** as modalities with richer symbolization and stronger outward stabilization (higher ), and
* **infinite/non-separate modes** as modalities with lower contrast tokenization, greater field-like continuity, and weaker public-object stabilization (lower ).

**7.1 Define modality channels**

**7.1.1 The modality set**

Let the set of modality channels be:  
[  
\mathsf{Mod}={m\_1,m\_2,\dots,m\_M}.  
]

At this stage we keep the modality taxonomy **coarse** and **structural**, not biological. A minimum useful working set (for the present discussion) is:

* (m\_{\text{intero}}): inward / bodily qualia channel (private modulation)
* (m\_{\text{interface}}): boundary/near-world channel (body–environment seam)
* (m\_{\text{world}}): distal structured-world / meaning channel (object-like outward representation)
* (optional later splits): (m\_{\text{concept}}), (m\_{\text{affect}}), (m\_{\text{motor}}), etc.

**Important discipline:** the labels are for *phenomenological convenience*.  
They do not commit us to a specific neurophysiology story.

**7.1.2 What a modality is in AR terms (definition)**

A modality (m) is defined as a **specific way the center band (0) can commit hinge-visible content**, characterized by:

1. **What distinctions exist in that channel** (subalphabet),
2. **How inward and outward records are read into those distinctions** (hinge maps), and
3. **Which coherence/stability constraints govern it** (gate profile + acceptance profile).

So a modality is a *choice of representation and constraints*—a configuration-level fact, not an extra ontological pipeline.

**7.2 Submanifest decomposition**

We now define modalities as **submanifests** of the 0-band manifest.

**7.2.1 Canonical band manifest reminder**

Recall the band manifest at (n) is:  
[  
\mathcal{M}\_n :=  
(\Xi\_n,; f\_n,; g\_n,; \Theta\_n,; \kappa\_n,; \mathrm{Struct}\_n,; \mathrm{ParentGate}\_n,; \mathrm{CRA}\_n,; \mathrm{Accept}\_n).  
]

For this module we focus on (n=0).

**7.2.2 Decomposition statement**

We represent the 0-band manifest as a composition of modal submanifests:  
[  
\mathcal{M}*0 \approx \bigoplus*{m\in\mathsf{Mod}} \mathcal{M}\_0^{(m)}.  
]

Each modal submanifest is:  
[  
\mathcal{M}\_0^{(m)} =  
(\Xi\_0^{(m)},; f\_0^{(m)},; g\_0^{(m)},; \Theta\_0^{(m)},; \kappa\_0^{(m)},;  
\mathrm{Struct}\_0^{(m)},; \mathrm{ParentGate}\_0^{(m)},; \mathrm{CRA}\_0^{(m)},; \mathrm{Accept}\_0^{(m)}).  
]

**7.2.3 What “⊕” means operationally (three implementation options)**

We are not committing to one of these yet; we’re recording the design space.

**Option 1: Disjoint partition of symbols (tagged union)**

* (\Xi\_0) is a disjoint union of subalphabets:  
  [  
  \Xi\_0 = \bigsqcup\_{m\in\mathsf{Mod}} \Xi\_0^{(m)}.  
  ]
* Each committed act produces **one dominant channel token** (or a small set) tagged with its modality.
* Pros: simplest; clean audit trail (“this token belongs to modality m”).
* Cons: may be too restrictive if experience should include simultaneous multimodal content per tick.

**Option 2: Product alphabet (vector-valued present)**

* The committed feature at 0 is a vector:  
  [  
  x\_k = (x\_k^{(m)})*{m\in\mathsf{Mod}} \in \prod*{m\in\mathsf{Mod}} \Xi\_0^{(m)}.  
  ]
* Hinge equality is applied componentwise:  
  [  
  f\_0^{(m)}(W\_{k+1}) = g\_0^{(m)}(Q\_k)\quad \forall m.  
  ]
* Pros: models “simultaneous” multimodal texture naturally.
* Cons: requires more structure; raises questions about partial matches (what if some channels match and others tie/fail?).

**Option 3: Hybrid (core token + auxiliary channels)**

* There is a primary committed token in one subalphabet plus auxiliary side-band tokens treated as constraints or annotations.
* Pros: closest to “one act” while still allowing rich content.
* Cons: you must specify which channels are “primary” vs “auxiliary,” and how they interact with Accept.

**Working choice for this record:** keep all three as viable; do not collapse prematurely.  
When we later write the PR/implementation plan, we will likely choose Option 2 (vector) for conceptual cleanliness, or Option 3 for engine practicality.

**7.2.4 The key point (why this matters)**

The decomposition is how we mathematically encode your claim:

“We are not sensing an environment; what we call sensing is the representation of context levels.”

Under this decomposition, “environment-like content” is simply the subset of committed tokens that belong to modalities whose source sets include +1/+2 bands and whose gate/accept profiles stabilize those tokens outwardly.

**7.3 Admissible source sets for modalities**

Now we connect modalities to the **extension-of-2 / cone geometry** from Section 6.

**7.3.1 Source set definition**

For each modality , define the admissible source set:

Interpretation (careful):

* does **not** mean “band sends signals to modality .”
* It means: distinctions originating in band can participate in the **seam commit** of modality as *experience-separable constraints/tokens* under the admissibility grammar and symbolization.

A refinement that is often cleaner is to specify **source paths** rather than only source nodes:

* Let be a set of admissible cone templates used by modality , e.g.

Then is the set of band indices appearing in those templates.

This “path version” makes mediation explicit and prevents “skip” misreadings.

**7.3.2 Working mapping (hypothesis-level)**

We record the working hypothesis that matches the current development state:

* **Interoceptive / inward bodily channel**

Notes:

* + This is the “private inward constraint” cone.
  + It terminates at 0 under CE2, supporting the inside-me/private character of this channel.
* **Interface / boundary channel**

Notes:

* + This is the seam channel where inward microstructure and outward tokenization meet most directly.
  + It is the natural home of “near environment” experience that is world-linked but still boundary-coupled.
* **World / meaning / distal structured channel**

Notes:

* + This is where outward structure is stabilized by container constraints (+2).
  + It is the natural home of object-like experience and meaning-rich world representation.

**7.3.3 Key corollary: “body boundary” is not a felt edge; it is a public-token cut**

Because , CE2 implies that:

* modalities with direct sources including −2 will not, by default, include +1 as a direct source without leaving the two-hop grammar.

This supports the discipline you want:

* inward-most qualities can shape the present (via −2→−1→0),
* but do not automatically become public environment tokens (+1).

**Alignment with Chapter 18:**  
This does not claim that interoceptive feeling contains a sharp inside/outside boundary. Chapter 18’s point stands: raw feeling can be a continuous field. The “boundary” referenced here is the location where content becomes **publicly objectified** as +1 tokens, not the location of a crisp edge inside raw felt presence.

**7.4 Qualia–informean weight parameters**

Now we pin down the “spectrum of consciousness” portion: how to encode “more infinite/qualia” vs “more finite/meaning” in the math.

**7.4.1 Spectrum weight per modality**

Assign each modality a spectrum weight:  
[  
\alpha\_m \in [0,1].  
]

Interpretation:

* (\alpha\_m\approx 0): qualia-heavy, boundary-immediate, private, minimally structured
* (\alpha\_m\approx 1): informean-heavy, structured, meaning-rich, communicable/shareable

This is not an additional physical law; it is a **bookkeeping parameter** describing how the submanifest behaves.

**7.4.2 How (\alpha\_m) is “implemented” (what it corresponds to in the manifest)**

We do not choose a single formula yet, but we record the operational factors that would increase/decrease (\alpha\_m).

**Factors that push (\alpha\_m) upward (more informean / meaning):**

1. **Symbol richness / articulation capacity**
   * larger and more structured subalphabet (\Xi\_0^{(m)})
   * more fine-grained or compositional tokens
2. **Structural stabilization strictness**
   * stronger (\mathrm{Struct}\_0^{(m)}) constraints that enforce object permanence, consistency, geometry, etc.
3. **Cross-center stability (public token tendency)**
   * the modality’s tokens are easier to stabilize as +1/CS-consistent outward features
4. **Inference depth / relational recursion**
   * the modality relies on deeper internal relational scaffolding (informean “depth”) to commit stable tokens

**Factors that push (\alpha\_m) downward (more qualia / boundary):**

1. **Low articulation / hard-to-symbolize content**
   * small or “coarse” (\Xi\_0^{(m)}), or tokens that are difficult to refine
2. **Higher dependence on inward-only constraints**
   * stronger reliance on source sets including −2, which terminates at 0
3. **Lower public stabilizability**
   * content tends to modulate the present privately without becoming stable +1 tokens
4. **Higher tie rate / ambiguity at the seam**
   * if the channel frequently yields tied survivors (in the ratiolex sense), the committed outcome is more “boundary-like” and less structurally determined

This gives you a clean, theory-internal way to say:

“The spectrum of consciousness maps onto context levels,”  
without turning it into “qualia is a substance.” It’s a spectrum of **how the manifest stabilizes tokens**.

**7.4.3 Optional: an explicit “spectrum score” functional (future refinement)**

Later, if you want this to be more than a descriptive parameter, you can define:

[  
\alpha\_m := F\Big(|\Xi\_0^{(m)}|,; \text{tie-rate}(m),; \text{CS-stability}(m),; \text{Struct-strictness}(m),; \text{CRA-width}(m)\Big),  
]

where each argument is measurable inside an engine run (toy or full sim). This would turn the spectrum into something you can compute from logs.

For now, the record simply notes that such a functional is plausible and would tie the philosophical spectrum to measurable engine behavior.

**7.5 Coherence-window and “carrier” sanity checks**

This subsection records the specific kind of “sanity linking” we discussed: using the hinge coherence window (\Theta) and the outward container scale to explain why some outward modalities feel “vast” while others feel “local,” **without** adopting materialist signal ontology.

**7.5.1 The hinge-time window is a manifest parameter**

We treat the “specious present” time window as a gate parameter:  
[  
\Theta\_0 \approx 0.1,\mathrm{s}.  
]

This is not merely psychological; in AR it is the coherence window for “what counts as one act” at the hinge. Different modalities may effectively have different sub-windows:  
[  
\Theta\_0^{(m)} \le \Theta\_0,  
]  
or different temporal smoothing profiles encoded in (\mathrm{Struct}\_0^{(m)}).

**7.5.2 “Why vision/world feels huge” in manifest language**

A disciplined AR phrasing is:

* The world/meaning modality (m\_{\text{world}}) is the one whose submanifest:
  + admits outward container constraints via (0\to +1\to +2),
  + has strong spatial/structural stabilization,
  + and has an outward-read map (f\_0^{(m\_{\text{world}})}) that can encode far-context structure into hinge-visible symbols.

In other words: it feels “huge” because it is the modality whose tokens are stabilized by outward container feasibility (ParentGate + Struct) and have a rich symbolization.

**7.5.3 The “light vs sound” intuition belongs here—but only as a consistency check**

We can use standard propagation speeds purely as an *interpretive consistency check*:

* Over ~0.1 s, light traverses ~30,000 km; sound traverses a few tens of meters.

In AR terms, the point is not “signals cause perception,” but:

* The +1 manifest contains outward constraints that make some forms of outward structure hinge-visible at 0 across much larger spatial scales within the coherence window, while others remain effectively local.
* This supports why the world/meaning/vision channel naturally integrates broader outward structure than the interface channels, even if both are ultimately seam-committed.

**7.5.4 Modal windows as future handles for testing**

Later, if you run toy sims, (\Theta\_0^{(m)}), (\kappa\_0^{(m)}), and the strictness of (\mathrm{Struct}\_0^{(m)}) become knobs you can vary to demonstrate:

* a modality becoming more “qualia-like” (lower (\alpha\_m)) as:
  + symbolization shrinks,
  + tie rate rises,
  + stabilization weakens;
* or more “informean-like” (higher (\alpha\_m)) as:
  + outward constraints stabilize tokens,
  + symbol richness increases,
  + CS-stability increases.

This keeps the whole “spectrum” idea anchored to engine parameters.

**Transition note to next section:**  
Section 8 will formalize how **instruments** allow +3 influence to become hinge-visible at 0 without violating the two-hop horizon: instruments will be treated as re-encoding operators (I) that translate +3 constraints into +1-readable tokens (or directly into (\Xi\_0^{(m)})) so the 0↔+1 seam can commit them.

**8. Instruments and Apparent +3 Access**

This section formalizes a key idea you stated early in the discussion:

“We get the extra +3 because of our instruments.”

Within the CE2/Ext₂ horizon model, this must be stated in a disciplined way. The point is **not** that a 0‑vantage directly senses +3. The point is that **stable structures in +1** can participate in outward couplings that reach +3 and then **re‑encode** those far‑context constraints into **+1‑readable tokens**. Once encoded into +1, those tokens become hinge-visible to 0 through the normal 0↔+1 seam.

So instruments are treated as **re-encoding operators** that allow far-context constraints to enter experience *indirectly* (as +1 tokens), without violating:

* neighbor-only / no-skip discipline,
* center mediation,
* CE2/Ext₂ horizon constraints.

**8.1 The problem: +3 is outside**

Under CE2-R, the human hinge’s two-hop reach set is:

Therefore:

**Interpretation (strict):**

* A 0-centered present-act cannot take +3 as a **direct experience-separable source** in the same way it can take +1 or +2 (within two-hop mediation).
* So “I see the cosmic shell” cannot be a primitive 0↔+3 coupling claim under this model.

But we also know (as lived fact and as scientific practice) that:

* humans obtain stable knowledge about scales far beyond +2 (cosmology, deep time, etc.).

So we need a mechanism that:

1. preserves CE2/no-skip discipline, and
2. explains how +3 constraints become **available** to 0 as committed content.

This is exactly what an “instrument” is in this module.

**8.2 Instruments as re-encoding operators**

**8.2.1 Definition: what counts as an instrument in this module**

An **instrument** is defined here as a stable +1 structure (a +1‑manifest-feasible object/process) that:

* couples outward (via +2) to +3-scale constraints, and
* produces a **+1-visible token stream** (readout, trace, number, image, record) that encodes those constraints in a form that:
  + is admissible under the +1 manifest,
  + and can be hinge-matched at 0 under the 0↔+1 seam.

In short: an instrument is a *re-encoder from “far context constraints” into “near context tokens.”*

**8.2.2 Mathematical object: the re-encoding map**

Let denote (informally) the portion of the world record most naturally described at band . We do not require a fully formal decomposition of to use this; it is bookkeeping notation.

Define an instrument encoding operator:

To make the relay/no-skip discipline explicit, we may factor this map into neighbor-mediated stages:

where each stage corresponds to admissible neighbor-band coupling and stabilization at the intermediate band.

Equivalently, in a more directly “hinge-ready” form, treat an instrument as mapping far context directly into a +1 symbol stream:

**8.2.3 Composition with the outward read map**

At the 0 hinge, we do not directly read . We read outward content through +1-visible structures and hinge maps. The disciplined statement is:

* the instrument injects +1-readable tokens encoding +3 constraints,
* and 0 commits those tokens via the normal 0↔+1 seam.

So for a modality (especially the world/meaning modality), define the **instrumented outward read**:

Or implement as a transformation of the candidate world record:

Either view preserves the same meaning: +3 is not directly present to 0; it is present **only as re-encoded +1 tokens**.

**8.2.4 Direct vs instrument-mediated sources**

Since , we distinguish:

* **direct sources** (experience-separable without re-encoding):
* **instrument-mediated influences** (arrive only as +1 tokens):

For the world/meaning modality:

* ,
* may be in , but only via instrument readouts (re-encoded +1 tokens).

**8.3 “No-skip compliance”: why this does not violate CE2/CMC**

This is the critical consistency subsection: we must show that instrumentation does not secretly smuggle in a forbidden skip connection.

**8.3.1 The apparent contradiction**

At first glance, saying “the human center can access +3 via an instrument” looks like we are allowing:

even though:

But the resolution is: **the human 0 does not couple to +3 directly.**  
The instrument is a +1 entity whose *own outward extension* (via +2) can reach +3. This is precisely the outward two-step extension you wrote down:

So the instrument is allowed to participate in +1→+2→+3 couplings because it lives at +1.

**8.3.2 The key structural idea: compress the long path into a +1 token**

From the 0-vantage, the only thing it ever sees is +1-visible output tokens. The instrument “internalizes” the longer outward path and collapses it into a near representation:

* within the instrument:
* then to the human hinge:

So the **effective coupling** (0 learning about +3) is mediated as:

This preserves both:

* NNS (neighbor-only, no skipping), because the instrument’s outward coupling itself is neighbor-mediated, and
* CMC (center mediation), because the “knowledge becomes experience” only when it becomes hinge-visible at 0 through the seam.

**8.3.3 CRA placement: instruments do not change the grammar; they change what passes it**

In manifest terms:

* CE2/CRA forbids direct 0↔+3 couplings. That remains unchanged.
* The instrument changes (or changes which outward tokens are present in ) so that +3 constraints are **encoded as +1 tokens** that are already admissible.
* Thus the act can pass CRA because the act is still a normal 0↔+1 commit, using admissible paths and admissible symbols.

So instruments are not “exceptions to CRA.”  
They are **ways to generate CRA-admissible tokens**.

This is exactly the kind of mechanism you want in a system that emphasizes feasibility constraints: you don’t break the feasibility rules; you build structures that *work within them*.

**8.4 Implications for scientific observation**

This is where the conceptual payoff becomes very clean. If the world is a seam-stabilized outward representation, then “science” is not a separate epistemology add-on; it is a natural extension of the same mechanism.

**8.4.1 Observation is re-encoding + stabilization, not direct contact**

Under this module, an “observation” consists of:

1. a +1 stable structure (instrument) that couples outward to broader constraints (+2/+3),
2. an encoding of those constraints into a **+1 token stream** (readout),
3. a 0↔+1 seam commit that renders that token stream hinge-visible and stable for the observer,
4. and often a CS process where multiple centers can compare and stabilize shared tokens.

So what makes observation “objective” is not “matter sending signals,” but:

* **stability of readout tokens under the +1 manifest**, and
* **cross-center (CS) stability** of those tokens.

**8.4.2 Why writing/record-keeping matters in this framework**

Under a manifest-centric AR view, “recording” (writing a number, taking a photograph, logging a trace) is not “storing information in matter” as a primitive. It is:

* creating a stable +1 token pattern that can be re-read by later acts and by other centers.

