THE ZERO PARADOX

ZP-G: Category Theory

Version 1.11 | May 2026

This document is self-contained within category theory, with one explicit import from ZP-C: the conditional Kolmogorov complexity K(x|n) and the coding theorem connecting it to Shannon entropy. That import is named and labelled; it replaces Bridge Axiom BA-G1 (Leinster categorical entropy characterization) with a native derivation. All other content from ZP-A, ZP-B, ZP-D, and ZP-E remains excluded from this document. Cross-framework connections are deferred to ZP-H.

Honest labelling is the governing discipline. Every claim is marked as Axiom, Definition, Derived, Import, Design Commitment, or Remark. Nothing slides between categories.

Illustrated Companion: A paired ZP-G Illustrated Companion provides concrete examples and visual intuitions for the results here. Examples are kept separate from the formal layers to distinguish illustrative material from proofs.

I. Categorical Primitives

Definitions D1 through D6 and results T1 through T5 are reproduced here for completeness and self-reference.

1.1 The Definition of a Category

Definition D1 — Category
Status: Definition — foundational
A category C consists of:
(i) Objects: A collection ob(C), written A, B, X, 0, ...
(ii) Morphisms: For each ordered pair (A, B), a collection hom(A, B) of morphisms, written $f: A \to B$.
(iii) Composition: $\circ$: $hom(B,C) \times hom(A,B) \to hom(A,C)$, written $g \circ f$.
(iv) Identity: For each A, a morphism $id_A: A \to A$.
Associativity: $h \circ (g \circ f) = (h \circ g) \circ f$.
Unit laws: $id_B \circ f = f = f \circ id_A$.

Definition D2 — Morphism Uniqueness Notation
Status: Definition

Definition D2 — Morphism Uniqueness Notation

A morphism f: A → B is unique if for any g, h: A → B, g = h. Written: ∃! f: A → B.

1.2 Initial and Terminal Objects

Definition D3 — Initial Object

Status: Definition — load-bearing

An object 0 ∈ ob(C) is initial if for every X ∈ ob(C), there exists a unique morphism ι_X: 0 → X.

Proposition T1 — Uniqueness of the Initial Object

Status: Derived — standard category theory [unchanged from v1.0]

If 0 and 0′ are both initial in C, ∃! isomorphism 0 ≅ 0′. The initial object is unique up to unique isomorphism.

Proof: ∃! f: 0 → 0′ and ∃! g: 0′ → 0. Initiality forces g ∘ f = id_0 and f ∘ g = $id_{0'}$. Therefore f is a unique isomorphism. ✓

Definition D4 — Terminal Object

Status: Definition — defined for exclusion

An object 1 ∈ ob(C) is terminal if for every X ∈ ob(C), ∃! morphism τ_X: X → 1. The Zero Paradox framework is not a zero object category (0 ≇ 1).

II. The Foundational Axioms of ZP-G

Axiom AX-G1 — Asymmetry Axiom

Status: Axiom — foundational structural commitment [unchanged from v1.0]

The category C possesses an initial object 0 and no terminal object.

Formally: ∃ 0 ∈ ob(C) satisfying D3. ¬∃ 1 ∈ ob(C) satisfying D4.

Correspondence: In ZP-A: join-semilattice without ⊤ and without ∧. In ZP-B: Q_2 has no element to which all paths converge. The present axiom is the categorical generalization.

Axiom AX-G2 — Source Asymmetry

Status: Axiom — foundational [unchanged from v1.0]

For any non-initial object X ≠ 0: hom(X, 0) = ∅.

Motivation: The categorical expression of irreversibility. Morphisms ι_X: 0 → X exist for all X. Their reversal does not exist. AX-G2 is consistent with AX-G1 but not derivable from it.

Remark R-AX — On the Non-Triviality of AX-G1 and AX-G2

Status: Remark [new in v1.7]

AX-G1 and AX-G2 are satisfied by many categories — they are structural conditions, not exotic ones. What distinguishes ZP-G from a trivial application of initial-object asymmetry is that the initial object here is not an abstract placeholder: it is ⊥, the algebraically minimal element of ZP-A's lattice. This identification is not asserted in ZP-G; it is demonstrated in ZP-H via four concrete domain functors (F_A, F_B, F_C, F_D), each of which maps the natural number depth hierarchy into its domain category and preserves the initial object. The axioms are not postulated in isolation; they are shown to hold in each of the four domain categories that constitute the framework's subject matter. The categorical layer generalises a phenomenon that is independently grounded in four distinct mathematical domains.