This is the same logic as instrumentation, extended in time:

* time‑extended re-encoding: that persists across acts.

So the whole scientific practice of “measure → record → compare → model” is simply **a layered +1 re-encoding stack**, making far-context constraints accessible to many centers across time.

**8.4.3 Why this matters for the experience spectrum module**

This section retroactively strengthens the phenomenology mapping:

* the world/meaning modality becomes richer (higher , more informean) precisely because instruments and records **increase symbol richness and stabilization**.
* That means the “spectrum of consciousness” is not only tied to bands; it is also tied to the **available re-encoding infrastructure** in the +1 world.

In other words: technology does not “add new senses” as primitive channels; it **modifies the manifest-visible token landscape** and therefore changes what can be committed in the world/meaning channel.

**8.4.4 A disciplined summary sentence (for later reuse)**

A clean, record-safe formulation you can reuse later:

**Instruments do not grant the 0 hinge direct access to +3; they translate +3 constraints into +1-stable tokens that the 0↔+1 seam can commit.** Scientific observation is therefore the practice of building +1 re-encoding structures that convert far-context constraints into hinge-visible, cross-center-stable tokens.

**Transition note to next section:**  
Section 9 will tighten the QM linkage: using the same seam-selection mechanism (hinge equality + feasibility + ratiolex + ties-only PF/Born), we will formalize what “measurement” means in this module, how underdetermination and ties arise near the inward boundary, and what we are *not* claiming (to keep it disciplined and non-overreaching).

**9. Quantum Measurement Linkage**

This section records how the “experience horizons” module connects to quantum measurement language **without** violating AR’s core discipline (no materialist signal-ontology; no “mind as a force”; no skipping context levels).

The guiding idea is:

* **Measurement is a special case of seam commitment**: the act in which a micro‑scale (−2) underdetermination is forced through the 0↔+1 hinge bottleneck into a stable +1 tokenization (often instrument‑mediated), producing a public outcome.
* **Randomness does not enter everywhere**; it enters only when the engine encounters a **true structural tie** after hinge equality + feasibility + ratiolex acceptance (ties-only PF/Born).

This aligns the measurement story with the same structural cut that produces the “body boundary” phenomenology: inward micro‑distinctions can shape the committed present at 0, but they do not automatically become public +1 facts unless the seam selection yields a stable outward token.

**9.1 Measurement as hinge-bottleneck selection**

This section records a **structural correspondence** between seam-selection mechanics and “measurement-like” outcomes. It is not yet a full derivation of quantum formalism; it is an internal alignment statement: the same commit mechanism that yields a stable outward “world” also yields measurement-like selection when multiple outward outcomes remain admissible.

**9.1.1 Measurement is not “an event in matter”; it is an act-commit event at the seam**

In the V2 contract, a committed present-act at the human hinge is produced by:

1. hinge equality in a finite alphabet,
2. feasibility filtering (Θ, κ, Struct, ParentGate, CRA),
3. acceptance ordering (ratiolex),
4. tie-break only if needed (PF/Born ties-only),
5. commit and update of records.

So, in this module, **“measurement”** refers to commit events where:

* the candidate set contains multiple outwardly distinct +1 outcomes that are each individually feasible,
* but they are not all simultaneously realizable as one committed act,
* so the commit process selects one (deterministically if unique, randomly only if tied).

Measurement is therefore not an extra postulate layered on top of the engine; it is the name for a particular *shape of candidate set* encountered by the engine.

**9.1.2 Minimal mathematical representation of “measurement-like” commit**

Fix a tick . Consider candidate next-world records and the current inward record .

Define the hinge-consistent candidate set at band 0:

Where is the conjunction of gates:

Then ratiolex acceptance imposes an ordering and yields a minimal survivor set:

* If , commit is deterministic.
* If , we have a **true structural tie** under the acceptance criteria and the ties-only rule applies:

**9.1.3 Where “apparatus” enters**

In typical measurement talk, the apparatus is treated as something external that interacts with the system. In this module it is treated as:

* a +1‑stable structure that produces +1‑readable tokens,
* often an instrument re-encoding operator (Section 8),
* which converts otherwise non-objectified distinctions into outward symbols.

So measurement scenarios are often modeled as:

That is: the apparatus is not a mystical observer; it is a re-encoding layer that changes what symbols exist in the outward record and therefore changes which outcomes can be stabilized as public +1 tokens.

**9.1.4 “Outcome” as a +1-stable tokenization**

To connect with ordinary language (“measurement yields an outcome”), define a pointer/readout token from the committed world record:

A “measurement outcome” is simply the committed value of (or a component), stable enough to be recorded and compared across centers.

**9.2 Where probabilities enter**

A central discipline of your V2 engine is that randomness is not an everywhere rule; it is a boundary-case rule.

**9.2.1 Randomness is ties-only**

The engine does **not** assign weights to arbitrary candidates and sample from them as a general “stochastic dynamics.” Instead:

* hinge equality + feasibility + ratiolex acceptance are designed to be **deterministic filters and orderings**,
* leaving a finite “winner set” of minimal survivors,
* and only if that winner set contains more than one member do we invoke PF/Born sampling.

So probability is not “how dynamics works.” Probability is “how the engine resolves genuine indistinguishability under the manifest.”

This is the key conceptual shift from materialist measurement stories: the fundamental engine is a constraint satisfaction / selection architecture; probability is a tie-break, not a continuous scoring.

**9.2.2 What the PF/Born object is *in this record***

For this internal record we do **not** attempt to re-derive the Born rule itself. We simply assume the engine contains a PF/Born tie-break procedure that:

* takes the tie set ,
* returns a distribution over its elements,
* samples an element.

So in notation:

The phrase “Born” here is interpreted narrowly as: *the tie-break weights match the conventional Born frequencies when the tie set corresponds to conventional quantum alternatives in a conventional experimental arrangement.*

That’s a later derivation / calibration problem. For this record, the key is where PF/Born is **allowed** to appear and why.

**9.2.3 Why this is compatible with “measurement”**

In many measurement setups, you are intentionally creating a situation where:

* multiple macroscopically distinct outcomes are feasible (each corresponds to a stable pointer reading),
* but the pre-measurement information at the seam does not uniquely determine which pointer reading will be committed,
* so the engine hits a tie condition and must resolve it.

In this view, “quantum randomness” is the engine’s way of handling **structural equivalence** after all admissibility and stability constraints have been applied.

**9.3 Why −2 matters**

This subsection ties the measurement story back to the **experience horizon** and the **body boundary** from Section 6.

The key structural fact is:

**9.3.1 The inward boundary creates underdetermination when exporting to +1**

Within CE2, −2 can influence the 0 act through the inner cone:

but it cannot directly participate in +1 tokenization in the same act (no two-hop path ending at +1 from −2). That means:

* inward micro‑distinctions can be “real” in the sense that they constrain the space of admissible commits at 0,
* but they may not be **exportable as stable public features** in without additional structure.

This provides an internal, structural reason for measurement-like phenomena:

Exporting inward microstructure into public +1 tokens is generically underdetermined unless a +1 apparatus (instrument) re-encodes micro differences into outwardly stable symbols.

And even then, the encoding may admit multiple stable outcomes consistent with the same inward constraints, producing a tie.

**9.3.2 Hinge compression as the V1-face reason for indistinguishability**

On the V1 face, the hinge is a strong compression point: collapse behaves like a low-rank projection near D≈2, meaning many micro distinctions are annihilated or become indistinguishable after boundary projection.

Translated into V2 terms, this is exactly the statement:

* many micro-distinct world candidates map to the same finite symbol token in after hinge mapping,
* so the hinge equality constraint can be satisfied by multiple distinct outward records.

Formally, the hinge map is many-to-one:

while the corresponding +1 pointer tokens may differ.

That is the structural origin of underdetermination: the seam must choose a single +1-stabilized world record even when multiple candidates are hinge-consistent.

**9.3.3 Measurement apparatus as the “export channel” for −2 into +1**

The apparatus (instrument) is best understood as a structure that attempts to convert some subset of −2 distinctions into +1 tokens by re-encoding.

In this module, that means:

* the apparatus expands or reshapes the relevant token space (it makes certain differences readable as pointer states),
* and it changes the feasibility landscape so that multiple “pointer outcomes” become stable alternatives.

So the measurement story becomes:

1. inward micro constraints shape which candidates are admissible at 0,
2. apparatus re-encodes micro distinctions into potential +1 pointer tokens,
3. seam selection commits one +1 pointer token as part of the outward record,
4. if more than one pointer token remains minimal under Accept, ties-only PF/Born resolves.

This is consistent with the horizon story and does not require “mind pushes matter.”

**9.3.4 A disciplined observer statement**

In this module, “observer” is not a separate agent. The “observer role” is:

* the existence of a center band enforcing hinge equality and commit under ,
* and (in experiments) the presence of a +1 apparatus that makes an outcome token stable and readable.

So the observer is a **constraint location**, not a causal force.

**9.4 What this module does not claim**

This subsection is deliberately explicit, because this is the area most likely to be misread or overclaimed.

**9.4.1 Not a full quantum theory derivation (yet)**

This record does **not** claim that we have derived:

* the full Hilbert-space formalism,
* unitary evolution,
* exact Born rule weighting from first principles,
* decoherence behavior as used in mainstream physics,
* or a complete account of all quantum phenomena.

What we are recording here is:

* a consistent internal interpretation of measurement-like selection events in AR/V2 language,
* anchored in the already-declared ties-only PF/Born rule and the seam/manifest structure.

**9.4.2 Not “consciousness causes collapse”**

We explicitly reject (for this module’s phrasing) the claim:

* “mind collapses wavefunction.”

Instead, what we claim is:

* “collapse-like selection is the engine’s commit rule at the seam,”
* “probabilities arise only under genuine structural ties.”

So consciousness does not act as an external force; rather, “experience” is the committed present-act itself.

**9.4.3 Not an empirical claim about anatomy or neurology**

When we talk about −2/−1/0 and “body boundary,” we are not claiming:

* that skin is literally a context boundary,
* or that a specific sensory modality is caused by a specific physical pathway.

We are claiming:

* the **structural geometry of admissibility and symbolization** explains why we experience something like a body boundary and an outward environment.

**9.4.4 Not a substitute for future tests**

To strengthen this linkage later, we would need:

* toy engine demonstrations showing tie sets and outcome selection under re-encoding,
* and/or deeper V1→V2 derivations that show why PF weights reproduce Born in standard experimental symmetries.

This record simply marks the measurement linkage as **consistent** with the module and identifies the exact points where further derivation/testing would live.

**Transition note to next section:**  
Section 10 will present the **V1 face** of this entire experience-horizon module: how the hinge compression / collapse-kernel perspective motivates a short experience-separability horizon and why two-hop reach is a natural boundary for distinctness, providing a formal justification for CE2 beyond “it seems right phenomenologically.”

**10. V1 Face of the Same Module**

**Scope note (important for this record):** The operator/mode language used in this section is a **linearized proxy** intended to capture the hinge-compression idea in a transparent mathematical form (e.g., low-rank projection / mode attenuation under boundary collapse). Final notation and any explicit kernel forms should be aligned to the project’s canonical V1 operator definitions when doing a final merge pass. The purpose here is conceptual and structural: to show that a short “experience-separability horizon” (CE2/Ext₂) is a natural consequence of seam composition near a compressive hinge, not an arbitrary phenomenological add-on.

The central V1 claim we want to capture is:

After one or two boundary projections (collapse kernels) near the hinge, most distinctions are annihilated into low-rank summaries. Therefore, beyond ~two seam steps, far-context differences cannot remain **separable** at the center band unless they are **re-encoded** into the small set of modes that survive projection.

That is exactly the V1 “face” of the CE2 / experience-horizon rule.

**10.1 Hinge compression justification**

**10.1.1 The V1 hinge as a compression point**

In V1, each context band (n) carries an effective geometric/fractal role captured by a dimension profile (D(n)) (and often a pivot-weighting function (g\_{\text{pivot}}(D(n))) or equivalent). The hinge band is the place where the projection/collapse behavior becomes maximally compressive.

The key property we will use (stated qualitatively here; in V1 it’s derived from the specific collapse kernel form):

* Near (D \approx 2), the collapse/back-projection operator behaves like a **rank‑1 (or near rank‑1) projector**: it preserves a constant/global mode and suppresses higher-order modes.

In “signal processing” language: it is a powerful low-pass filter with an extreme cutoff.

In “geometry” language: it is angular averaging / spherical harmonics collapse, where only the (l=0) component survives strongly.

**10.1.2 A clean mathematical proxy: modal attenuation under projection**

Let (F\_{n+1}) be a function space representing “distinctions” or “feature fields” at band (n+1). Expand an element (u\in F\_{n+1}) in an orthogonal basis of modes ({\phi\_{\ell}}\_{\ell\ge 0}) (think “harmonics” or “eigenmodes” of the relevant geometry):

[  
u ;=; \sum\_{\ell\ge 0} a\_{\ell},\phi\_{\ell}.  
]

Let the collapse kernel (back-projection) from (n+1) to (n) be a linear operator:  
[  
K\_{n+1\to n}: F\_{n+1}\to F\_n.  
]

We model its action on modes as:  
[  
K\_{n+1\to n}(\phi\_{\ell}) ;=; \lambda\_{\ell}(n),\psi\_{\ell},  
]  
where (\psi\_{\ell}) are modes in (F\_n) and (\lambda\_{\ell}(n)) are attenuation factors.

The hinge-compression statement is then:

* (\lambda\_0(n)\approx 1) (constant/mean survives),
* (\lambda\_{\ell>0}(n)\ll 1) near the hinge,
* and in the idealized “rank‑1” hinge limit: (\lambda\_{\ell>0}(n)\to 0).

So after one projection near the hinge:  
[  
K\_{n+1\to n}(u) ;\approx; a\_0,\psi\_0,  
]  
i.e., only a scalar summary remains.

This is the V1 “why” behind the qualitative claim: **the hinge destroys separability** of most fine distinctions.

**10.1.3 Interpretive consequence: “what survives as distinct” is inherently limited**

If only a tiny subset of modes survive the projection strongly, then the center band cannot carry arbitrarily many distinct features sourced from deeper bands. Distinctiveness dies for generic differences unless those differences happen to align with the surviving modes.

This is the conceptual bridge to the experience-horizon module:

* “Experience-separable content” at 0 corresponds to distinctions that survive seam composition as **distinct modes/tokens**, rather than collapsing into the same low-rank summary.

That is exactly what we will use to justify CE2 from V1: beyond ~two seam crossings, the surviving mode set is so small that differences are not separable at 0.

**10.2 Seam composition as operator chaining**

To turn the hinge intuition into an actual *reach* statement, we need the V1 picture of how a band sees the influence of other bands: by chaining export/update/collapse operators.

**10.2.1 The canonical three operators per seam step**

A standard V1 “one-step” transformation from band (n) to band (n+1) and back can be written using three operators:

1. **Export / lifting** (from (n) into (n+1)):  
   [  
   E\_{n\to n+1}: F\_n \to F\_{n+1}  
   ]
2. **Update / evolution** (within band (n+1)):  
   [  
   U\_{n+1}: F\_{n+1} \to F\_{n+1}  
   ]
3. **Collapse / projection back** (from (n+1) to (n)):  
   [  
   K\_{n+1\to n}: F\_{n+1}\to F\_n  
   ]

Then the one-step “reproduction” or “effective update” operator at band (n) induced by (n+1) is:  
[  
M\_n ;:=; K\_{n+1\to n}\circ U\_{n+1}\circ E\_{n\to n+1}.  
]

This is the V1 face of “what the next outward context does to the band.”

**10.2.2 Two-step influence is two chained projections**

Now consider influence from band (n+2) down to (n). It must pass through **two seam projections**:

* from (n+2) down to (n+1), then
* from (n+1) down to (n).

In terms of effective operators, the “two-step induced operator” is approximately:  
[  
M\_n^{(2)} ;\approx; M\_n \circ M\_{n+1},  
]  
and expanding those:  
[  
M\_n^{(2)} ;=;  
\big(K\_{n+1\to n}\circ U\_{n+1}\circ E\_{n\to n+1}\big);\circ;  
\big(K\_{n+2\to n+1}\circ U\_{n+2}\circ E\_{n+1\to n+2}\big).  
]

The crucial structural fact is that this chain contains **two collapse kernels**:  
[  
K\_{n+2\to n+1}\quad \text{and}\quad K\_{n+1\to n}.  
]

If either of these is near-rank‑1 (hinge-like), the composed operator becomes extremely low rank. If both are compressive, the composite can become essentially rank‑1 even if each individually is only “near” rank‑1.

**10.2.3 Attenuation multiplies across seams**

Return to the attenuation model:  
[  
K\_{n+1\to n}(\phi\_\ell) = \lambda\_\ell(n),\psi\_\ell,  
\qquad  
K\_{n+2\to n+1}(\tilde{\phi}*\ell)=\tilde{\lambda}*\ell(n+1),\tilde{\psi}\_\ell.  
]

Then under two seam crossings, mode amplitudes are suppressed by a **product**:  
[  
\text{effective attenuation} \sim \lambda\_\ell(n),\tilde{\lambda}*\ell(n+1),  
]  
so if (\lambda*{\ell>0}\ll 1) at either seam, higher modes are crushed; if both seams are hinge-adjacent, they are crushed doubly.

This is the V1 “mechanism” behind a practical horizon:  
**two seam crossings is enough to annihilate almost all separable information.**

**10.2.4 Why “two hops” shows up naturally**

In the experience-horizon module we set “two hops” as the primary extension scale. In V1 terms, that is not arbitrary: it corresponds to the minimal chain length that includes:

* a full inward–boundary–center pathway, or
* a full center–boundary–outer pathway,

and—crucially—it is the shortest chain length that generically yields **double projection**, which is where low-rank collapse becomes decisive.

So “two hops” is the point where:

* you have crossed enough seams for the hinge compression to become dominant,
* and therefore the center cannot reliably preserve separable distinctions from beyond that radius.

**10.3 CE2 as “where separability dies”**

We can now restate CE2/Ext₂ in V1 language as a statement about **separability under the effective map from far bands to the center**.

**10.3.1 Define separability at band 0 in V1 terms**

Let (T\_{m\to 0}) denote the effective operator mapping from a higher or lower band (m) into band 0 through the required seam chain (export/update/collapse compositions).

We call two states (u,v\in F\_m) **0-separable** if their images under (T\_{m\to 0}) are distinguishable in (F\_0) under the resolution of the 0-band representation:

[  
T\_{m\to 0}(u)\neq T\_{m\to 0}(v)  
\quad\text{in a way that survives the 0-band symbolization}.  
]

In the strictest linearized proxy, separability requires that (T\_{m\to 0}) have rank > 1 “in the relevant subspace,” so that more than one independent degree of freedom survives as a distinguishable feature at 0.

**10.3.2 The V1 horizon criterion**

The hinge-compression + chaining result suggests a criterion:

* For (|m-0|\ge 2) (two or more seam steps away), the effective operator (T\_{m\to 0}) becomes low-rank enough that generic differences (u-v) are mapped close to 0 (or into the same surviving mode), making them **not separable** at band 0.

In other words, beyond two seam steps, the mapping collapses onto a small “summary subspace” at 0.

This is the V1 justification for the experience-horizon statement:

**CE2 (V1 face):** Two seam crossings typically mark the point at which distinctness collapses into low-rank summaries, so beyond ~two steps, far-context differences cannot appear as separable features at the center without being re-encoded into the surviving modes.

**10.3.3 Why instruments are the V1-consistent exception**

From the V1 perspective, an “instrument” (as formalized later in V2 terms) is exactly a structure that:

* takes far-context differences and **projects them into the surviving low-order modes** that can pass back through the hinge without being annihilated.

In the attenuation picture: instrumentation does not defeat the projection; it *aligns information* with (\phi\_0)-like components (or the small surviving mode set).

So instruments are not “breaking the horizon.” They are:

* **encoding far distinctions into the tiny subspace that the horizon allows to survive.**

This is precisely why the V1 face and the V2 face agree:

* V1: only low-rank summaries survive; instruments encode into summaries.
* V2: only CRA/Ξ-admissible tokens survive; instruments encode into admissible tokens.

**10.3.4 What remains to be tightened (future formalization hooks)**

To strengthen this V1 face later (beyond this internal record), we can:

1. Write explicit forms for (K\_{n+1\to n}) in the hinge regime and compute actual (\lambda\_\ell(n)) behavior near (D\approx 2).
2. Derive a quantitative “two-step attenuation threshold” showing when separability is effectively lost (e.g., when (\lambda\_{\ell>0}\lambda'\_{\ell>0} < \varepsilon) for some (\varepsilon) tied to (\Xi\_0) resolution).
3. Align this threshold with the observed hinge anchors (UGM ~0.1–0.12 mm; Θ ~0.1 s) to produce a single consistent “experience horizon” story across space and time.

Those are refinement steps; they aren’t required for the structural integration we’re recording here.

**Transition note to next section:**  
Section 11 will now give the **V2 face** of the same story: how CE2 becomes a CRA/Struct constraint inside (\mathcal{M}\_0), how modalities are implemented as submanifests, and how the “audit question” becomes a practical part of making the module robust in the engine (and in future sims).

**11. V2 Face of the Same Module**

This section expresses the entire “experience horizons / extension-of-2 / modality mapping / instruments / measurement linkage” module **purely in V2 operational terms**—i.e., as constraints and configuration objects in a manifest-driven present‑act engine.

The goal is to make the module:

* implementable (even as a toy engine),
* auditable (“why did this act pass?”),
* and modular (no hardcoded band assumptions; everything lives in manifests).

We treat this as the **engine-side twin** of Section 10 (V1 face). Where V1 explains *why* separability dies after seam composition, V2 explains *how* that reality is enforced as a selection/gating architecture.

**11.1 Where CE2 lives in the engine**

CE2 / “extension-of-2” can be encoded in V2 in two complementary ways:

1. as a **CRA grammar constraint** (legal coupling templates), and
2. as an **experience-horizon feasibility gate** (direct-source limits).

We want both available, but we will treat the CRA grammar form as the “canonical” V2 implementation because it is the most auditable and least likely to drift into ambiguous language.

**11.1.1 CE2 as CRA path grammar (preferred, auditable)**

Recall the key choice from Section 5:

* adopt a **template grammar** version of CE2 (CRA²‑B), not just a distance cutoff.

So implement CE2 as a configuration object inside that accepts only the three canonical two-hop templates as “direct phenomenological channels” for a 0-centered commit:

* inner:
* interface:
* outer:

**Minimal CRA structure**

Define:

* A set of allowed path templates:

each template is an ordered list of band indices.

* A CRA predicate that takes a candidate act’s declared coupling signature and checks it:

Where is the **coupling signature** for the candidate act.

**What is a “coupling signature” in V2?**

To make CRA enforceable, each candidate act needs a lightweight declarative record of *what cross-band structure it relied on*.

In practice, attach to each candidate (or candidate pair ) a metadata object, e.g.:

* support\_paths: a set/list of path-template IDs used to generate its candidate tokens; and/or
* support\_bands: the set of band indices referenced; and/or
* support\_edges: a set of adjacent band edges used.

Then CRA does not need to introspect deep state; it just verifies that the declared support is legal under the manifest.

This is crucial for two reasons:

1. **It makes CRA checkable** (instead of “vibes-based”).
2. **It makes the engine auditable**: you can log “candidate was rejected because it attempted a forbidden path”.

**11.1.2 CE2 as a direct horizon feasibility gate (optional, secondary)**

In parallel, you can implement a simpler “horizon gate” that rejects any candidate whose **direct** source set is not contained in :

* direct source set:

Then:

This gate is useful as a *belt-and-suspenders* constraint (and for quick debugging), but it is less expressive than the grammar:

* it cannot encode “must go through 0,”
* it cannot distinguish “two-hop via +1” from “attempted direct skip to +2,”
* and it is easier to misinterpret as “causal influence distance.”

So: treat it as a convenience, not the main statement.

**11.1.3 How instruments fit CE2 without breaking it (engine-side)**

From the V2 perspective, the key compliance rule is:

* **0 does not get direct +3 sources.**
* +3 influence must arrive as **re-encoded +1-visible tokens**, produced by a +1-stable instrument.

So, in manifest terms, add to CRA a clause:

* instrument\_mediated\_sources\_allowed = {+3}
* instrument\_mediation\_requires = encode\_to\_band +1
* instrument\_requires\_token\_type = "instrument\_readout"

In other words:

* if a candidate tries to justify something with +3 directly → reject;
* if it includes +1 readout tokens that are explicitly flagged as instrument-encoded outputs (generated by an instrument process that itself is +1-feasible) → allow, because the seam is still 0↔+1.

This is the cleanest V2 form of “instruments give +3” that doesn’t require violating CE2.

**11.1.4 Where CE2 sits in the commit pipeline**

With CE2 implemented as CRA and/or HorizonGate, the 0-band commit pipeline becomes (conceptually):

1. Generate candidate worlds (proposal stage).
2. Compute hinge tokens (per modality or globally):
3. Hinge equality filter:
4. Apply feasibility gates:
   * **(CE2 lives here)**
   * optional:
5. Apply (ratiolex ordering).
6. If tie remains → PF/Born tie-break.
7. Commit , update , proceed.

So CE2 is not an extra “law of motion.” It’s a **feasibility/admissibility rule** that filters candidate acts.

**11.2 Modal submanifests as concrete configuration objects**

This subsection makes the “qualities of experience” mapping operational:

* modality = subalphabet + hinge maps + gate profile + acceptance profile.

This is how we avoid “senses as input channels” while still giving the theory a concrete internal structure for qualitative diversity.

**11.2.1 Minimal modal submanifest schema**

For each modality , define a submanifest:

Notes:

* and are record-level annotations (bookkeeping) that help interpret/diagnose the mode; they can be derived from the other fields later, but they’re useful to store explicitly during development.
* can be a restriction of the global CRA (e.g., each modality is allowed only certain cones/templates).

**11.2.2 How modalities interact with hinge equality**

There are three clean implementation strategies (as noted in Section 7); here we restate them as engine rules:

**Strategy A: Disjoint-token (tagged union)**

* Commit one (or a small number) of tokens that are tagged by modality.
* Hinge equality checks only the active modalities for a candidate.

**Strategy B: Vector token (product alphabet)**

* Each tick commits a vector:
* Hinge equality is applied per component (with optional “required vs optional channels”).

**Strategy C: Hybrid (primary + auxiliary)**

* One primary token drives act identity/choice; auxiliary tokens are constraints or annotations.

For an internal record, the important thing is not which you pick today; it’s that all three are consistent with the same underlying engine contract.

**11.2.3 Modal feasibility: different Θ/κ/Struct profiles**

A key advantage of submanifests is that each modality can have its own stabilization profile:

* : how much temporal coherence is demanded for that modality’s content to count as “one act”
* : spatial granularity/coherence required
* : structural predicates (e.g., continuity, periodicity, object permanence, internal consistency constraints)

This is the V2 way to encode the qualia–informean spectrum:

* modalities that are more “qualia-heavy” can be represented as having smaller symbol alphabets and/or higher tie rates (less determinacy under Accept),
* modalities that are more “informean-heavy” can be represented as having richer and stronger structural stabilization, yielding stable tokens and lower tie rates.

So can be treated as an interpretable *summary* of manifest choices.

**11.2.4 Modal admissibility: S(m) as cone/template restrictions**

Use the cone geometry from Section 6 as a direct restriction on each modality’s admissible support:

* is the set of nodes appearing in .

So you can set, for example:

* Intero mode:
* Interface mode:
* World mode:
  + plus instrument readouts as special allowed +3 influence (Section 8)

This makes the “body/environment/world” partition a literal configuration object, not a prose claim.

**11.2.5 Modal acceptance: a place where priorities can diverge (carefully)**

Your engine has a global acceptance discipline (ratiolex). A subtle but powerful option is:

* allow per-modality acceptance *vectors* while preserving the global “no weighted sums” rule.

Example (conceptual):

* each modality produces a residual vector ,
* global Accept is lexicographic on a structured concatenation:

with fixed modality priority ordering.

This would let you encode, for example:

* “world-stability residuals dominate unless intero residuals are catastrophic,”  
  without sliding into weighted scoring.

This is optional and should be treated carefully (because it becomes a deep architectural choice), but it’s exactly the kind of thing you can now state clearly using the modal submanifest approach.

**11.3 Audit question**

This subsection is about making the module **robust** in practice: if the theory is going to claim “experience arises from admissibility and commit,” then every committed act should be traceable to **which manifest fields** admitted it.

This is not just good software practice. It is also core to the defensive-publication mindset:

* “Here is the mechanism, enabling enough that you can reproduce it.”

**11.3.1 The audit question (canonical phrasing)**

For every committed act at 0:

**Which manifest field(s) allowed this act to pass, and which field(s) would have rejected it if changed?**

For this module specifically, add:

* Which **cone template(s)** did the act rely on?
* Which **modality submanifest(s)** were active/required?
* Did the act contain **instrument-mediated tokens** (and if so, what was the instrument encoding ID/type)?
* Was the final selection deterministic, or did it require **ties-only PF/Born**?

**11.3.2 Minimal audit record schema**

For each tick , store an audit record such as:

* tick: k
* selected\_candidate\_id: id(w\*)
* hinge\_match:
  + per modality:
* feasibility\_results:
  + Θ: pass/fail (+ margin if defined)
  + κ: pass/fail
  + Struct: pass/fail (+ which predicate)
  + ParentGate: pass/fail
  + **CRA / CE2**: pass/fail
    - allowed template(s) used
    - forbidden template(s) attempted (if any)
* acceptance:
  + acceptance residual vector(s) (or summary)
  + rank position among survivors
  + tie\_set\_size
  + tie\_break\_used: true/false
  + if tie\_break\_used: PF/Born seed/outcome index
* instrumentation:
  + instrument\_readouts\_used: list of readout tokens
  + instrument\_ids: list (if modeled)
  + instrument\_mediated\_bands: e.g., [+3]
* notes: freeform

Even in a toy engine, this audit log will immediately expose whether CE2 is doing what you intend:

* you can see if −2 ever leaks into +1 tokenization directly,
* you can see if +3 ever appears without instrument readouts,
* you can see which modalities are dominating the acceptance ordering,
* and you can quantify tie frequency per modality (which becomes a measurable correlate of later).

**11.3.3 Why auditability is part of the theory (not optional)**

Within AR/V2, the “material world” is not a substrate; it is a stabilized outward representation that results from the commit process. That means:

* if you cannot explain *why a particular act was committed*, you lose the theory’s core explanatory advantage (it becomes story instead of mechanism).

So the audit question is not an engineering afterthought; it is the discipline that keeps the whole framework from collapsing into handwaving.

**Transition note to next section:**  
Section 12 will integrate this V2 implementation picture with the broader CFD / band manifest / CCLK addition: i.e., show explicitly how CE2 (CRA grammar), modality submanifests, instrumentation re-encoding, and auditability fit into the “context = feasibility” unification—and how this module becomes an interpretive payoff for the manifest-driven engine architecture.

**12. Integration With CFD, Band Manifests, and CCLK**

This section records how the “Experience Horizons from Context Extension” module is **not a separate subsystem**, but a *direct specialization* of the newer “CFD / band manifests / CCLK” direction.

The central integration claim is:

**Experience horizons are feasibility horizons.**  
The “body/environment/world” partition is what a center band’s manifest makes representable and admissible under CRA + Struct + Θ/κ, and what can be stabilized as outward (+1) tokens across centers (CS).

So, from the CFD viewpoint, this module is simply:

* **a particular CRA grammar (CE2)**,
* a particular **Ξ partition (modal alphabets)**,
* a particular **Struct/ParentGate profile** (stabilizing “world” tokens), and
* a particular **re‑encoding story for instruments** (how far‑context becomes hinge-visible).

This makes the module cleanly compatible with the rest of the architecture and gives the manifest‑based story a strong interpretive payoff.

**12.1 CFD fit: context = feasibility**

**12.1.1 The CFD premise, restated in the language of this record**

CFD (Context = Feasibility) can be restated in the notation we’ve fixed:

* A context level (band) is not “a place where stuff lives.”
* A context level is the **constraint object** that determines which acts are admissible and stable.

In V2 terms, that is exactly the manifest:

So “context” is operationally identical to “the feasibility and acceptance rules that survive audit.”

**12.1.2 What experience horizons become under CFD**

Under CFD, the experience-horizon module becomes extremely simple to state:

* CE2 / Ext₂ is a **CRA refinement** (“which seam compositions are admissible as direct phenomenological channels”).
* The three cones are **CRA path templates** (inner/interface/outer).
* The “body boundary” is a **feasibility/stability cut**:
  + inward constraints can shape the commit at 0,
  + but only what can be stabilized as +1 tokens becomes public “environment.”

So instead of saying “we sense the environment,” the CFD-aligned statement is:

The “environment” is the set of +1 tokens that are repeatedly feasible under and coherent with the center band’s hinge-equality commitments under .

**12.1.3 Why this is an integration win (not just compatibility)**

Without this module, CFD/manifests can look like “engine plumbing.”  
This module supplies a direct **interpretive payoff** for the plumbing:

* It explains why there is a stable, persistent “world out there” and a stable “body boundary” *as a direct consequence* of feasibility and admissibility structure, rather than as a brute philosophical claim.

So the theory becomes narratively tighter:

* “Context levels” are not only a modeling convenience; they explain phenomenology.

**12.2 Band manifests as the unification object**

This subsection records the specific “plug points” where the new module attaches to the band manifest schema—so later PRs (and later DP packaging) can treat it as an explicit, auditable extension.

**12.2.1 Where each new concept sits inside**

**(A) CE2 / “extension-of-2”**

* Lives in (admissibility grammar), optionally supported by a horizon gate.
* Implemented as allowed cone templates:

**(B) Experience cones**

* Live as named **CRA path templates** plus audit metadata.
* You should be able to log: “this candidate relied on cone template X.”

**(C) Modalities**

* Live as a structured partition/decomposition of the manifest:
  + becomes ,
  + become ,
  + gates become modality-specific profiles ,
  + acceptance can remain global ratiolex while allowing structured modality residual vectors (without weighted sums).

**(D) Qualia↔informean spectrum parameters**

* is not a new primitive; it is a **summary** of:
  + symbol richness in ,
  + strictness and shape of ,
  + tie-rate after ratiolex acceptance,
  + ease of +1 stabilization (publicness).

**(E) Instruments / +3 access**

* Live as a **re‑encoding operator** that generates +1‑readable tokens:
* Implemented operationally as: candidates may include instrument readout tokens (tagged), and CRA allows +3 influence only through those tagged readouts (never as direct +3 sources at 0).

So: every element of this module lands cleanly in existing manifest fields, rather than requiring new ontology.

**12.2.2 The “context = manifest” reframe of phenomenology**

A key integration sentence to preserve for later writing:

**Phenomenology is a manifest readout.**  
The character of experience is determined by the center band’s symbolization (), coherence windows (), structural predicates (Struct/ParentGate), and admissibility grammar (CRA), rather than by a materialist “signals in” story.

This is exactly how the experience module becomes a continuation of CFD rather than a separate philosophical overlay.

**12.2.3 Auditability is the unifying discipline**

Both the CFD addition and this module require the same hygiene:

* every admissibility decision is traceable to manifest fields,
* no “handwavy causation” is allowed to bypass gates.

So the experience module is integrated by sharing the **audit architecture**:

* For each committed act, record:
  + which cone template(s) it used,
  + which modality submanifests were active,
  + whether instrument readouts were used,
  + whether acceptance produced a tie,
  + whether PF/Born tie-break was invoked.

This makes the theory’s interpretive claims operationally checkable.

**12.3 CCLK and learning/compression**

This subsection connects the experience module to the “learning/compression kernel” idea: why stable modalities, stable horizons, and stable world tokens should arise and persist.

**12.3.1 CCLK as “learned feasibility kernel”**

CCLK (Context-Compression Learned Kernel) can be stated as:

* repeated present-acts teach the system which low-dimensional summaries are sufficient to maintain feasibility and stability under the relevant manifests.

In other words, CCLK is how “what counts as a coherent symbol” becomes entrenched.

**12.3.2 Modalities as learned stable partitions of**

In this module, modalities are introduced as explicit partitions/submanifests. CCLK provides a natural explanation for why such partitions can become stable:

* Over repeated acts, the engine learns that:
  + some tokens are best stabilized by inner cone constraints (private modulation),
  + some by seam interface constraints (boundary coherence),
  + some by outward container constraints (world/meaning).

So the modality decomposition is not arbitrary: it is the learned/selected decomposition that reduces instability (ties, infeasibility, contradictions) while maximizing coherence.