III. Universal Constituent and Unreachability

Lemma T2 — Universal Constituent

Status: Derived — from D3 and AX-G1 [unchanged from v1.0]

For every $X \in ob(C)$, $\exists! \iota_X: 0 \to X$. The initial object 0 is the universal categorical source.

Proof: Immediate from D3 and AX-G1. ✓

Lemma T3 — Unreachability of 0

Status: Derived — from AX-G2 [unchanged from v1.0]

For any $X \neq 0$: $hom(X, 0) = \varnothing$. The initial object 0 is unreachable from any non-initial object.

Proof: Direct from AX-G2. ✓

Remark R1 — Structural Inversion — The Categorical Zero Paradox

Status: Remark [unchanged from v1.0]

T2 and T3 together constitute the categorical Zero Paradox. 0 reaches every object (T2); no non-initial object reaches 0 (T3). This is not a logical contradiction. It is a structural inversion: the unique universal source is the unique object with no incoming non-trivial morphisms.

Remark R2 — Categorical Expression of Self-Containment

Status: Remark — connecting note to ZP-A CC-2 [new in v1.3]

R1 frames the structural inversion of 0. This remark connects that structure to ZP-A CC-2: $\bot = \{\bot\}$. The null state is its own extension — a Quine atom. A self-containing object has no external interpreter by structure; it IS its own interpretation.

Remark R2 — Categorical Expression of Self-Containment

In categorical terms, this corresponds to two conditions together: (1) AX-G2: $hom(X, 0) = \varnothing$ for all $X \neq 0$ — no morphism can reach inside 0 from outside; and (2) T2: $\exists! \iota_X: 0 \to X$ for all X — 0 is structurally present in every object. Together these are the categorical image of undifferentiated self-containment: unreachable from without, yet constitutive of everything.

0 "points in all directions" (T2) because it is the undifferentiated ground from which all differentiation proceeds — not because it selects a direction. The uniqueness of each ι_X is not a choice among alternatives; it is the absence of internal structure that would allow differentiation among morphisms.

This remark bridges ZP-G to ZP-A CC-2. The formal correspondence between the categorical initial object structure and the set-theoretic Quine atom $\bot = \{\bot\}$ is made explicit in ZP-H.

IV. Monotone Structure and the Additive Ontology

Definition D5 — Morphism Chain

Status: Definition [unchanged from v1.0]

A morphism chain of length n from 0 is a sequence:

$0 = X_0 \to X_1 \to \ldots \to X_n$

where each $X_k \to X_{k+1}$ is a morphism in C.

Proposition T4 — Chains are Forward-Only

Status: Derived — from AX-G2 [unchanged from v1.0]

No morphism chain from 0 can return to 0 through non-initial objects.

Proof: A return morphism $X_n \to 0$ for $X_n \neq 0$ would contradict AX-G2. ✓

Definition D6 — Functor

Status: Definition — standard category theory [unchanged from v1.0]

A functor $F: C \to D$ consists of an object map $F: ob(C) \to ob(D)$ and a morphism map $F: hom_C(A,B) \to hom_D(F(A), F(B))$, preserving composition and identity.

Proposition T5 — Functors Preserve Initial Objects

Status: Derived — [OQ-G2 closed in ZP-H T-H1; unchanged from v1.0]

For each instantiation functor $F \in \{F_A, F_B, F_C, F_D\}$, F(0) is an initial object in the codomain. Verified by direct universal property check in ZP-H T-H1. ✓

V. The Kolmogorov Import from ZP-C

This section contains the single import from outside category theory that ZP-G requires. It is named, scoped, and labelled explicitly. It replaces BA-G1 (the Leinster Bridge Axiom) as the informational foundation of D7′.

Import I-KC — Conditional Kolmogorov Complexity from ZP-C
Status: Import — from ZP-C D1 and standard algorithmic information theory
What is imported: The conditional Kolmogorov complexity K(x|y), defined as the length of the shortest program p such that U(p, y) = x, where U is a fixed universal Turing machine:
$K(x\|y) = \min \{ \|p\| : U(p, y) = x \}$
Key property — The Coding Theorem: For any computable probability measure P, Kolmogorov complexity and Shannon entropy are related up to an additive constant c (depending only on U, not on x or y):
$K(x\|y) \approx -\log_2 P(x\|y) + O(c)$
The coding theorem is a standard result of algorithmic information theory (Li and Vitanyi, An Introduction to Kolmogorov Complexity and Its Applications). It is not derived within ZP-G. It is imported as a named result.
Scope of import: I-KC imports K(x|y) and the coding theorem only. No other content from ZP-C is imported into ZP-G. The Kolmogorov complexity machinery is already present in ZP-C D1 (incompressibility threshold P_0), so I-KC introduces no new external dependency into the overall Zero Paradox framework — it only introduces a dependency within ZP-G specifically.
Computability note: K(x|y) is not computable in general (it is approximable from above by standard results). This is not a defect for the present purposes: the framework requires that K(x|y) be well-defined, not that it be computable. The ontological claims of ZP-G do not depend on computability.
Status: This is an import, not a bridge axiom. A bridge axiom is a claim that cannot be derived from either side and must be assumed. K(x|y) is a defined mathematical object with a complete internal theory. I-KC is a decision to use that object within ZP-G, not an assumption about it.

VI. Categorical Information Theory [Rebuilt in v1.1]

6.1 Native Categorical Surprisal — Definition D7'

Version 1.0 defined categorical surprisal via the Shannon entropy functor H imported through BA-G1. Version 1.1 replaces this with conditional Kolmogorov complexity, imported via I-KC. The definition is native to the morphism structure of C.

Definition D7' — Native Categorical Surprisal
Status: Definition — from D5, I-KC [replaces D7 from v1.0]
Let f: A → B be a morphism in C. Represent A and B as binary strings x_A and x_B via any injective encoding consistent with the morphism structure of C. The categorical surprisal of f is:
$I(f) = K(x_B \mid x_A)$

Definition D7' — Native Categorical Surprisal

the conditional Kolmogorov complexity of the target given the source.

Interpretation: I(f) measures the minimum description length of B given knowledge of A. It is the irreducible informational content added by the transition f: A → B, independent of any probability distribution.

Well-definedness: $K(x_B|x_A)$ depends on the encoding of objects as strings. Different encodings yield values differing by at most an additive constant c (the coding theorem constant of I-KC). All claims in ZP-G are stated in terms of whether I(f) is finite, zero, or undefined — qualitative properties that are invariant under any additive constant. This invariance is a consequence of what ZP-G chooses to claim, not a general property of K-complexity (additive constants can matter for precise K-complexity comparisons in AIT).

Relationship to v1.0 D7: By the coding theorem (I-KC), $K(x_B|x_A) \approx -\log_2 P(x_B|x_A) + O(c)$ for any computable measure P. Therefore D7′ and D7 are equivalent up to O(c). The choice of D7′ over D7 is not a change in what is being measured; it is a change in how the measure is defined — natively versus via import.

6.2 Properties of the Native Surprisal

Lemma T6-a — Surprisal of the Identity Morphism is Zero

Status: Derived — from D7′ and I-KC

Claim: $I(id_A) = K(x_A|x_A) = 0$ up to the additive constant c.

Proof: The shortest program producing x_A given x_A is the empty program (output the input). Therefore $K(x_A|x_A) = 0$ up to c. The identity morphism adds no informational content. ✓

Lemma T6-b — Surprisal is Non-Negative for Forward Morphisms

Status: Derived — PDF-level (from D5, D7′, AX-G2); NOT Lean-verified — see Lean scope remark below

Claim: For any morphism f: A → B in a forward morphism chain from 0, $I(f) \geq 0$ up to c, with strict inequality when $A \neq B$.

Proof: $K(x_B|x_A) \geq 0$ by definition (program length is non-negative). Strict inequality holds when x_B cannot be computed from x_A by the empty program — i.e., when A and B are distinct objects encoding distinct states. In a forward morphism chain (D5), each step adds content by the additive ontology (AX-G2). ✓

Proposition T6-c — Surprisal Accumulates Along Chains

Status: Derived — PDF-level (from D5, T6-b, subadditivity of K); NOT Lean-verified — see Lean scope remark below

Claim: For a morphism chain $0 = X_0 \to X_1 \to \ldots \to X_n$, the total surprisal $\sum I(X_k \to X_{k+1}) \geq 0$, with monotone accumulation as n increases.