Operationally, you can think:

* CCLK gradually shapes and and the partition of so that hinge equality is achievable in a stable way across the cones.

**12.3.3 CE2 as a learned “effective horizon”**

Even if CE2 begins as a postulate, CCLK gives a story for why a two-hop horizon could become the **effective** (practically enforced) horizon:

* Beyond two seam steps, hinge compression (V1 face) annihilates distinctions into low-rank summaries.
* If the engine tries to treat farther distinctions as directly separable, it runs into:
  + unstable tokenization,
  + high tie rates,
  + contradictions with outward stabilization,
  + and feasibility failure.

Therefore, a “two-hop horizon” emerges as the learned stable operational boundary where symbolization remains reliable.

So CE2 can be framed (in later refinement) not only as a postulate, but as:

the horizon at which CCLK converges for a given hinge/vantage and its coherence windows.

**12.3.4 Instrumentation as an extension of CCLK**

Instruments are +1 structures that produce new +1 tokens. From a CCLK perspective:

* instrumentation expands the outward alphabet by adding new stable token types (readouts),
* which allows the system to learn new stable mappings from far-context constraints into hinge-visible symbols.

So technology is not “new senses”; it is:

* an expansion of the symbolization and stabilization space in +1,
* which CCLK can then incorporate into the learned kernel.

This gives a precise AR meaning to “science increases what we can see”:

* it increases the set of stable +1 tokens that can be committed and shared.

**12.4 AI connection**

This subsection records how the experience-horizon module naturally supports your broader “agent” / AI framing in AR terms.

**12.4.1 Modality without sensors**

In standard AI, “modality” often means “sensor type.”  
In this module, modality is:

* a submanifest profile—i.e., a representation/gating regime.

So an artificial agent could have modality-like channels even if it has no human sensory apparatus, because the channels are defined by:

* different symbol alphabets,
* different hinge constraints,
* different stability gates,
* different admissibility templates.

This supports the claim that “qualitative structure” is not inherently biological; it is a property of how a system commits coherent present-acts under constraints.

**12.4.2 Experience horizons as admissibility horizons**

Similarly, an AI could have an “experience horizon” if:

* its CRA grammar restricts which context couplings it can make directly,
* it can only access farther context through re-encoding structures (instruments, sensors, models, tools).

That is precisely how many real systems work:

* a model cannot “see” upstream processes directly; it sees encoded data products.

So the instrument‑as‑re‑encoding operator is a natural bridge to AI systems that rely on measurement pipelines, logs, telemetry, and tools.

**12.4.3 CCLK as learning of stable representation partitions**

If CCLK is “learned feasibility kernels,” then modality emergence is a direct AI story:

* stable features/channels emerge because they reduce infeasibility and tie ambiguity,
* and because they stabilize actions under the acceptance ordering.

That means your experience-spectrum mapping has a clean AI analog:

* “qualia-heavy” channels correspond to low-symbol, high-ambiguity, high tie-rate regimes,
* “informean-heavy” channels correspond to rich-symbol, low-ambiguity, high stability regimes.

This can later become a measurable story even in toy sims.

**Transition note to next section:**  
Section 13 will tie this module back to the “gravity / χ / feasibility geometry” track: i.e., how ParentGate and outward container feasibility curvature shape what gets stabilized as the +1 world, and why the same outward feasibility geometry that shows up in χ can also be understood as shaping the “world/meaning” modality’s stabilization landscape.

**13. Integration With Gravity, χ, and Outer-Context Geometry**

This section records how the “experience horizons” module connects to the gravity/geometry track of the theory—specifically the framing of **gravity as feasibility geometry** and the role of a curvature-strength parameter (here written as **χ**) that encodes how strongly outer-context constraints shape the +1 world.

The integration point is simple but important:

* In the experience module, the “world/meaning” channel is stabilized primarily by the **outer cone** (0\to +1\to +2), i.e., by outward tokenization (+1) under container constraints (+2).
* In the gravity module, “gravity” is interpreted as a **geometric bias in feasibility**—a structure in the +1 feasibility landscape induced by outer-context constraints.
* Therefore, the “space” we experience (and the regularities we call motion under gravity) is not an extra add‑on: it is the same outward feasibility geometry that stabilizes the +1 representation in the first place.

This makes “gravity,” “space,” and “world representation” different faces of one mechanism: **stable outward tokenization under ParentGate/feasibility curvature**.

**13.1 Why it belongs at all**

The experience-horizon module is not “about gravity” in the narrow sense, but it *must* be consistent with the gravity track because:

1. **The world/meaning modality is defined by outward stabilization.**  
   In Sections 6–7 we defined the structured “world out there” as the set of +1 tokens that are stable under outward feasibility and cross-center stability. That stability is governed by the outward part of the manifest, in particular:
   * (\mathrm{ParentGate}\_{+1}) (outer/container feasibility geometry),
   * (\mathrm{Struct}\_{+1}) (structural constraints for outward coherence),
   * and the admissibility grammar (CRA) that enforces mediation through +1.
2. **Gravity in this theory is not a force; it is a feasibility geometry.**  
   In the gravity track, “gravity” is the way feasibility geometry is curved or biased so that some outward configurations/paths are *more admissible/stable* than others. That is already a statement about **ParentGate** and the acceptance landscape.
3. **Therefore: experienced “space” and “gravity” are not separate topics.**  
   In this record’s language, the “space” we navigate is:
   * the stable outward representational geometry of +1 tokens,
   * and gravity is the *curvature/shape* of that same stability landscape.

So the experience module belongs here because it makes the phenomenology payoff explicit:

The outward, meaning-rich “world” modality is *stabilized by the same feasibility geometry that the gravity track identifies as curvature.*

In particular, the outward cone (0\to +1\to +2) is the route by which container constraints become hinge-visible as “world structure.” If the gravity module says outer constraints induce a curved feasibility metric at +1, then the world/meaning modality is exactly where that curvature is experienced as “spatial structure and motion regularities.”

A practical consequence: **you do not need to treat gravity as an extra physical input.**  
Gravity is part of the outward stabilization regime that defines the world’s geometry as a representational surface.

**13.2 χ as outer-constraint amplitude**

This subsection records the minimal way χ enters the experience framework.

**13.2.1 χ is a parameter of outward feasibility geometry, not a new primitive**  
We treat χ as an outer-constraint amplitude imported from the gravity track. Within this experience-horizon record, χ has only one role: it parameterizes outward feasibility predicates that govern which +1 tokenizations are admissible/stable.

We do not need to commit in this record to χ’s derivation formula. This section only records χ’s interface role in the experience stack.

Engine/DP discipline:  
χ may influence control only through boolean or finite-tag feasibility interfaces. For example, χ may appear in predicates such as:

ParentGate₊₁(w; χ) ∈ {true, false}  
and/or  
Struct₊₁(w; χ) ∈ {true, false}

If any real-valued diagnostic quantity is computed in the gravity track (e.g., a curvature score, action proxy, or geometry diagnostic), it must be quantized into a finite token (or pass/fail tag) before it can affect feasibility gates. No continuous minimization, likelihood weighting, or gradient-like tuning is part of act commitment.

**13.2.2 How χ shapes world token stabilization**  
Operational statement:  
A candidate +1 world tokenization is stable only when it passes the χ-conditioned outward feasibility predicates within the tolerances encoded by the +1 manifest. In practice, this means χ affects which outward patterns can be stabilized and repeatedly re-committed as “world tokens.”

This influence enters through feasibility (gates), not by inserting a continuous χ-score into Accept₀. Acceptance remains ratio-lex/finite, with PF/Born invoked only on genuine ties after hinge equality and feasibility filtering.

**13.2.3 How χ connects to the cones and modalities (where it enters the experience stack)**

Within the experience-horizon framework, χ enters the center (0) primarily through the **outer cone**:

[  
0 \to +1 \to +2  
]

because χ is an outer-context-driven curvature parameter affecting +1 feasibility geometry.

So the clean mapping is:

* χ contributes to the stabilization of (m\_{\text{world}}) through outward feasibility predicates:  
  [  
  \mathrm{Struct}\_0^{(\text{world})},;\mathrm{ParentGate}*0^{(\text{world})},;\text{and/or};\mathrm{ParentGate}*{+1}  
  ]  
  (depending on exactly where your implementation locates the geometry check).

A useful record-level statement is:

* χ does **not** need to appear inside the inner cone (-2\to -1\to 0) to be “felt.”  
  It can still shape bodily experience indirectly through the interface cone (-1\to 0\to +1), because +1 tokens are part of the interface coupling, and “weight/effort/orientation” can be treated as cross-modal constraints linking (m\_{\text{world}}) and (m\_{\text{intero}}) via interface stabilization.

That is consistent with Chapter 18’s separation of:

* sharp world carving (finite face), and
* seamless body/presence (infinite face),  
  while still allowing “gravity-likeness” to modulate both via how the outward world is stabilized and then reflected inward as interface constraints.

**13.2.4 Sensitivity note: χ depends on the outer metric definition**

Because your gravity track computes χ from scale relationships across context levels, χ is sensitive to the exact definition of the outer boundary scale (e.g., which “observable universe radius” or outer-context metric is used).

For this record’s integration, the safe discipline is:

* Treat χ as *the* curvature-strength parameter produced by the gravity module **once the metric choice is fixed**, and
* Keep the experience-horizon module agnostic to that choice.

So the integration is stable even if the outer metric definition is refined: the experience module simply consumes χ as the parameter governing outward feasibility curvature.

**13.3 Practical note**

This module’s primary job is to formalize **experience structure** (horizons, modalities, instrument re-encoding). The gravity/χ linkage is a **consistency tie-in**, not the core of the phenomenology argument. So the practical recommendation for how you use this record is:

1. **Keep the linkage lightweight in the record’s main flow.**  
   Use it to show unification (“world representation and gravity are both outward feasibility geometry”), but don’t turn this section into a re-derivation of the gravity math.
2. **Where to place it in later packaging (book vs DP):**
   * In the book: this section can be a short bridge paragraph showing why “space feels like a geometry” and why “motion under gravity feels regular,” without introducing materialist signal ontology.
   * In a DP addendum: keep it as a corollary statement (“χ enters ParentGate; the world modality is stabilized by ParentGate”), with references to the gravity module for details.
3. **Simple future test hook (if you simulate):**
   * Add χ as an explicit manifest parameter in a toy engine.
   * Vary χ and observe how:
     + world-token stability changes (object permanence, trajectory regularities),
     + tie-rate changes in the world modality,
     + and cross-modal coupling to intero/interface channels changes (e.g., “effort/weight-like” constraints becoming more/less dominant).  
       This would directly connect the “gravity as feasibility geometry” claim to the “world as stabilized representation” claim in a measurable way.

**Transition note to next section:**  
Section 14 will list weaknesses/risks and how to fix them (ambiguity about “extension,” modality overclaim risk, QM language risk, and the need to encode mediation constraints explicitly in CRA rather than leaving them implied).

**14. Weaknesses, Risks, and Improvement Plan**

This section records the **main failure modes** of the Experience-Horizons module as it currently stands, what each one would look like if it went wrong, and the **concrete edits/constraints** that prevent those problems. It also lists the most meaningful next steps to make the module more robust (both mathematically and rhetorically) before you rely on it as a long-term reference.

The goal here is not to “defend” the module—it is to keep it *safe to use* without accidentally overclaiming or drifting into language that conflicts with your core AR discipline (present-act primacy, feasibility-driven context, no materialist signal-ontology).

**14.1 Language and interpretation risks**

**14.1.1 Risk: “Extension” gets misread as physical causal propagation**

**What could go wrong:**  
A reader (or future-you) interprets CE2/Ext₂ as “causal influence travels two layers,” which pulls the theory back into a quasi-materialist propagation picture.

**Why it matters:**  
It undermines the core AR claim that “world = stabilized representation,” and it invites exactly the wrong objections (“why two?”, “what speed?”, “what medium?”).

**Mitigation (record-safe phrasing rule):**

* Always phrase CE2/Ext₂ as an **admissibility / representability / experience-separability horizon**, not a causal range.
* When you say “reaches,” follow it with “via admissible seam composition and symbolization.”

**Implementation guardrail:**

* Encode CE2 primarily as **CRA path grammar** (CE2‑G), not as a distance law.
* Use the word “template” more than “reach” in prose.

**14.1.2 Risk: “Body boundary” gets misread as literal skin boundary (contradicting Chapter 18)**

**What could go wrong:**  
Your record is read as claiming “the body boundary is literally where the skin is,” while Chapter 18 insists raw feeling is seamless and not boundary-carving.

**Why it matters:**  
It creates internal inconsistency between the phenomenology chapter and the engine mapping, and it invites unnecessary “biology literalism.”

**Mitigation:**

* Keep the boundary claim where it belongs: **public objectification** vs **private inward modulation**.
* Explicitly state (as we did in the corrected subsection) that this boundary is **not** a sharp felt edge.

**Implementation guardrail:**

* Treat “boundary” as a property of **+1 token stabilization**, not a property of interoceptive qualia content.

**14.1.3 Risk: Modalities drift into “senses as input channels”**

**What could go wrong:**  
“Modality” language slips into implying biological sensor realism (“vision receives photons,” “smell receives molecules”) as the explanatory primitive.

**Why it matters:**  
It reintroduces “signals in → mind,” which is precisely what the module is meant to avoid.

**Mitigation (strict translation rule):**

* Replace “input channel” with:
  + subalphabet (\Xi\_0^{(m)}),
  + hinge maps (f\_0^{(m)}, g\_0^{(m)}),
  + gate profile (\Theta^{(m)}, \kappa^{(m)}, \mathrm{Struct}^{(m)}, \mathrm{CRA}^{(m)}),
  + acceptance dominance / tie behavior.

**Implementation guardrail:**

* Keep modality claims framed as **submanifest differences**, and explicitly label any biological mapping as “future empirical mapping.”

**14.1.4 Risk: “Environment-as-representation” gets misread as solipsism**

**What could go wrong:**  
A reader thinks “if the environment is represented, then nothing exists except my experience.”

**Why it matters:**  
It’s an avoidable misunderstanding that can derail discussion and cause you to spend time defending a position you are not taking.

**Mitigation (one paragraph to reuse whenever needed):**

* State: the outward (+1) world is **CS-stable**—its stability is precisely what makes it appear public and external.
* “Representation” here means “stabilized outward tokenization,” not “private imagination.”

**Implementation guardrail:**

* Always mention +1 stability across centers (CS) when defining “environment,” even briefly.

**14.2 Structural / mathematical risks**

**14.2.1 Risk: CE2 treated as universal law without justification**

**What could go wrong:**  
CE2 gets treated as a global axiom (“every context extends two layers”) rather than as a human-hinge effective rule, and then it becomes vulnerable to needless attacks (“why not 3?”).

**Why it matters:**  
You lose modularity, and you make the theory harder to refine.

**Mitigation:**

* Frame CE2 as: **human-hinge effective admissibility horizon** (centered at 0), consistent with hinge compression and symbolization limits.
* Allow the possibility that other centers/hardwares could have different effective horizons.

**Implementation guardrail:**

* Keep CE2 in CRA (manifest field), not as “physics law text.”

**14.2.2 Risk: CRA is referenced but not fully formalized as an auditable grammar**

**What could go wrong:**  
CRA remains described narratively (“must go through 0,” “no skipping”) without a formal object that can actually reject/accept a candidate.

**Why it matters:**  
The module becomes unfalsifiable and hard to implement; “admissibility” turns into vibes.

**Mitigation:**

* Treat CRA as a grammar over declared **support paths** (template IDs) and enforce it mechanically.
* Require candidates to carry a coupling signature (support metadata).

**Implementation guardrail:**

* Add a minimal CRA schema definition in the record (or in a PR spec):
  + allowed templates list,
  + forbidden patterns list,
  + required mediation rules,
  + audit outputs.

**14.2.3 Risk: “Experience-separable” is invoked without a formal criterion**

**What could go wrong:**  
We say “beyond two hops, structure is not separable,” but we never define what “separable” means operationally.

**Why it matters:**  
This weakens the bridge to V1 and makes CE2 feel arbitrary.

**Mitigation (operational criterion options):**

* **Symbol criterion:** two candidate states are separable at 0 iff they map to different tokens in (\Xi\_0^{(m)}).
* **Tie criterion:** far-source differences are “non-separable” if they systematically collapse into ties under Accept at 0.
* **Rank criterion (V1 proxy):** separability corresponds to whether the effective seam-composed operator has rank > 1 in the relevant subspace.

**Implementation guardrail:**

* Pick one criterion for toy sims (symbol or tie criterion is easiest), and state it explicitly.

**14.3 QM linkage risks**

**14.3.1 Risk: slipping into “consciousness collapses the wavefunction”**

**What could go wrong:**  
Readers interpret Section 9 as making a mind-as-force collapse claim.

**Why it matters:**  
It invites an entire category of debate you don’t need, and it conflicts with the engine discipline.

**Mitigation:**

* Always define measurement as **seam-selection under hinge equality + feasibility + ratiolex**, with PF/Born invoked **only on true structural ties**.
* Avoid “collapse because observer” phrasing; use “commit because candidate set must select one public tokenization.”

**14.3.2 Risk: overclaiming Born-rule derivation**

**What could go wrong:**  
The record is read as claiming a complete derivation of the Born rule from first principles when it is currently a tie-break rule in the engine.

**Why it matters:**  
It creates a mismatch between what is claimed and what is shown.

**Mitigation:**

* Keep the statement as: *where probabilities enter* (ties-only), not *how the probabilities are derived*.
* Clearly label any “Born calibration” work as future derivation.

**14.4 Instrument modeling risks**

**14.4.1 Risk: re-encoding map (I) looks like a teleportation shortcut**

**What could go wrong:**  
The map (I: W^{(+3)}\to W^{(+1)}) is read as “direct +3→+1 coupling,” violating no-skip discipline.

**Why it matters:**  
It undermines the careful CE2/no-skip story.

**Mitigation:**

* Always present the factorization:  
  [  
  I\_{(+3\to +1)} = I\_{(+2\to +1)}\circ I\_{(+3\to +2)}.  
  ]
* Emphasize: the instrument is a **+1 structure** that participates in outward couplings; the 0 hinge only ever reads +1 tokens.

**Implementation guardrail:**

* Require instrument readouts to be explicitly tagged token types in (\Xi\_{+1}), and have CRA allow +3 only through those tagged readouts.

**14.5 Gravity/χ integration risks**

**14.5.1 Risk: χ definition instability leaks into experience claims**

**What could go wrong:**  
Because χ depends on outer-scale metric choices, changes in that definition appear to change the phenomenology module.

**Why it matters:**  
It creates unnecessary coupling between modules.

**Mitigation:**

* Keep the experience module agnostic: χ is **a parameter consumed by ParentGate/outer feasibility geometry**, whatever its final derivation.
* Put all metric-definition sensitivity inside the gravity module; keep this module only as a consumer.

**Implementation guardrail:**

* Phrase: “Given χ from the gravity module…” instead of “χ is defined here as…”

**14.6 Empirical/testability weaknesses and how to make them stronger**

**14.6.1 Main weakness: modality mapping is currently structural, not empirically calibrated**

**What could go wrong:**  
People treat the intero/interface/world mapping as an empirical claim about sensory physiology.

**Mitigation:**

* Keep the mapping explicitly as **hypothesis-level structural mapping** in terms of admissibility and stabilization.
* If you want empirical anchoring later, add a separate “mapping to neuroscience” appendix, clearly labeled as conjectural.

**14.6.2 Immediate test hooks that fit the current engine architecture**

Even without full sims, you can strengthen the module by defining measurable internal quantities:

* **Tie rate by modality:**  
  (\mathrm{TieRate}(m) = \Pr(|\mathcal{S}\_k^{(m)}|>1))
* **Symbol richness / entropy per modality:**  
  (|\Xi\_0^{(m)}|) and distributional usage in logs
* **Public stabilization rate:**  
  how often tokens in modality (m) stabilize as +1-readable, CS-shareable tokens
* **Cone usage frequency:**  
  counts of inner/interface/outer template invocations per act
* **Instrument mediation frequency:**  
  how often +3 appears via instrument readouts

These are simple “engine observables” you can log in a toy model and later in fuller simulations.

**14.7 Packaging and document-hygiene risks**

**14.7.1 Risk: mixing narrative metaphysics into technical claims**

**What could go wrong:**  
Chapter 18 contains strong metaphysical/spiritual language (oneness, love, ethics). If this language is not clearly separated from the engine-level claims, the whole module can be dismissed as “spiritual philosophy.”

**Mitigation:**

* Keep “two faces” and “spectrum” as *interpretive mapping*, and keep engine claims explicit and auditable.
* Use **Appendix E** (the mapping table) so narrative terms are always connected to manifest terms without collapsing one into the other.

**14.7.2 Risk: overloading the DP with speculative parts**

**What could go wrong:**  
If you later include this material in a defensive publication, and it reads as “a finished derivation” rather than “a recorded structural linkage,” it could weaken the DP by giving easy targets.

**Mitigation:**

* For DP purposes, keep only:
  + CE2/CRA grammar idea,
  + modality as submanifest framing,
  + instruments as re-encoding principle,
  + and the auditability discipline.
* Keep spiritual/ethics extension and deeper QM claims clearly labeled as interpretive/future-work.

(For your internal record, it’s fine to include all of it; just separate layers cleanly.)

**14.8 Next steps to solidify the module**

This is the prioritized work that would most increase robustness:

1. **Write the CRA grammar as a concrete schema**
   * allowed templates, forbidden patterns, mediation constraints
   * and define a candidate “support signature” metadata format.
2. **Pick and state a separability criterion**
   * token separability, tie separability, or rank proxy
   * use the same criterion consistently across sections.
3. **Formalize (\alpha\_m) as a computed summary (optional but powerful)**
   * e.g., a functional of symbol richness, tie rate, CS-stability, and Struct strictness.
4. **Define a minimal toy engine experiment**
   * demonstrate:
     + inner/private modulation,
     + outward public stabilization,
     + instrument-mediated +3 readouts,
     + and ties-only randomness behavior.
5. **Add one diagram** (even in text form)
   * ladder with cones + tokenization boundary
   * readers (and future-you) will understand faster with a single stable visual.
6. **Keep Appendix E updated**
   * whenever you revise Chapter 18 language, update the mapping so narrative and engine remain aligned.

**Transition note to next section:**  
Section 15 will outline the minimum “toy simulation / verification plan” needed to sanity-check the module’s claims in-engine (without requiring full-scale sims), including what to log, what to vary, and what outputs would count as confirming vs disconfirming behavior.

**15. Toy Simulation and Verification Plan**

This section defines the **minimum verification work** needed to sanity-check the Experience‑Horizons module *inside the AR/V2 engine framing*, without requiring full-scale “real world” simulations. The goal is not empirical validation of physics yet; it is to ensure the module is:

* **internally consistent,**
* **implementable as manifest constraints,**
* **auditable per-tick,**
* and **stable under controlled perturbations** (changing CE2, CRA, symbolization, χ, etc.).

The plan is deliberately modular so you can run it in a small “toy engine” (5–7 bands, small discrete alphabets) and still get meaningful diagnostics.

**15.1 What “verification” means here**

There are three levels of verification relevant to this module:

1. **Formal consistency checks (no code):**  
   Sanity-check that the definitions don’t contradict one another (e.g., CE2 implies (-2) cannot directly objectify into +1 in two hops; instruments re-encode +3 into +1; PF/Born is invoked only on true ties).
2. **Toy engine compliance tests (code / small sim):**  
   Implement the minimal manifest+commit pipeline and verify:
   * CRA enforces cone templates,
   * direct forbidden couplings do not leak,
   * instrument mediation behaves as specified,
   * ties-only randomness triggers only when it should,
   * the “public tokenization cut” actually emerges as intended.
3. **Sensitivity tests (parameter sweeps):**  
   Vary CE2 strictness, symbol richness, Struct strictness, χ (ParentGate curvature strength), and observe whether:
   * the qualitative partition (private vs public) remains robust,
   * modality spectrum behavior (tie rate vs stability) tracks (\alpha\_m) as expected,
   * and the engine stays auditable.

This section focuses on levels (2) and (3), because those are where hidden contradictions usually surface.

**15.2 Minimal toy engine specification**

This toy engine is not meant to “simulate the universe.” It is meant to enforce the **shape** of the AR/V2 commit architecture with enough structure to test this module’s claims.

**15.2.1 Bands used**

Minimum viable band set:

* (n\in{-2,-1,0,+1,+2})

Optional additions (recommended for instrument tests):

* include (+3) so you can enforce “+3 not in (\mathrm{Ext}\_2(0))” and demonstrate instrument mediation.

So either:

* **Toy‑5:** ({-2,-1,0,+1,+2})
* **Toy‑6:** ({-2,-1,0,+1,+2,+3})

**15.2.2 State representation**

You need only a compact discrete representation:

* Let each candidate world state be a small feature vector:  
  [  
  w = (w\_{-2}, w\_{-1}, w\_0, w\_{+1}, w\_{+2}, [w\_{+3}])  
  ]  
  where each component is in a small finite set (e.g., integers 0–9 or small categorical labels).
* Let inward record (Q\_k) be another small vector (or even a subset of fields of (w)) so hinge equality can be defined.

This toy state should support two kinds of distinctions:

* **private/inward distinctions** (differences in (w\_{-2}) or (w\_{-1}) that affect 0 but should not automatically appear as +1 tokens), and
* **public/outward distinctions** (differences in (w\_{+1}) that are meant to stabilize across centers).

**15.2.3 Minimal manifest fields required**

For each band you do not need full generality; you need only what this module uses:

* (\Xi\_n): finite alphabets (can be small)
* (f\_n, g\_n): hinge maps (many-to-one is allowed and desirable)
* (\mathrm{CRA}\_0): path grammar enforcing cone templates (CE2‑G)
* (\mathrm{Struct}*0), (\mathrm{Struct}*{+1}): simple structural predicates
* (\mathrm{ParentGate}\_{+1}(w;\chi)): outward feasibility geometry (χ parameter)
* (\mathrm{Accept}\_0): deterministic ordering + ties-only PF/Born

You can treat (\Theta,\kappa) as fixed (always pass) in the first pass, and then add them later as a secondary sweep.

**15.3 Required audit logging**

A toy engine is only useful if it produces **per-tick audit logs**. The audit record (A\_k) should include at minimum:

1. **Support / coupling signature**

* which cone templates were used (inner/interface/outer),
* which bands were referenced directly,
* whether instrument-readout tokens were present.

1. **Hinge tokens**

* (x^{(m)} = f\_0^{(m)}(w)) and (\hat{x}^{(m)} = g\_0^{(m)}(Q\_k)) (per modality if using modalities)
* whether hinge equality passed.

1. **Gate outcomes**

* pass/fail for CRA, Struct, ParentGate,
* and optionally margins or “which predicate failed.”

1. **Acceptance**

* ranking residuals or ordering key,
* survivor set size (|\mathcal{S}\_k|),
* whether PF/Born tie-break was invoked.

This audit log is also your primary “proof object” for later writeups: it demonstrates the module is not narrative-only.

**15.4 Core test suite**

This is the heart of the plan: each test is a small scenario with a clear pass/fail criterion.

**15.4.1 Test 1: CE2/CRA grammar compliance**

**Purpose:** verify that CE2 lives as a *real constraint* (not a story) and blocks forbidden cross-band shortcuts.

**Setup:**

* Create candidate acts that attempt to justify committed content using forbidden support signatures:
  + direct ((-2\to +1)) coupling,
  + direct ((0\to +2)) coupling without passing through +1,
  + direct ((0\to +3)) coupling (if Toy‑6).
* Also create candidates that use allowed cone templates:
  + (-2\to -1\to 0),
  + (-1\to 0\to +1),
  + (0\to +1\to +2).

**Pass criteria:**

* All forbidden candidates fail CRA (CE2‑G).
* All allowed candidates can pass CRA (assuming other gates also pass).

**Key metric:**

* CE2\_violation\_count must be **0** among committed acts.

**15.4.2 Test 2: Body boundary as public-token cut**

**Purpose:** verify the central claim that inward-most distinctions can shape the 0 commit without automatically becoming +1 public tokens.

**Setup:**

* Construct two candidate worlds (w^{(A)}) and (w^{(B)}) identical in outward fields (+1/+2), but different in inward fields (−2 and/or −1).
* Make both hinge-consistent at 0 (so both are legitimate possibilities).
* Ensure the only difference is in inward fields that are “private” under the inner cone.

**Expected behavior:**

* The 0 tokenization (or the intero modality token) may differ, reflecting private modulation.
* The outward +1 token should **not** differ purely because −2 differs, unless you explicitly add a re-encoding mechanism that routes the difference into +1 through a legal template (e.g., via interface coupling).

**Pass criteria:**

* Differences in (w\_{-2}) should not appear as differences in committed (y=f\_{+1}(W\_{k+1})) unless a legal mediation is present.
* Public outward tokenization is stable with respect to purely inward variations.

**Key metrics:**

* private\_influence\_detected: yes (in 0/intero token)
* -2\_to\_+1\_leak\_count: **0**

**Important note (matches Chapter 18):**

* This test is not “does the system feel a sharp boundary.”
* It is: “does public +1 objectification remain insulated from purely inward differences.”

**15.4.3 Test 3: Modal submanifest separation and (\alpha\_m) behavior**

**Purpose:** verify that the modality framework is not just naming; it produces measurable differences in stability, tie rates, and token richness consistent with the qualia–informean spectrum.

**Setup:**

* Implement at least two modalities at 0:
  + (m\_{\text{intero}}) driven mainly by the inner cone,
  + (m\_{\text{world}}) driven mainly by the outer cone.
* Give them different symbolization and gate profiles:
  + smaller (\Xi\_0^{(\text{intero})}), weaker object-stabilizing Struct,
  + richer (\Xi\_0^{(\text{world})}), stronger Struct + ParentGate coupling.

**Measures to log per modality:**

* tie rate: (\Pr(|\mathcal{S}\_k^{(m)}|>1))
* token entropy / usage diversity in (\Xi\_0^{(m)})
* cross-center stability (if running multi-center)

**Pass criteria (qualitative):**

* (m\_{\text{intero}}) tends toward:
  + higher tie tolerance or higher ambiguity,
  + lower symbol richness,
  + lower public stabilization tendency.
* (m\_{\text{world}}) tends toward:
  + lower tie rate (more determinacy),
  + higher symbol richness,
  + higher outward stability and persistence.

**Optional computed summary:**

* define a provisional (\alpha\_m) estimator, for example:  
  [  
  \widehat{\alpha}\_m  
  = \mathrm{Norm}\Big(  
  \mathrm{CSStability}(m)
  + \mathrm{Entropy}(\Xi^{(m)})
  + \mathrm{TieRate}(m)  
    \Big)  
    ]  
    where Norm rescales into ([0,1]).  
    (This is not a law; it is a diagnostic.)

**15.4.4 Test 4: Instrument mediation and +3 access**

**Purpose:** verify “+3 is not directly hinge-visible at 0,” and instruments enable +3 influence only through +1 readout tokens.

**Setup (Toy‑6 recommended):**

* Include +3 band variables that the center cannot access directly under CE2.
* Define an instrument operator:  
  [  
  I\_{(+3\to +1)} = I\_{(+2\to +1)}\circ I\_{(+3\to +2)}  
  ]  
  which produces a tagged +1 readout token type.

Construct two candidate families:

1. **Direct +3 attempt:** candidate references +3 as a direct support band.
2. **Instrument-mediated:** candidate includes +1 readout tokens tagged as instrument output, and does not reference +3 directly.

**Pass criteria:**

* Direct +3 attempt fails CRA/horizon gate.
* Instrument-mediated candidate passes (assuming other gates pass).
* Audit logs show +3 appears only in instrument\_mediated\_bands, never in direct\_sources.

**Key metrics:**

* direct\_+3\_reference\_count: **0** among committed acts
* instrument\_readout\_usage\_count: >0 when +3 influence is present

**15.4.5 Test 5: Measurement-like tie selection and ties-only PF/Born**

**Purpose:** verify that PF/Born randomness is invoked **only** on true structural ties after feasibility + acceptance.

**Setup:**

* Create scenarios where:
  + there is a unique minimal survivor (deterministic commit), and
  + there is a genuine tie set (|\mathcal{S}\_k|>1).

**Pass criteria:**

* If (|\mathcal{S}\_k|=1), PF/Born is not invoked.
* If (|\mathcal{S}\_k|>1), PF/Born is invoked and selects one element.

**Key metrics:**

* pf\_invoked\_when\_tie: always true
* pf\_invoked\_when\_not\_tie: always false

This is an extremely important invariant for your entire V2 architecture; the toy engine should enforce it perfectly.

**15.4.6 Test 6: χ sensitivity in outward stabilization**

**Purpose:** verify the integration claim: χ (curvature strength / feasibility geometry) shapes the stability landscape of world tokens in the outward channel.

**Setup:**

* Implement a simple ParentGate cost or feasibility predicate depending on χ:  
  [  
  \mathcal{C}\_{+1}(w;\chi)\le \epsilon  
  ]  
  or a discrete rule that changes admissibility as χ changes.
* Sweep χ across a small range (e.g., 5–10 values).

**Observe:**

* stability of world tokens (persistence across ticks),
* changes in the “preferred trajectory” patterns (if you model motion),
* tie rate changes in (m\_{\text{world}}).

**Pass criteria (qualitative):**

* changing χ changes outward stable token landscapes in a consistent, continuous way (not arbitrary), and the change shows up primarily through world/meaning channel stabilization, not by contaminating inner cone rules.

**15.5 Optional multi-center stability tests**

These tests are not required for the first pass, but they strengthen the “public world” story substantially.

**15.5.1 Multi-center setup**

Run (C) centers (agents) with identical or near-identical +1 manifests and allow them to commit acts independently.

Define a “public token” criterion:

* a +1 token is public if it is stable across centers within tolerance.

**15.5.2 Tests**

* **CS alignment test:** how often do centers commit the same +1 token under the same outward conditions?
* **Private modulation test:** do centers diverge in intero tokens while remaining aligned in +1 tokens?

**Pass criteria:**

* high alignment on +1 tokens (public world coherence),
* allowable divergence in inward tokens (private modulation).

**15.6 What outcomes force revision**

This subsection defines clear failure states—results that would mean the module (as stated) is not functioning and must be revised.

1. **CE2 cannot be enforced without breaking everything**  
   If enforcing cone templates makes the toy engine unable to commit coherent acts at all, CE2 is too strict or placed incorrectly.
2. **Private-to-public leakage cannot be prevented**  
   If −2 distinctions reliably leak into +1 public tokens without explicit legal mediation, the “body boundary as public token cut” claim is not realized by the current constraints.
3. **Instrument mediation cannot be made non-skip**  
   If the only way to incorporate +3 influence is to allow direct +3 coupling at 0, the instrumentation story needs rework (likely in CRA and token tagging).
4. **PF/Born is invoked outside tie cases**  
   This is a hard violation of V2 discipline and indicates acceptance/feasibility separation is not implemented correctly.
5. **Modalities do not behave differently under any reasonable configuration**  
   If varying (\Xi^{(m)}), Struct, and cone restrictions does not change tie rates/stability in modality channels, the modality formalism is not grounded enough to be useful.

**15.7 Minimal deliverables**

If you run this plan (even in a toy engine), the minimum deliverables that materially strengthen the record are:

1. **A manifest specification file** for Toy‑5 or Toy‑6 (human hinge)
2. **An audit log example** showing:
   * a normal deterministic act,
   * a tie-resolved act (PF/Born invoked),
   * a forbidden coupling rejected by CRA,
   * an instrument-mediated +3 readout accepted without direct +3 coupling
3. **A small table of metrics**:
   * CE2 violations: 0
   * −2→+1 leak: 0
   * PF invoked only on ties: 100%
   * tie rates per modality
   * stability measures vs χ sweep

Even one page of these results is enough to “pin down” that the module is not merely interpretive prose—it is a working constraint architecture.

**Transition note to next section:**  
Section 16 will provide a clean “implementation + writeup checklist” for merging this module into your master theory bundle (where to place definitions, how to keep the DP narrative safe, and what phrasing to avoid), using the risks from Section 14 and the test hooks from this section.

**16. Integration and Writeup Checklist**

This section is a practical “merge guide” for taking the Experience‑Horizons module (CE2/Ext₂, cones, modalities, instruments, measurement linkage, χ integration) and incorporating it into your master theory bundle and (optionally) into a defensive publication—without introducing drift, overclaiming, or internal inconsistencies with Chapter 18 and the core AR/V2 engine discipline.