Proof: By subadditivity of Kolmogorov complexity: $K(x_n|x_0) \leq \sum K(x_{k+1}|x_k) + O(n \cdot c)$. Each term is ≥ 0 by T6-b. Adding distinct objects strictly increases the total. ✓

Remark — Lean Scope of T6-b and T6-c

Status: Scope note [strengthened v1.5] — T6-b and T6-c are NOT Lean-verified for their mathematical claims

T6-b and T6-c are not Lean-verified. The ZPG.lean proofs for these results compile without error, but they verify nothing about Kolmogorov complexity. The ZPSurprisal typeclass defines surp : hom → ℕ (surprisal as a natural number) and the proofs reduce to Nat.zero_le _, which states that any natural number is ≥ 0. This is trivially true by type for any ℕ-valued function, regardless of its mathematical content. A compiling Lean proof here does not mean the K-theoretic claims have been verified.

What the Lean proofs do NOT establish: (1) T6-b strict inequality — $K(x_B|x_A) > 0$ when $A \ncong B$ (distinct objects cannot have zero description length). (2) T6-c subadditivity — $K(x_n|x_0) \leq \sum K(x_{k+1}|x_k) + O(n \cdot c)$ (total surprisal along a chain). These are standard and correct results from algorithmic information theory, but they require a K-formalization that does not exist in Lean 4 / Mathlib.

What IS Lean-verified: T6-a (identity morphism has zero surprisal — from surp_id), T6 Part II (inward surprisal is undefined — from AX-G2 and the absence of morphisms to 0), and T7 insofar as it depends on Parts II, III, V, VI. T6 Part I (outward accumulation) and T7 Part IV rely on T6-b and T6-c and are therefore also PDF-level only.

Readers citing "the Lean-verified ZP-G framework" should note this boundary. The PDF-level arguments for T6-b and T6-c are mathematically valid — these are standard K-theoretic results (Li and Vitanyi). The gap is Lean scope, not mathematical correctness.

VII. The Informational Singularity of 0

This is the central theorem of the information-theoretic section. It is proved from D7′ and AX-G2 alone, with I-KC as the only external dependency.

Theorem T6 — Informational Singularity of 0

Status: Derived — from AX-G2, D7′, I-KC [rebuilt from v1.0, OQ-G1 closed]

Setup: Let 0 be the initial object of C (AX-G1). Let $I(f) = K(x_B|x_A)$ be the categorical surprisal (D7′). Let I-KC provide the Kolmogorov framework.

Part I — Outward surprisal accumulates (from T6-b, T6-c): For any morphism chain $0 = X_0 \to \ldots \to X_n$, $\sum I(X_k \to X_{k+1}) \geq 0$, with strict accumulation as n increases. ✓

Part II — Inward surprisal is undefined (from AX-G2): For any $X \neq 0$, $\text{hom}(X, 0) = \varnothing$ (AX-G2). Therefore D7′ cannot be applied to any morphism $f: X \to 0$ from outside 0 — no such morphism exists. $I(X \to 0)$ is undefined not because K diverges to infinity, but because there is no morphism to apply D7′ to. The undefined-domain condition is strictly stronger than divergence. ✓

Part III — The singularity: 0 is the unique object in C for which outward surprisal is defined and accumulates (Part I) while inward surprisal is undefined by absence of morphisms (Part II). This is the informational singularity: the initial object is informationally accessible in the outward direction and categorically inaccessible in the inward direction. The singularity is structural, not numerical. It does not require K to diverge — it requires only AX-G2 and D7′. ✓

Theorem T6 — Informational Singularity of 0

Comparison with ZP-C (to be reconciled in ZP-H T-H2): ZP-C establishes that the discrete surprisal DF diverges (numerically, to ∞) along infinite sequences approaching 0 in Q_2. T6 Part II establishes that $I(X \to 0)$ is undefined (domain-absent) for any $X \neq 0$ in C. These are compatible: undefined is stronger than infinite. ZP-H T-H2 proves they describe the same obstruction under the functor F_C.

Status: DERIVED. Depends on AX-G1, AX-G2, D3, D5, D7′, I-KC, T6-a, T6-b, T6-c. OQ-G1 is closed. BA-G1 is no longer a premise of T6. ✓

7.1 Compatibility with Shannon Entropy — BA-G1 Demoted to Remark

Remark R-BA — Compatibility of D7' with the Shannon Entropy Functor

Status: Remark — BA-G1 demoted from Bridge Axiom [v1.0] to Compatibility Remark [v1.1]

Version 1.0 introduced BA-G1 as a bridge axiom: it imported Leinster's categorical characterization of Shannon entropy (naturality, maximality, chain rule) to define the surprisal functor. BA-G1 was the only bridge axiom in ZP-G v1.0 and was the source of OQ-G1.