It is split into two layers:

1. **Implementation / architecture checklist** (how the module should exist as engine constraints and manifest objects).
2. **Writeup / packaging checklist** (how to present it in documents, book, and DP safely).

**16.1 What this module is “allowed to be”**

Before merging anything, keep this framing stable:

* This module is an **extension layer** that turns existing AR/V2 structures into a **phenomenology payoff**:
  + “inside/body vs near-world vs world/meaning”
  + as a consequence of **admissibility, symbolization, and stabilization**.
* It is not a new ontology, not a new “substance,” and not a replacement for the gravity/QM formal tracks.
* It is best treated as:
  + a **CRA grammar specialization** (CE2‑G),
  + a **0‑band modal submanifest decomposition**,
  + plus **instrument re-encoding** as a disciplined explanation for apparent +3 access.

If you keep that stable, everything else becomes easier.

**16.2 Where to place things in the master document bundle**

The primary rule is: **do not smear this across every doc.**  
Keep it modular and cross‑referenced.

**16.2.1 Minimal‑diff integration approach**

**Create one new “Extension Module” document** (or one dedicated chapter/section in your “new addition framework”) containing:

* CE2 (both CE2‑R and CE2‑G),
* the three cones (inner/interface/outer),
* modalities as submanifests,
* instrument re-encoding,
* the measurement linkage section (clearly labeled as structural alignment),
* and Appendix E mapping Chapter 18 terms ↔ engine terms.

Then, in the other core docs, add only **short cross‑references** (not full rewrites):

* **Context Level framework:** add a pointer that CE2 is being used as an effective horizon at the human hinge and implemented as CRA templates; do not rewrite the ladder.
* **V2 – Present‑Act Engine:** add a pointer that CRA includes a cone grammar option and modalities can be implemented as submanifests; keep the engine core unchanged.
* **Bridge (V1–V2):** add a dictionary entry mapping “experience horizon / separability horizon” to:
  + V1: seam composition + hinge compression (low‑rank proxy), and
  + V2: CRA cone grammar + (\Xi) partitions + tie behavior.
* **Philosophical Underpinnings / Book:** keep Chapter 18 as narrative; add Appendix E mapping (or a short “how to read this in engine terms” note) without turning the chapter into equations.

This avoids the biggest practical risk: “everything refers to everything,” making later revisions impossible.

**16.2.2 Explicit dependency labels to prevent drift**

At the top of the module doc (or section), include a small “Dependencies / Non-dependencies” box:

* **Depends on:**
  + manifests (\mathcal{M}\_n), CRA, hinge equality, ratiolex acceptance, ties‑only PF/Born, and the context ladder indexing.
* **Does not redefine:**
  + the definition of the hinge, the definition of the bands, the definition of PF/Born, or the χ derivation.

This prevents later edits from quietly mutating the core.

**16.3 Implementation checklist**

This is the “if I had to code it” view. Even if you never code it fully, this checklist keeps the math claims disciplined.

**16.3.1 CE2 should live as CRA grammar, not as prose**

**Required:**

* Implement CE2 primarily as **CE2‑G**: a CRA path‑template grammar with allowed cone templates:
  + (-2\to -1\to 0)
  + (-1\to 0\to +1)
  + (0\to +1\to +2)

**Required metadata:**

* Every candidate act must carry a lightweight **support signature**, e.g.:
  + support\_templates = {inner, interface, outer}
  + support\_bands = {...}
  + optional: support\_edges = {...}

**Reason:**

* CRA must be auditable; otherwise CE2 becomes story and can’t be checked.

**16.3.2 Define “experience‑separable” explicitly in engine terms**

Pick one criterion and state it at the top of the module implementation notes:

* **Token criterion (recommended):**  
  Two candidates are separable at 0 (for modality (m)) iff they map to different tokens in (\Xi\_0^{(m)}).

or

* **Tie criterion (useful in sims):**  
  A distinction is “non-separable” at 0 if it survives feasibility but repeatedly collapses into ties under Accept (i.e., differences do not change committed content except under tie-break).

This matters because CE2 claims are about separability, not about “influence.”

**16.3.3 Modalities must be submanifests, not external channels**

**Required:**

* Represent modalities as:  
  [  
  \mathcal{M}\_0^{(m)} =  
  (\Xi\_0^{(m)}, f\_0^{(m)}, g\_0^{(m)}, \Theta\_0^{(m)}, \kappa\_0^{(m)}, \mathrm{Struct}\_0^{(m)}, \mathrm{CRA}\_0^{(m)}, \mathrm{Accept}\_0^{(m)}).  
  ]

**Choose an implementation strategy:**

* Disjoint union (tagged tokens), OR
* Product alphabet (vector token), OR
* Hybrid primary + auxiliary.

**Minimum requirement regardless of strategy:**

* You must be able to log per tick:
  + which modalities were active,
  + which cone templates each modality used,
  + tie rate per modality.

That makes the Chapter 18 ↔ engine mapping measurable.

**16.3.4 Instruments must be re-encoding with explicit no-skip factorization**

**Required:**

* Instrument-mediated +3 influence must appear only as **+1 readout tokens**.

**Write the factorization explicitly:**  
[  
I\_{(+3\to +1)} = I\_{(+2\to +1)}\circ I\_{(+3\to +2)}.  
]

**Required token tagging:**

* Instrument output tokens in (\Xi\_{+1}) must be tagged as instrument\_readout.

**CRA rule:**

* Reject direct +3 references at 0.
* Permit +3 influence only through tagged instrument readouts (which are +1 tokens).

This prevents the most common conceptual mistake: treating (I) like teleportation.

**16.3.5 Keep χ as a ParentGate parameter (consumer-only)**

**Required:**

* The experience module must treat χ as an input consumed by:
  + (\mathrm{ParentGate}\_{+1}(\cdot;\chi)) or equivalent.

**Not allowed inside this module:**

* redefining χ or re-deriving the outer metric choices.

This isolates the experience module from changes in the gravity track.

**16.3.6 Audit log must be a first-class output**

**Required per tick:**

* cone templates used,
* modality tokens committed,
* CRA pass/fail and reason,
* survivor set size,
* PF/Born invoked or not (must be ties-only),
* instrument readouts used (if any),
* and optionally χ value for that run.

If you can’t audit it, you can’t rely on it as a “record.”

**16.4 Writeup checklist**

This is the “how to write it so it won’t cause problems later” list.

**16.4.1 Keep three layers explicitly separated**

**Layer 1: Mechanism (engine claims)**

* CE2 as CRA cone grammar, modalities as submanifests, instruments as re-encoding, ties-only PF/Born.

**Layer 2: Interpretation (Chapter 18 mapping)**

* finite face ↔ outward stabilization / high (\alpha\_m) modes
* infinite face ↔ qualia/presence / low (\alpha\_m) modes

**Layer 3: Extensions (spiritual/ethics framing, big narrative)**

* oneness/love/ethics implications

The record can contain all three, but they must be labeled so nobody confuses Layer 3 as “derived physics.”

Appendix E exists to make this separation safe.

**16.4.2 DP-safe subset**

If/when you use this in a defensive publication, the safest subset is:

* CE2 as an admissibility grammar proposal (cone templates)
* Modalities as submanifests (representation/gating profiles)
* Instruments as re-encoding rule (no direct +3 at 0)
* Auditability discipline

Everything else can be included as:

* “interpretive mapping”
* “future work”
* “structural correspondence (not a full derivation)”

This protects the DP from “easy target” critiques while still putting the idea on record.

**16.4.3 High-risk phrases to avoid and their replacements**

* Avoid: “signals travel from the environment into the mind”  
  Use: “+1 tokens become hinge-visible at 0 under CRA/Struct feasibility.”
* Avoid: “−2 ends at the skin”  
  Use: “−2 influences 0 through the inner cone but does not directly objectify into +1 tokens under CE2.”
* Avoid: “consciousness collapses the wavefunction”  
  Use: “commit selection occurs under hinge equality + feasibility + ratiolex; PF/Born is invoked only on true ties.”
* Avoid: “we directly see +3”  
  Use: “instruments re-encode +3 constraints into +1 readouts; 0 commits those readouts via the normal seam.”

**16.4.4 Always include the boundary clarification (Chapter 18 alignment)**

Wherever you explain “body boundary,” include this one-sentence guardrail:

The boundary here is not a sharp felt edge in raw feeling; it is the cut between private modulation and public +1 objectification.

That keeps the record consistent with the seamless-feeling emphasis in Chapter 18.

**16.5 Pre-merge consistency pass**

Before you treat this as a final record, do one pass with this checklist:

1. **Terminology pass**

* “Qualia–InformeAN” is spelled consistently.
* CE2 is called “effective horizon for human hinge,” not “universal law.”

1. **Constraint placement pass**

* CE2 is implemented as CRA grammar (not as free prose).
* Instruments are re-encoding (+3 only via +1 readouts).
* PF/Born appears only under ties.

1. **Boundary pass**

* Boundary is defined as public tokenization cut, not literal skin.

1. **Appendix E pass**

* Chapter 18 language mapping exists and is coherent with the section text.

1. **Remove chat artifacts**

* No “in this chat I can’t access…” notes remain inside the record.

**16.6 Post-merge maintenance policy**

Because this module touches both narrative (Chapter 18) and technical engine language, adopt a simple maintenance policy:

* **Version the module separately** (e.g., EH‑v0.1, EH‑v0.2).
* Any time you revise CE2/CRA templates or modality definitions:
  + update Appendix E mapping,
  + update the audit schema section,
  + and update the DP-safe subset notes.

This prevents silent drift and keeps old versions usable.

**Transition note to next section:**  
Section 17 will provide a concise “module summary + canonical statements” page: the 10–15 sentences and 5–10 equations that define the module unambiguously (CE2, cones, modalities, instruments, boundary cut, ties-only PF/Born), plus a one-paragraph Chapter 18 alignment statement.

**17. Canonical Module Summary and Canonical Statements**

This section is the “one-page spine” of the Experience‑Horizons module: the smallest set of statements and equations that, together, define what the module is claiming—without narrative padding and without overreach. It is designed to be copied into the front of the module as the canonical reference.

**17.1 Canonical statements**

1. **Context levels are operationally manifests.** A band (n) is not a substance layer; it is the feasibility/representability contract (\mathcal{M}\_n) that governs what can be committed and stabilized.
2. **The human hinge is treated as the center band (0)** for this module, and all “inner/outer” language is relative to that choice.
3. **CE2 is an effective admissibility/separability horizon for the human hinge, not yet asserted as a universal constant.** It is best encoded as a CRA grammar over seam templates (CE2‑G), not as a physical propagation range.
4. **The two-hop horizon at the human hinge is (\mathrm{Ext}\_2(0)={-2,-1,0,+1,+2}).** Bands outside this set (e.g., (+3)) cannot be direct experience‑separable sources at 0 without mediation and re‑encoding.
5. **The module’s core geometry is the three canonical two-hop cones:** inner ((-2\to -1\to 0)), interface ((-1\to 0\to +1)), and outer ((0\to +1\to +2)). These are CRA‑admissible path templates for direct phenomenological coupling.
6. **The “body boundary” is not a sharp felt edge.** It is the stabilization cut between (i) private inward modulation of the 0 act and (ii) public +1 objectification (CS-stable outward tokens). Raw interoceptive feeling can remain seamless while the public tokenization boundary still exists.
7. **The “environment” is the stabilized +1 representational surface**, not a primitive substrate delivered by “signals in.” “Sensing” is the repeated hinge-consistent commitment of +1 tokens under feasibility constraints.
8. **Modalities are not sensors.** A modality is a **0-band submanifest profile**: a subalphabet plus hinge maps plus gate/acceptance profile. Qualitative diversity is modeled as differences in symbolization and stabilization regimes, not as separate ontological input pipes.
9. **The qualia–InformeAN spectrum is represented by modality profiles**, where “finite/contrast-heavy” modes correspond to richer (\Xi\_0^{(m)}) and stronger outward stabilization, and “infinite/non-separate” modes correspond to lower contrast tokenization and more field-like continuity. A scalar (\alpha\_m\in[0,1]) may be used as a bookkeeping summary of these properties.
10. **Instruments do not grant direct +3 access to the 0 hinge.** Instruments are +1-stable re‑encoding structures that translate far-context constraints into +1‑readable tokens; 0 then commits those tokens via the normal 0↔+1 seam.
11. **Measurement-like selection is a special case of seam commitment.** It occurs when hinge equality + feasibility + acceptance leave multiple minimal survivors; then (and only then) PF/Born resolves genuine structural ties.
12. **PF/Born is ties-only.** The engine remains deterministic unless a true tie remains after ratiolex acceptance; probabilistic selection is never used as a general weighted-scoring rule.
13. **χ enters the experience stack as a parameter of outward feasibility geometry** (ParentGate / outward stabilization), shaping which +1 tokens are stable and therefore shaping the structure of the world/meaning modality.
14. **Auditability is a first-class requirement.** Every committed act must be traceable to which cone template(s), which modality submanifest(s), which gates, and whether a tie-break occurred—otherwise the module is not operationally pinned down.

**17.2 Canonical definitions and equations**

These are the minimal math objects used throughout the module.

**17.2.1 Band indexing and distance**

* Bands are indexed by integers:  
  [  
  n\in\mathbb{Z},\quad \text{with human hinge centered at } 0.  
  ]
* Neighbor-only ladder distance (base model):  
  [  
  \mathrm{dist}(a,b)=|a-b|.  
  ]

**17.2.2 Two-hop extension set**

* Two-hop horizon (reach-based):  
  [  
  \mathrm{Ext}\_2(n):={m\in\mathbb{Z}:\mathrm{dist}(n,m)\le 2}.  
  ]  
  In particular:  
  [  
  \mathrm{Ext}\_2(0)={-2,-1,0,+1,+2}.  
  ]

**17.2.3 Cone templates (CE2‑G as CRA grammar primitives)**

* The three canonical two-hop templates at 0:  
  [  
  t\_{\text{inner}}:;-2\to -1\to 0,  
  \quad  
  t\_{\text{interface}}:;-1\to 0\to +1,  
  \quad  
  t\_{\text{outer}}:;0\to +1\to +2.  
  ]
* CE2‑G (template grammar form) is encoded as an admissibility condition in CRA:  
  [  
  \mathrm{CRA}*0(p)=\text{true};\Longrightarrow; p \in {t*{\text{inner}},t\_{\text{interface}},t\_{\text{outer}}}\ \ (\text{for direct phenomenological support}).  
  ]

**17.2.4 Band manifest schema**

* Band manifest:  
  [  
  \mathcal{M}\_n =  
  (\Xi\_n,; f\_n,; g\_n,; \Theta\_n,; \kappa\_n,; \mathrm{Struct}\_n,; \mathrm{ParentGate}\_n,; \mathrm{CRA}\_n,; \mathrm{Accept}\_n).  
  ]
* Hinge equality at band (n):  
  [  
  f\_n(w)=g\_n(q)\in \Xi\_n.  
  ]
* Feasibility gate bundle at band (n):  
  [  
  \mathrm{Feas}\_n := \Theta\_n \wedge \kappa\_n \wedge \mathrm{Struct}\_n \wedge \mathrm{ParentGate}\_n \wedge \mathrm{CRA}\_n.  
  ]

**17.2.5 Candidate set, survivor set, and ties-only PF/Born**

At tick (k) with inward record (Q\_k), define hinge-consistent feasible candidates:  
[  
\mathcal{C}\_k := {w:\ f\_0(w)=g\_0(Q\_k)\ \wedge\ \mathrm{Feas}\_0(w,Q\_k)=\text{true}}.  
]

Define the minimal survivor set under acceptance ordering:  
[  
\mathcal{S}\_k := \mathrm{MinAccept}\_0(\mathcal{C}\_k).  
]

Commit rule:

* If (|\mathcal{S}\_k|=1), commit deterministically.
* If (|\mathcal{S}*k|>1), invoke ties-only PF/Born:  
  [  
  W*{k+1}\sim \mathrm{PF/Born}(\mathcal{S}\_k).  
  ]

**17.2.6 Modal submanifests and source sets**

* Modal decomposition (conceptual):  
  [  
  \mathcal{M}*0 \approx \bigoplus*{m\in\mathsf{Mod}} \mathcal{M}\_0^{(m)}.  
  ]
* Direct admissible source sets:  
  [  
  S\_{\text{dir}}(m)\subseteq \mathrm{Ext}\_2(0).  
  ]
* Spectrum bookkeeping parameter:  
  [  
  \alpha\_m\in[0,1],  
  ]  
  interpreted as “more informean / more structured / more publicly stabilizable” as (\alpha\_m\to 1), and “more qualia / more field-like / less contrast-tokenized” as (\alpha\_m\to 0).

**17.2.7 Instruments as re-encoding (no-skip explicit factorization)**

* Instrument re-encoding from +3 into +1:  
  [  
  I\_{(+3\to +1)}:\ W^{(+3)} \to W^{(+1)}.  
  ]
* No-skip relay factorization:  
  [  
  I\_{(+3\to +1)} = I\_{(+2\to +1)} \circ I\_{(+3\to +2)}.  
  ]
* +3 influence is admissible at 0 only as **tagged +1 readout tokens**, never as direct +3 sources.

**17.2.8 χ as outward feasibility geometry parameter**

* Treat χ as a parameter in outward feasibility geometry:  
  [  
  \mathrm{ParentGate}*{+1}(w;\chi)\quad \text{or}\quad \mathcal{C}*{+1}(w;\chi).  
  ]  
  The experience module consumes χ; it does not redefine it.

**17.3 Chapter 18 alignment statement**

Chapter 18’s “two faces” (finite contrast vs infinite non-separation) maps cleanly onto the engine language in this module **without reducing one to the other**. The finite face corresponds to outward (+1) tokenization and meaning-rich stabilization: modes whose symbols are rich, contrast-heavy, and publicly shareable (high (\alpha\_m)), dominated by the outer cone (0\to +1\to +2) and strong structural/ParentGate constraints. The infinite face corresponds to qualia-dominant presence and field-like continuity: modes that do not primarily carve experience into separable objects (low (\alpha\_m)), dominated by inner-cone coupling (-2\to -1\to 0). Crucially, Chapter 18’s insistence that raw feeling can be seamless is preserved: the “boundary” in this module is **not** a sharp line inside feeling; it is the **public-object stabilization cut** between private inward modulation and CS-stable +1 objectification.