In v1.1, BA-G1 is no longer a premise of any theorem. It is retained here as a compatibility remark: the coding theorem (I-KC) guarantees that D7′ and the Shannon functor of BA-G1 are equivalent up to an additive constant c. Specifically:

$K(x_B|x_A) \approx H(F(B)) - H(F(A)) + O(c)$

for any computable probability measure P consistent with the morphism structure of C. This means all quantitative results that v1.0 derived from BA-G1 remain valid under D7′ — they differ only by the additive constant c, which does not affect any structural (finite/zero/undefined) claim.

BA-G1 is not false. It is not retired. It is now a derived compatibility result rather than an assumed premise. Any reader who finds the Shannon characterization more intuitive than Kolmogorov complexity may use BA-G1 as an equivalent formulation, knowing that I-KC and the coding theorem connect them.

VIII. The Categorical Zero Paradox — Formal Statement

Theorem T7 is the closing theorem of ZP-G. Part IV (informational singularity) rests on T6, which does not depend on BA-G1.

Theorem T7 — The Categorical Zero Paradox

Status: Derived — Closing Theorem [Part IV strengthened in v1.1]

Setup: Let C satisfy AX-G1 and AX-G2. Let I be the categorical surprisal from D7′. Let I-KC provide the Kolmogorov framework.

Part I — Universal Constituent (T2): $\forall X \in ob(C), \exists! \iota_X: 0 \to X$. The initial object 0 is the universal categorical source.

Part II — Unreachability (T3): $\forall X \neq 0, hom(X, 0) = \emptyset$. No non-initial object reaches 0.

Part III — Forward Irreversibility (T4): No morphism chain from 0 can return to 0 through non-initial objects.

Theorem T7 — The Categorical Zero Paradox
Part IV — Informational Singularity (T6, rebuilt): I(X → 0) is undefined for all X ≠ 0 (no such morphism exists, AX-G2). Outward surprisal from 0 accumulates along any morphism chain (T6-b, T6-c). 0 is an informational singularity: undefined inward, accumulating outward. This part no longer depends on BA-G1.
Part V — The Structural Inversion: Parts I and II together constitute the paradox. 0 is the unique universal source of all objects, and simultaneously the unique object unreachable from outside. The foundation is the one object the morphism machinery cannot return to.
Part VI — Resolution: The paradox is not a logical contradiction. It is a structural inversion. The correct tools for characterizing 0 are the universal property (D3) and D7′ applied to outward morphisms from 0. Under these tools, 0 is fully characterized. The paradox is the precise boundary between what can reach 0 and what cannot.
Status: DERIVED — Closing Theorem. Depends on D3, D5, D7′, AX-G1, AX-G2, I-KC, T2, T3, T4, T6. BA-G1 is not a dependency. ✓

IX. Open Items Register

Item	Status	Description
OQ-G1	Closed — D7′, T6	Native categorical derivation of surprisal without importing Shannon entropy. Closed by replacing D7 with D7′ (conditional Kolmogorov complexity K(B|A)). BA-G1 demoted from Bridge Axiom to Compatibility Remark R-BA. The single remaining external dependency is I-KC (Kolmogorov framework from ZP-C), which is an import, not a bridge axiom.
OQ-G2	Closed — ZP-H T-H1	Left adjoint verification for instantiation functors. Resolved in ZP-H v1.0 by direct universal property verification for each functor.
OQ-G3	Closed — ZP-H C-H1 through C-H4	Explicit construction of four instantiation functors. Resolved in ZP-H v1.0.
OQ-G4	Closed — ZP-H T-H2	Reconciliation of categorical and ZP-C singularity characterizations. Resolved in ZP-H v1.0. Undefined domain (ZP-G) and infinite accumulation (ZP-C) shown to be the same obstruction under the functor F_C.
I-KC	Import — named dependency	Conditional Kolmogorov complexity K(x|y) and the coding theorem, imported from ZP-C D1 and standard algorithmic information theory. This is an import, not a bridge axiom: K(x|y) is a fully defined mathematical object. ZP-G is no longer purely categorical; this dependency is explicitly stated.
AX-G1	Axiom — intentional	Asymmetry: initial object 0, no terminal object. Foundational structural commitment. Not a gap.
AX-G2	Axiom — intentional	Source asymmetry: hom(X, 0) = ∅ for X ≠ 0. Foundational irreversibility commitment. Not a gap.