**17.4 Canonical invariants for future use**

If any of these invariants are violated in future drafts or implementations, treat it as a module-breaking regression:

1. CE2 is enforced as CRA cone grammar (or explicitly replaced with a declared alternative).
2. −2 does not directly objectify into +1 tokens under CE2 without explicit legal mediation/re-encoding.
3. +3 never appears as a direct source at 0; it appears only via instrument-tagged +1 readouts.
4. PF/Born is invoked **only** when (|\mathcal{S}\_k|>1) (true ties).
5. The “boundary” is defined as public tokenization cut, not as a literal anatomy boundary.

If you want the very next section after this, it should be either **(A) a concluding “what to do next / PR plan”** or **(B) a short “full-module outline index and cross-reference map”**, depending on how you want to close out the record.

**18. Cross‑Reference Map, Versioning Policy, and Final Packaging Guidance**

This final section turns the record into something you can reliably *use later* without drifting, duplicating definitions across documents, or accidentally changing a foundational assumption (CE2/CRA, modalities, instrument mediation, ties-only PF/Born) without noticing.

It includes:

1. a **cross-reference/index map** (“where does each concept live, and where is it used?”),
2. a **dependency map** (what this module depends on and what depends on it),
3. a **versioning/change-control policy** (how to revise safely), and
4. a **packaging kit** (what to lift into DP/book and what to keep as internal).

**18.1 Cross‑reference index**

Use this as the quick “where do I find the canonical definition?” map.

**18.1.1 Core objects and where they are defined**

* **Band indexing (n\in\mathbb{Z}), human hinge at (0)**  
  Defined: Section 4.1  
  Used: throughout
* **Ladder graph / distance / reach**  
  Defined: Section 4.2–4.3  
  Used: Sections 5–7 (CE2), Section 6 (horizon), Section 8 (instrument mediation), Section 17 (canonical equations)
* **Band manifest (\mathcal{M}\_n)**  
  Defined: Section 4.5  
  Used: Sections 7, 11, 12, 15, 16, 17
* **Hinge equality (f\_n(w)=g\_n(q))**  
  Defined: Section 4.4  
  Used: Sections 9, 11, 15, 17
* **CE2 / Ext₂**
  + Reach form (CE2‑R)
  + Grammar form (CE2‑G)  
    Defined: Section 5.3 (corrected replacement)  
    Used: Sections 6–8, 11, 15–17
* **Three cones (inner/interface/outer)**  
  Defined: Section 6.2  
  Used: Sections 7 (modal sources), 8 (instrument route), 11 (CRA templates), 15 (tests), 17 (canonical)
* **“Body boundary” as public-token cut**  
  Defined: Section 6.3 (corrected replacement)  
  Used: Sections 7.3, 9.3, Appendix E, Section 17
* **Environment-as-representation**  
  Defined: Section 6.4  
  Used: Sections 8, 12, Appendix E
* **Modal submanifests (\mathcal{M}\_0^{(m)})**  
  Defined: Section 7.2  
  Used: Sections 7.3–7.5, 11, 15, 17, Appendix E
* **Qualia–InformeAN spectrum parameter (\alpha\_m)**  
  Defined: Section 7.4  
  Used: Sections 12 (CCLK learning link), 15 (verification metrics), 17 (canonical), Appendix E (narrative mapping)
* **Instruments as re‑encoding (I\_{(+3\to +1)})** (with no-skip factorization)  
  Defined: Section 8.2 (corrected replacement)  
  Used: Sections 8.3–8.4, 11.1.3–11.1.4, 15.4.4, 17.2.7
* **Measurement-like selection and ties-only PF/Born**  
  Defined: Section 9.1 (corrected replacement) + Section 9.2  
  Used: Sections 11, 15.4.5, 17
* **V1 face / hinge compression justification**  
  Defined: Section 10  
  Used: Section 17 (canonical summary), and as conceptual support for CE2’s “separability horizon” framing
* **V2 face / implementation placement**  
  Defined: Section 11  
  Used: Sections 15–16 (verification + merge checklist), Section 17
* **CFD / CCLK integration**  
  Defined: Section 12  
  Used: Sections 15–16 (implementation/roadmap)
* **Gravity/χ integration**  
  Defined: Section 13  
  Used: Sections 15.4.6 (χ sweep test), Section 17
* **Risks and mitigation**  
  Defined: Section 14  
  Used: Section 16 (writeup checklist)
* **Toy verification plan**  
  Defined: Section 15  
  Used: Section 16 (implementation checklist), future sim roadmap
* **Chapter 18 mapping**  
  Defined: Appendix E  
  Used: anywhere narrative language is invoked (especially if you reuse book text inside technical docs)

**18.1.2 Canonical “do not redefine elsewhere” list**

To prevent drift, treat the following as “defined once here” and only referenced elsewhere:

* CE2‑G cone templates (the allowed CRA templates)
* the meaning of “boundary” as **public tokenization cut**
* the definition of “instrument mediation” as **+3 only via tagged +1 readouts**
* PF/Born as **ties-only** (never a generic scoring sampler)
* modalities as **submanifests** (not sensors)

**18.2 Dependency map**

This module is intentionally *downstream* of your core engine and context architecture. That’s what makes it safe.

**18.2.1 Depends on**

* The **band/ladder** idea (context levels indexed by (n))
* The **manifest** idea (\mathcal{M}\_n) (context = feasibility contract)
* The **present-act commit** pipeline (hinge equality → feasibility → acceptance → ties-only PF/Born)
* CRA as an admissibility mechanism (here specialized into CE2‑G)

**18.2.2 Does not depend on**

* Any specific outer-universe metric choice (those affect χ derivation, but not the horizon module structure)
* A full derivation of the Born rule (the module only needs the placement of PF/Born as ties-only)
* A biological/neural mapping (modalities are submanifests; physiology mapping is optional later)

**18.2.3 What depends on this module**

Only interpretive/packaging layers should depend on this module:

* the Chapter 18 “two faces / spectrum” bridge (Appendix E)
* any “phenomenology payoff” claims (body boundary, world-as-representation)
* any DP narrative that claims “the model yields experiential structure”

Core physics derivations (gravity math, etc.) should not depend on this module. Keep that direction one-way: physics supports the module, not vice versa.

**18.3 Versioning and change-control policy**

This is the policy that keeps the record usable even after you evolve the theory.

**18.3.1 Recommended version tags**

Version the module as its own unit:

* **EH‑v0.1**: current record (CE2‑G cones + modality submanifests + instruments + ties-only measurement linkage)
* EH‑v0.2, EH‑v0.3… for later refinements

Always include:

* date
* a short “delta list” (what changed)
* whether it changes any canonical invariants (below)

**18.3.2 Canonical invariants (“regression tests” for language + logic)**

If any of these are violated, treat it as a breaking change that requires rewriting related sections:

1. CE2 is enforced as **CRA cone grammar** (or explicitly replaced with a named alternative).
2. −2 does not directly objectify into +1 tokens under CE2 without explicit legal mediation/re-encoding.
3. +3 never appears as a direct source at 0; +3 influence appears only via instrument-tagged +1 readouts.
4. PF/Born is invoked **only when (|\mathcal{S}\_k|>1)** (true ties).
5. “Boundary” remains defined as **public objectification cut**, not a literal anatomical edge.

**18.3.3 What edits are “safe” vs “breaking”**

**Safe edits (do not force broad rewrite):**

* adding a new modality (m) as another submanifest
* refining (\alpha\_m) into a computed diagnostic
* adding more detailed CRA metadata/audit schema
* adding more tests to Section 15

**Breaking edits (force re-check of the whole module):**

* changing the set of allowed cone templates
* redefining what counts as “instrument readout”
* changing PF/Born placement (anything other than ties-only)
* redefining the boundary as felt/anatomical instead of stabilization cut

**18.4 Packaging guidance**

This section tells you exactly what to lift where (book vs DP vs internal record) so you don’t create avoidable vulnerability.

**18.4.1 What is DP-safe (minimal subset)**

If you include any of this in a defensive publication, the safest subset is:

* CE2‑G as a CRA cone grammar proposal
* modalities as submanifests (representation/gating profiles)
* instruments as re-encoding (+3 only via +1 readouts)
* auditability discipline (support signatures + gate logs)

Keep the measurement linkage as “structural correspondence” (not “full derivation”).

**18.4.2 What belongs primarily in the book**

* the Chapter 18 narrative (two faces, spectrum, oneness/love framing)
* Appendix E mapping (so readers see how narrative maps to engine language)
* the “environment-as-representation” explanation in accessible prose

**18.4.3 What belongs primarily in your internal technical archive**

* the full CE2‑G formalism + CRA template schema
* the full audit schema
* the toy verification plan (Section 15)
* the V1 operator face (Section 10 proxy)
* the χ/ParentGate integration details (Section 13)

This separation keeps the DP crisp and keeps the book readable while preserving technical rigor in your archive.

**18.5 “One paragraph” reusable summary**

This is the paragraph you can paste into other documents without dragging the entire module with it:

In the AR/V2 framing, context levels are feasibility contracts (manifests) governing what can be committed and stabilized. For the human hinge centered at 0, we propose an effective two-hop admissibility/separability horizon (CE2) encoded as a CRA cone grammar: (-2\to-1\to0), (-1\to0\to+1), and (0\to+1\to+2). This yields an experience geometry in which inward micro-structure can modulate the present without automatically objectifying as public +1 tokens, while the “environment” is the stabilized +1 representational surface coherent across centers. Qualitative channels are modeled as 0-band modal submanifests (not sensors), spanning a qualia–informean spectrum via symbolization/stabilization profiles. Apparent access to +3 occurs only instrumentally: +1-stable structures re-encode far-context constraints into +1 readouts that 0 commits through the normal seam. Measurement-like randomness appears only when feasibility and acceptance leave a true tie, invoking PF/Born as ties-only selection.

**18.6 Final “maintenance checklist”**

Whenever you revise the module, do this quick pass:

1. Does CE2 still live in CRA as a grammar (and are templates listed explicitly)?
2. Does any sentence accidentally imply “signals in” as primitive ontology?
3. Does “boundary” remain public-token cut (not felt skin edge)?
4. Is instrument mediation still “+3 only via +1 readouts,” with no-skip factorization?
5. Does PF/Born remain ties-only?
6. If you edited narrative language (Chapter 18), did you update Appendix E mapping?

If all six are “yes,” the module remains stable.

**18.7 Closing note**

This record now contains everything needed to treat the experience-horizons insight as a **stable, auditable extension** of your existing framework—without turning it into a fragile metaphysical add-on. The only “next work” required to elevate it further is optional: implementing the toy verification plan (Section 15) so the module has logged examples demonstrating that the CRA constraints, the public-token boundary cut, and the instrument mediation discipline behave exactly as stated.

**Appendix E. Chapter 18 Terminology ↔ Engine Terminology Map**

This appendix records the direct correspondence between the narrative language in Chapter 18 (“two faces,” qualia spectrum, oneness, love, etc.) and the operational language used in this record (manifests, cones, modalities, stabilization, acceptance).

The intent is not to reduce Chapter 18 to mechanics, but to ensure the **bridge is explicit** so later writing stays consistent.

**E.1 Two faces of reality**

* **Finite face (contrast, separation, objects, edges, language, “me here / world there”)**  
  ↔ **Outward tokenization / +1 representation**: CS-stable features in and meaning-rich committed tokens at 0 whose stability is driven by strong Struct/ParentGate constraints (high ).
* **Infinite face (non-separation, presence, undivided being, “I am” beneath content)**  
  ↔ **Qualia-dominant channel at 0**: low contrast tokenization, high field-like continuity, and greater tolerance of ambiguity/ties at the seam (low ). This is not “less real”; it is a different stabilization mode of the same present-act architecture.

**E.2 Spectrum of consciousness (Chapter 18) ↔ Modal submanifests (this record)**

* **Vision / thought / language (sharp, contrast-heavy)**  
  ↔ (and/or conceptual submodes) implemented as submanifests with:
  + richer ,
  + stronger (object stability, spatial coherence),
  + strong outward coupling templates ,
  + higher (informean-heavy).
* **Emotions / atmosphere / mood (softer boundaries, pervasive quality)**  
  ↔ interface or mid-band modalities whose symbolization is structured but less object-like:
  + medium ,
  + different smoothing/coherence profiles,
  + often dominated by interface cone constraints ,
  + intermediate .
* **Deep body feeling / subtle presence / “I am” (global, diffuse, non-partitioned)**  
  ↔ and/or a minimal “presence” mode:
  + direct cone template ,
  + low contrast tokenization,
  + low ,
  + higher field-like continuity (does not carve sharp inside/outside edges).

**E.3 “Feeling is seamless” ↔ Stabilization boundary (important compatibility note)**

Chapter 18 emphasizes that raw feeling does not cleanly locate a boundary between inside and outside.

This record’s “body boundary” claim is compatible because it is **not** a claim about a sharp felt edge. It is a claim about **public objectification**:

* The boundary is the point where distinctions become +1-stable, shareable tokens (public “world objects”) versus remaining private inward modulation of the 0 act.
* So “seamlessness in feeling” and “boundary in world tokenization” can both be true.

**E.4 Oneness / non-separation ↔ Dominance shift in submanifests**

Chapter 18 describes “oneness” experiences as shifts toward the infinite face.

In engine terms, the disciplined mapping is:

* A shift in which submanifest dominates commitment:
  + reduced priority of contrast-carving Struct predicates,
  + increased dominance of low-contrast, field-like modalities,
  + a reduction in the centrality of object-token stabilization as “what’s real.”

This does not mean the +1 world disappears; it means the center’s committed content becomes less dominated by +1 object carving and more dominated by boundary/presence.

**E.5 Love / compassion ↔ Recognition of shared center structure (record-safe phrasing)**

Chapter 18 frames love as the “feeling-tone of non-separation recognized.”

In engine terms (and staying within the non-overclaim discipline):

* “Love/compassion” corresponds to a mode where the center’s committed valuation/acceptance priorities treat other centers’ stabilization as continuous with self-relevant stabilization (i.e., reduced self/other partition salience in the internal representational regime).
* This is a statement about **how the center’s acceptance and valuation overlays behave**, not a claim about a new physical force.

(If later you formalize ethics/acceptance vectors, this is where it would connect.)

**Appendix F. Implementation Schemas and Templates**

This appendix gives “copy/paste‑ready” **schemas and templates** you can reuse whenever you (or future‑you) want to implement, audit, or excerpt the Experience‑Horizons (EH) module without re-deriving definitions. Nothing here adds new claims; it operationalizes what Sections 11, 15, 16, and 17 already established.

**F.1 CRA cone grammar schema**

This is the canonical CE2‑G implementation object: the **allowed cone templates**, the **forbidden patterns**, and the **instrument mediation exception** (which is not an exception to CE2, but a rule about how far-context influence must appear as +1 readouts).

**F.1.1 Cone template catalog**

Use a small catalog keyed by IDs:

CRA\_ConeTemplates:

inner:

path: [-2, -1, 0]

description: "Private inward modulation route"

interface:

path: [-1, 0, +1]

description: "Boundary seam route (inward↔outward interface)"

outer:

path: [0, +1, +2]

description: "World/meaning stabilization route (outward container)"

**F.1.2 CRA admissibility rules (CE2‑G)**

CRA\_Rules:

mode: "CE2-G\_template\_grammar"

# Direct phenomenological support must be expressible in terms of these templates.

allowed\_direct\_templates: ["inner", "interface", "outer"]

# No-skip: support edges must be adjacent.

require\_adjacent\_edges: true

# Center mediation: any negative↔positive crossing must include 0.

require\_center\_mediation\_for\_sign\_crossing: true

# Optional: forbid direct support that references bands beyond Ext2(0) as direct sources.

# (Keep as "diagnostic gate" if you want a belt-and-suspenders check.)

enforce\_direct\_source\_horizon:

enabled: true

allowed\_direct\_bands: [-2, -1, 0, +1, +2]

**F.1.3 Instrument mediation rule (+3 only via +1 readouts)**

InstrumentMediation:

enabled: true

# Which far bands are allowed to influence the 0-hinge only via instrument readouts:

allowed\_far\_bands: [+3]

# A far-band may NEVER appear as a direct support band for a 0-centered commit:

forbid\_far\_band\_as\_direct\_source: true

# Required representation form: must appear as +1 tokens of a tagged type.

required\_readout\_band: +1

required\_readout\_token\_tag: "instrument\_readout"

# Optional explicit relay factorization requirement (documented discipline):

require\_no\_skip\_factorization: true

factorization\_forms:

- "I\_(+3->+1) = I\_(+2->+1) ∘ I\_(+3->+2)"

**F.1.4 Forbidden patterns list**

CRA\_ForbiddenPatterns:

- name: "direct\_-2\_to\_+1"

description: "No direct -2→+1 objectification support"

forbidden\_edge\_or\_jump: [-2, +1]

- name: "direct\_0\_to\_+2\_skip"

description: "No 0→+2 support without +1 mediation"

forbidden\_edge\_or\_jump: [0, +2]

- name: "direct\_0\_to\_+3"

description: "No direct 0→+3 support (instrument mediation required)"

forbidden\_edge\_or\_jump: [0, +3]

**F.2 Candidate support signature schema**

To make CRA auditable, each candidate world/action must carry a lightweight **support signature** describing which templates and sources were used to justify the candidate’s tokens.

This prevents “CRA as vibes.”

**F.2.1 Minimal required fields**

CandidateSupportSignature:

candidate\_id: "<string>"

# Cone templates used as direct phenomenological support for this candidate:

support\_templates: ["inner" | "interface" | "outer" | ...]

# Bands referenced directly (should be subset of Ext2(0) unless instrument-mediated):

direct\_support\_bands: [-2, -1, 0, +1, +2]

# Adjacent edges actually used (optional but great for debugging):

support\_edges:

- [-2, -1]

- [-1, 0]

- [0, +1]

- [+1, +2]

# Instrumentation (only if used):

instrument\_readouts:

- token\_id: "<string>"

band: +1

tag: "instrument\_readout"

instrument\_id: "<string>"

mediated\_far\_band: +3

**F.2.2 CRA check procedure (conceptual)**

Given the signature:

1. Verify support\_templates ⊆ allowed\_direct\_templates.
2. Verify all edges in support\_edges are adjacent if require\_adjacent\_edges.
3. Verify any sign-crossing path includes 0 if require\_center\_mediation\_for\_sign\_crossing.
4. Verify direct\_support\_bands ⊆ Ext2(0) if enforce\_direct\_source\_horizon.enabled.
5. Verify no far band appears in direct support; if far influence exists, verify it appears only in instrument\_readouts with correct tag/band.

**F.3 Audit record schema**

This is the “per tick” audit record that turns the module into a reproducible mechanism rather than a narrative.

**F.3.1 Minimal audit record**

AuditRecord:

tick: <int>

selected\_candidate\_id: "<string>"

# Modalities: which submanifests were active and what tokens were committed

modalities:

- modality\_id: "intero" | "interface" | "world" | ...

x0\_token: "<Xi0 token>"

hinge\_match: true | false

tie\_set\_size: <int> # optional per modality if computed

# Hinge equality summary

hinge\_equality:

passed: true | false

# optional: per modality components

# Feasibility gates

gates:

Theta0: { passed: true | false }

kappa0: { passed: true | false }

Struct0: { passed: true | false, reason: "<predicate id>" }

ParentGate0: { passed: true | false, reason: "<predicate id>" }

CRA0:

passed: true | false

reason: "<violation id or 'ok'>"

# Acceptance + tie-break

acceptance:

survivor\_set\_size: <int>

deterministic\_commit: true | false

pf\_born\_invoked: true | false

pf\_born\_outcome\_index: <int|null> # only if invoked

# Support signature for the winning candidate (and optionally top-N losers)

support\_signature:

candidate\_id: "<string>"

support\_templates: ["inner", "interface", "outer"]

direct\_support\_bands: [-2, -1, 0, +1, +2]

instrument\_readouts: [ ... ]

# Optional: χ (if used in the run)

chi:

value: <float|null>

**F.3.2 Canonical audit invariants (must hold)**

* If acceptance.survivor\_set\_size == 1 then pf\_born\_invoked == false.
* If pf\_born\_invoked == true then survivor\_set\_size > 1.
* If instrument\_readouts includes mediated +3, then direct\_support\_bands must **not** include +3.
* CRA violations must be logged with a **specific reason ID**, not “failed”.

**F.4 Minimal toy-manifest configuration template**

This is a simple template you can adapt for Toy‑5 or Toy‑6 verification (Section 15).

**F.4.1 Band set and alphabets**

ToyEngineConfig:

bands: [-2, -1, 0, +1, +2, +3] # drop +3 for Toy-5

alphabets:

Xi\_-2: ["a0","a1","a2"]

Xi\_-1: ["b0","b1","b2"]

Xi\_0:

intero: ["i0","i1"]

interface: ["u0","u1","u2"]

world: ["w0","w1","w2","w3"]

Xi\_+1:

base: ["p0","p1","p2"]

instrument\_readouts: ["r0","r1","r2"]

Xi\_+2: ["c0","c1"]

Xi\_+3: ["d0","d1"]

**F.4.2 Hinge maps (conceptual placeholders)**

hinge\_maps:

# Many-to-one mappings are allowed and often desirable to create underdetermination/ties

f0:

intero: "map\_world\_state\_to\_intero\_token"

interface: "map\_world\_state\_to\_interface\_token"

world: "map\_world\_state\_to\_world\_token"

g0:

intero: "map\_inward\_record\_to\_intero\_token"

interface: "map\_inward\_record\_to\_interface\_token"

world: "map\_inward\_record\_to\_world\_token"

**F.4.3 Gates**

gates:

Theta0:

enabled: true

value\_seconds: 0.1 # can be symbolic in toy

kappa0:

enabled: false

Struct0:

enabled: true

predicates:

- id: "world\_object\_stability"

applies\_to\_modality: "world"

- id: "interface\_coherence"

applies\_to\_modality: "interface"

- id: "intero\_continuity"

applies\_to\_modality: "intero"

ParentGate\_+1:

enabled: true

uses\_chi: true

chi\_value: 1.0

feasibility\_rule: "C\_plus1(state;chi) <= epsilon"

epsilon: 0.5

CRA0:

use\_cone\_grammar: true

use\_instrument\_mediation\_rule: true

**F.4.4 Acceptance and PF/Born**

acceptance:

Accept0:

type: "ratiolex"

# specify lexicographic residual components if you want

residual\_components:

- "CRA\_violation"

- "ParentGate\_cost"

- "Struct\_cost"

- "hinge\_mismatch"

ties\_allowed: true

PF\_Born:

enabled: true

mode: "ties\_only"

weights: "uniform" # placeholder; later can be calibrated

**F.5 DP‑safe excerpt templates**

These are drop-in paragraphs you can reuse in a DP or technical note without exposing the most critique-sensitive parts.

**F.5.1 CE2 and cones (DP-safe)**

For the human hinge centered at 0, we propose an effective two-hop admissibility/separability horizon (CE2) implemented as a CRA template grammar over three canonical two-hop seam paths: (-2\to-1\to0), (-1\to0\to+1), and (0\to+1\to+2). These templates define the direct phenomenological coupling routes under which 0-band commitments are admissible. This is an admissibility/representability constraint, not a claim about physical propagation range.

**F.5.2 Boundary cut (DP-safe, Chapter 18 consistent)**

The “body boundary” in this framing is not a sharp felt edge in raw interoceptive experience. It is the stabilization cut between private inward modulation of the 0-band commit and public +1 objectification (CS-stable outward tokens). Raw feeling can remain seamless while public object-token boundaries still arise through outward stabilization constraints.

**F.5.3 Instruments (+3) (DP-safe)**

Apparent access to far context (e.g., +3) is modeled as instrument mediation: +1-stable structures re-encode far-context constraints into +1-readout tokens, which 0 then commits via the normal 0↔+1 seam. Far bands do not appear as direct sources at 0; they appear only via tagged +1 instrument readouts.

**F.5.4 Ties-only PF/Born (DP-safe)**

Randomness is not applied as a general dynamic rule. Commit selection is deterministic under hinge equality, feasibility gates, and ratiolex acceptance unless a genuine structural tie remains among minimal survivors. Only in the tie case is PF/Born invoked as a ties-only selection rule.

**F.6 Quick “paste checklist” for future edits**

Before you paste these schemas into any document, verify you haven’t drifted on the canonical invariants:

1. CE2 is expressed as a **CRA cone template grammar** (or explicitly replaced with a named alternative).
2. “Boundary” is defined as **public tokenization cut**, not literal anatomy.
3. +3 appears only via **instrument-tagged +1 readouts**, never as a direct 0 source.
4. PF/Born is **ties-only**.

If all four remain true, the appendix templates remain compatible with the rest of the record.

**Appendix G. Worked Scenarios and Example Audit Logs**

This appendix gives **concrete worked examples** showing how the Experience‑Horizons (EH) module behaves in practice under the toy‑engine framing from Section 15 and the schema templates in Appendix F.

The aim is not realism; it is **mechanical clarity**:

* how CE2‑G (CRA cone grammar) blocks forbidden couplings,
* how “body boundary” shows up as a **public tokenization cut**,
* how instrument mediation implements “apparent +3 access” without no‑skip violations, and
* how ties-only PF/Born appears **only** when a genuine tie survives acceptance.

**Small note:** some earlier uploads in this chat expired on my side, but that does not affect these worked examples because they’re derived from the canonical module definitions in this record. If you ever want me to align these examples to exact variables/notation from a specific document, you can re-upload that doc.

**G.1 Common toy setup used in all examples**

We will use a Toy‑6 band set:

[  
{-2,-1,0,+1,+2,+3}  
]

and we will assume the canonical cone templates (CE2‑G):

* inner: ([-2,-1,0])
* interface: ([-1,0,+1])
* outer: ([0,+1,+2])

We treat +3 as **not directly admissible** at 0, except via instrument readouts tagged as instrument\_readout at +1 (Section 8 / Appendix F).

**G.1.1 “World record” placeholder structure**

A candidate world record (w) is a tuple:

[  
w=(w\_{-2},w\_{-1},w\_0,w\_{+1},w\_{+2},w\_{+3})  
]

You can think of each (w\_n) as a small categorical value.

**G.1.2 Modalities used**

We will reference two modalities at 0:

* (m\_{\text{intero}}): inner-cone dominated
* (m\_{\text{world}}): outer-cone dominated

and we’ll treat “public outcome” as the committed +1 token:

[  
y=f\_{+1}(W\_{k+1})  
]

**G.1.3 Acceptance discipline**

Acceptance is deterministic ratiolex ordering unless there is a tie among minimal survivors. If tie remains, PF/Born is invoked **ties-only**.

**G.2 Scenario 1: Private modulation without public leakage**

**Goal:** demonstrate the “body boundary” claim in its disciplined form:

* a change in −2 can alter the **private/intero** committed content at 0,
* without automatically altering the **public +1** tokenization.

This is exactly what Chapter 18 requires to remain consistent: the intero field can change without that change being “an object in the world.”

**G.2.1 Candidate set**

Let the candidate set (\mathcal{C}\_k) include two feasible candidates (w^{(A)}) and (w^{(B)}):

* (w^{(A)} = (\color{#000}{a0},;b0,;x,;\color{#000}{p1},;c0,;d0))
* (w^{(B)} = (\color{#000}{a1},;b0,;x,;\color{#000}{p1},;c0,;d0))

They differ only in (w\_{-2}): (a0) vs (a1).  
They are identical in the outward public region (w\_{+1}=p1), (w\_{+2}=c0).

Assume hinge equality can be satisfied for both candidates (they’re both in (\mathcal{C}\_k)).

**G.2.2 Support signatures (both are CRA‑legal)**

Both candidates rely only on the **inner cone** for the intero difference:

CandidateSupportSignature:

candidate\_id: "A"

support\_templates: ["inner"]

direct\_support\_bands: [-2, -1, 0]

support\_edges: [[-2,-1],[-1,0]]

instrument\_readouts: []

CandidateSupportSignature:

candidate\_id: "B"

support\_templates: ["inner"]

direct\_support\_bands: [-2, -1, 0]

support\_edges: [[-2,-1],[-1,0]]

instrument\_readouts: []

No +1 differences are being justified by −2; that would be forbidden.

**G.2.3 Expected committed tokens**

* Intero token differs:  
  [  
  x^{(\text{intero})}(w^{(A)}) \neq x^{(\text{intero})}(w^{(B)})  
  ]
* Public +1 outcome is the same:  
  [  
  y(w^{(A)}) = y(w^{(B)}) = p1.  
  ]

So, even if the engine selects (w^{(A)}) or (w^{(B)}), the public world token can remain identical while private modulation differs.

**G.2.4 Example audit record (if (w^{(A)}) wins)**

AuditRecord:

tick: 101

selected\_candidate\_id: "A"

modalities:

- modality\_id: "intero"

x0\_token: "i0" # produced by f0^(intero)(w^A)

hinge\_match: true

- modality\_id: "world"

x0\_token: "w2" # produced by f0^(world)(w^A)

hinge\_match: true

hinge\_equality:

passed: true

gates:

Theta0: { passed: true }

kappa0: { passed: true }

Struct0: { passed: true }

ParentGate0: { passed: true }

CRA0: { passed: true, reason: "ok" }

acceptance:

survivor\_set\_size: 1

deterministic\_commit: true

pf\_born\_invoked: false

support\_signature:

candidate\_id: "A"

support\_templates: ["inner"]

direct\_support\_bands: [-2,-1,0]

instrument\_readouts: []

**Why this matters:**  
This demonstrates the “boundary cut” correctly: −2 differences can live as private modulation without becoming public +1 objects.

**G.3 Scenario 2: Forbidden −2→+1 objectification attempt**

**Goal:** show CRA/CE2‑G actually prevents the most common drift error: treating −2 distinctions as directly becoming +1 public tokens.

**G.3.1 Construct a forbidden candidate**

Let (w^{(F)}) attempt to justify a +1 difference using −2:

* (w^{(F)} = (a1,;b0,;x,;\color{#000}{p2},;c0,;d0))

and it claims that the reason (p2) is present at +1 is “because −2 is a1.”

That is exactly the forbidden coupling shape: **direct −2→+1**.

**G.3.2 Support signature (explicitly forbidden)**

CandidateSupportSignature:

candidate\_id: "F"

support\_templates: ["inner"] # tries to hide it here

direct\_support\_bands: [-2, +1] # <-- smoking gun

support\_edges: [[-2, +1]] # <-- non-adjacent skip

instrument\_readouts: []

This fails for at least two reasons:

* non-adjacent edge skip violates no-skip, and
* “direct −2 support for +1 tokenization” violates the boundary cut.

**G.3.3 Example CRA rejection log**

AuditRecord:

tick: 102

selected\_candidate\_id: "A" # some other candidate wins; F rejected

gates:

CRA0:

passed: false

reason: "direct\_-2\_to\_+1" # canonical reason ID

rejected\_candidates:

- candidate\_id: "F"

reason: "direct\_-2\_to\_+1"

**Outcome:** candidate (F) cannot be committed under CE2‑G.  
This is the enforcement mechanism that keeps the record consistent with Chapter 18 and the “public tokenization cut.”

**G.4 Scenario 3: +3 access only through instrument-tagged +1 readouts**

**Goal:** demonstrate the instrument rule cleanly:

* +3 may influence the 0 hinge only as **+1 readout tokens**, never as direct +3 support.

**G.4.1 Direct +3 attempt (must fail)**

Candidate (w^{(D)}) tries to justify a world token at 0 by directly referencing +3:

CandidateSupportSignature:

candidate\_id: "D"

support\_templates: ["outer"]

direct\_support\_bands: [0, +3] # forbidden: +3 direct at 0

support\_edges: [[0,+3]] # forbidden skip

instrument\_readouts: []

CRA must reject:

* reason: "direct\_0\_to\_+3" (or equivalent).

**G.4.2 Instrument-mediated candidate (must pass if other gates pass)**

Now define an instrument (I) that produces a tagged readout token at +1:

* far constraint is at (w\_{+3}=d1)
* instrument readout is at +1: r2 with tag instrument\_readout

Candidate (w^{(I)}) includes the readout:

* (w^{(I)}=(a0,b0,x,; \color{#000}{r2},;c0,;d1))

Support signature:

CandidateSupportSignature:

candidate\_id: "I"

support\_templates: ["outer"]

direct\_support\_bands: [0, +1, +2] # note: no +3 here

support\_edges: [[0,+1],[+1,+2]]

instrument\_readouts:

- token\_id: "r2"

band: +1

tag: "instrument\_readout"

instrument\_id: "scope\_01"

mediated\_far\_band: +3

This passes because:

* direct support stays within Ext₂(0),
* the far-band appears only in instrument\_readouts.

**G.4.3 Example audit record (instrument-mediated act)**

AuditRecord:

tick: 103

selected\_candidate\_id: "I"

gates:

CRA0: { passed: true, reason: "ok" }

support\_signature:

candidate\_id: "I"

support\_templates: ["outer"]

direct\_support\_bands: [0,+1,+2]

instrument\_readouts:

- token\_id: "r2"

band: +1

tag: "instrument\_readout"

instrument\_id: "scope\_01"

mediated\_far\_band: +3

**Interpretation:**  
The 0 hinge does not see +3. It sees +1 readouts that encode +3 constraints. That is the entire point of the instrument mechanism.

**G.5 Scenario 4: Measurement-like tie and ties-only PF/Born**

**Goal:** demonstrate the commit-selection rule exactly as stated:

* deterministic unless a genuine tie remains among minimal survivors.

**G.5.1 Construct a tie set**

Let two candidates be identical on all gates and hinge constraints, but differ on a +1 pointer token (e.g., two distinct but equally feasible outcomes):

* (w^{(1)}=(a0,b0,x,;p1,c0,d0))
* (w^{(2)}=(a0,b0,x,;p2,c0,d0))

Assume:

* both are hinge-consistent,
* both pass feasibility,
* and acceptance cannot break the tie (same minimal residual vector).

Then:

[  
\mathcal{S}\_k={w^{(1)},w^{(2)}},  
\quad |\mathcal{S}\_k|=2.  
]

**G.5.2 PF/Born invoked (ties-only)**

The audit record must show:

* survivor\_set\_size: 2
* pf\_born\_invoked: true

Example:

AuditRecord:

tick: 104

selected\_candidate\_id: "2" # PF chose outcome 2

acceptance:

survivor\_set\_size: 2

deterministic\_commit: false

pf\_born\_invoked: true

pf\_born\_outcome\_index: 2

support\_signature:

candidate\_id: "2"

support\_templates: ["interface"] # example: pointer readout at seam

direct\_support\_bands: [-1,0,+1]

instrument\_readouts: []

**G.5.3 Required invariant check**

This is the “never break this” invariant:

* if survivor\_set\_size == 1 then pf\_born\_invoked == false
* if pf\_born\_invoked == true then survivor\_set\_size > 1

This is what keeps the theory disciplined: PF/Born is not a generic stochastic dynamics.

**G.6 Optional: Turning logs into a computed (\alpha\_m) diagnostic**

This is not a new postulate; it’s a **recording convenience** that makes the Chapter 18 mapping measurable in toy runs.

Given logs across many ticks, define:

* (\mathrm{TieRate}(m)): fraction of ticks where modality (m) had a tie among its minimal survivors (or contributed to a global tie)
* (\mathrm{Entropy}(m)): entropy of token usage in (\Xi\_0^{(m)})
* (\mathrm{CSStability}(m)): (if multi-center) fraction of ticks where +1 outcome agrees across centers when outward conditions match

A simple normalized diagnostic (one of many possible) is:

[  
\widehat{\alpha}\_m

\mathrm{Norm}\Big(  
\mathrm{CSStability}(m) + \mathrm{Entropy}(m) - \mathrm{TieRate}(m)  
\Big)\in[0,1].  
]

Expected qualitative outcome:

* (m\_{\text{world}}) → higher (\widehat{\alpha}) (more structured, stable)
* (m\_{\text{intero}}) → lower (\widehat{\alpha}) (more field-like, less publicly objectified)

This gives you a concrete way to say “the spectrum appears in-engine” without importing new metaphysics.

**G.7 What these scenarios certify**

If you can reproduce versions of Scenarios 1–4 (even in an abstract toy engine), you have certified the key EH module claims at an operational level:

1. CE2‑G cone grammar is enforceable and blocks forbidden paths.
2. The “boundary” behaves as a **public tokenization cut**, consistent with seamless interoceptive phenomenology.
3. Instruments create apparent +3 access strictly through +1 readouts (no skip violations).
4. PF/Born is invoked only on genuine ties (ties-only rule holds).

That’s enough to justify using this module as a stable, trustworthy internal record—even before any large simulations.