Item	Status	Description
R-BA	Remark — BA-G1 demoted	Leinster Shannon entropy characterization is now a compatibility remark, not a bridge axiom premise. Derivable from D7′ and I-KC via the coding theorem. Not a gap.

X. Validation Status

Component	Status / Notes
D1: Category	Valid — Definition. Standard; foundational. Unchanged.
D2: Uniqueness notation	Valid — Definition. Unchanged.
D3: Initial object	Valid — Definition. Load-bearing for T2, T7. Unchanged.
D4: Terminal object	Valid — Definition. Defined for exclusion. AX-G1 prohibits it. Unchanged.
D5: Morphism chain	Valid — Definition. Native to C. Unchanged.
D6: Functor	Valid — Definition. Standard. Unchanged.
D7′: Native categorical surprisal	Valid — Definition [new in v1.1]. $K(x_B\|x_A)$ via I-KC. Replaces D7. Well-defined up to additive constant c. Structurally invariant.
I-KC: Kolmogorov import	Import — named [new in v1.1]. $K(x\|y)$ and coding theorem from ZP-C. Not a bridge axiom. Introduces explicit ZP-C dependency into ZP-G.
AX-G1: Asymmetry Axiom	Axiom — intentional. Unchanged.
AX-G2: Source Asymmetry	Axiom — intentional. Unchanged.
R-BA: BA-G1 compatibility remark	Remark — [BA-G1 demoted from Bridge Axiom in v1.0]. Shannon entropy functor compatible with D7′ up to O(c) by coding theorem. No longer a premise of any theorem.
Proposition T1: Uniqueness of initial object	Valid — Derived. Relabelled Proposition in v1.2 (subsidiary uniqueness result). Unchanged. ✓
Lemma T2: Universal constituent	Valid — Derived. Relabelled Lemma in v1.2 (stepping-stone result). Unchanged. ✓
Lemma T3: Unreachability of 0	Valid — Derived. Relabelled Lemma in v1.2 (stepping-stone result). Unchanged. ✓
R1: Structural inversion	Valid — Remark. Unchanged.
R2: Categorical expression of self-containment	Valid — Remark [new in v1.3]. Connects T2 + AX-G2 to ZP-A CC-2 ($\bot = \{\bot\}$). No new derivation; explanatory bridge note.
Proposition T4: Chains are forward-only	Valid — Derived. Relabelled Proposition in v1.2. Unchanged. ✓
Proposition T5: Functors preserve initial objects	Valid — Conditional on ZP-H T-H1 (closed). Relabelled Proposition in v1.2. Unchanged. ✓

Component	Status / Notes
Lemma T6-a: Identity surprisal is zero	Valid — Derived [new in v1.1]. Relabelled Lemma in v1.2. $K(x_A \| x_A) = 0$ up to c. ✓
Lemma T6-b: Non-negative outward surprisal	Valid (PDF-level) — Derived from D5, D7′, AX-G2. $K \geq 0$; strict inequality for distinct objects. NOT Lean-verified: Lean proof reduces to Nat.zero_le _ (trivially true for any ℕ-valued function; verifies nothing about K).
Proposition T6-c: Surprisal accumulates along chains	Valid (PDF-level) — Derived from D5, T6-b, subadditivity of K. NOT Lean-verified: Lean proof reduces to Nat.zero_le _. Subadditivity of K is a standard AIT result but requires K-formalization absent from Mathlib.
Theorem T6: Informational singularity	Valid — Derived [rebuilt in v1.1]. Does not depend on BA-G1. Part II: undefined domain (AX-G2) — fully Lean-verified. Parts I, III: accumulation via T6-b, T6-c — PDF-level only (T6-b/T6-c not Lean-verified).
Theorem T7: Categorical Zero Paradox	Valid — Derived [Part IV strengthened in v1.1]. All six parts derived. BA-G1 not a dependency. ✓
OQ-G1: Native surprisal derivation	Closed — D7′, T6. No bridge axiom remains as a theorem premise.