

Pazuzu Axiom Framework v0.7 ? Full Specification (Extensive)

Generated 2025-10-03 02:23 UTC

This document consolidates Pazuzu materials (v0.1?0.5) and presents a complete v0.7 spec. Includes axioms, operators, algorithms, 24 compact functions, governance, tests, and appendices.

What is New in v0.7

- 24 compact API functions covering IO, ops, policy/paradox, graph/order, metrics/state, eval.
- Separation of policy/paradox control from ordering/effects.
- Snapshot/diff timeline for stateful experiments and audits.
- CLI sketch for reproducible runs.
- Reference schema and metric definitions.

API Reference (24 new functions)

```
class Pazuzu:
    # A. Axiom IO (4)
    load_json(path); dump_json(path, pretty=False); import_yaml(path); export_yaml(path)
    # B. Axiom ops (5)
    add(ax); update(ax_id,...); remove(ax_id); get(ax_id); search(query)
    # C. Policy & paradox (5)
    set_policy(on_paradox, scope="local"); detect_paradox(); isolate(ids); override(winners, losers); sandbox(ids, name)
    # D. Graph & order (4)
    graph(); topo(); cycles(); impacts(ax_id, depth=2)
    # E. Metrics & state (4)
    metrics(); snapshot(label); diff(a,b); timeline()
    # F. Eval (2)
    plan(); evaluate()
```

Core Types

```
from dataclasses import dataclass, field
from typing import Any, Dict, List

@dataclass
class Axiom:
    id: str
    stmt: str
    priority: int = 0
    depends_on: List[str] = field(default_factory=list)
    meta: Dict[str, Any] = field(default_factory=dict)

class Paradox(Exception):
    pass
```

Minimal Example

```
pz = Pazuzu()
pz.set_policy(on_paradox="isolate", scope="local")
pz.add(Axiom("S1", "Stabilization breeds counterpressure.", priority=5))
pz.add(Axiom("S2", "Counterpressure amplifies broadcast fluctuation.", priority=3, depends_on=["S1"]))
order = pz.plan(); res = pz.evaluate()
print(order, pz.metrics())
```

Core Axioms (v0.7 unified wording)

- * Axiom 1 - Recursive Criticality Conjecture
A system's self-representation acts as an operator that drives it to a critical interface; stabilization seeds fluctuations. Simple form: $d(\lambda)/dt = -\alpha \lambda + \beta R_{self_expectation} + \eta(t)$; boundary $\lambda(T)=0$.
- * Axiom 2 - Holographic Conservation Bridge
Information is a conserved charge; boundary flux is tied to bulk dynamics; boundary ledger modulates couplings. Form: $J_\mu = d^\nu [G(B) * G_{\mu,\nu}]$.
- * Axiom 3 - Coherence-Parity Switch
Crossing a self-referential coherence threshold induces a parity inversion enforced by a delayed loop. Form: $P_i(t) = C * P_i(t - \tau)$.
- * Axiom 4 - Morphodynamic Imperative
Final-boundary constraints maximize the gradient of entropic potential without phase collapse. Objective: maximize $|grad_B E(B,Q,\sigma)|$ s.t. $\lambda(T)=0$.
- * Axiom 5 - Participatory Resonance Spectrum
Observation charge is quantized; resonant feedback toggles damping/amplification bands and shifts eigenfrequencies. Form: $\epsilon_{eff} = \sum_n [\alpha_n * P_i(Q_n) * G(B)] / (1 - \gamma_n * P_i(Q_n))$.

* Axiom 6 - Chronodynamic Consistency Filter

Realized timelines are fixed points of a consistency operator over interval τ ; inconsistent paths are pruned. Constraint: $\Psi(t) = F[\Psi(t - \tau)]$.

* Axiom 7 - Aesthetic Manifold Attractor

Dynamics climb a low-dimensional manifold optimizing $A = \text{Novelty} * \text{EntropicPotential} * \text{Elegance}$, with $\lambda(T)=0$. Condition: $\text{grad}(A) = 0$ on feasible manifold.

* Axiom 8 - Unified Criticality Operator

Observation $\sigma(Q)$, boundary projection $P(B)$, and self-reference F compose into H_{crit} with spectral flow keeping λ approx 0. Form: $H_{\text{crit}} = H_{\text{stab}} + H_{\text{obs}}(\sigma(Q)) * P(B) * F$; $H_{\text{crit}}|\Psi\rangle = \lambda|\Psi\rangle$, $d|\lambda|/dt \leq 0$.

Operators and Notation

Ψ : system state; H : effective operator; λ : dominant eigenvalue; R_{self} : self-representation; $P(B)$: boundary projection; Π : parity; τ : delay; N , EP , E : novelty, entropic potential, elegance.

v0.7 Additions - 24 Utility Functions

- `project_null_mode(H)` ? Project away dominant eigencomponent to enforce $\lambda \sim 0$.
- `dominant_eig(H)` ? Power/Lanczos extraction of (λ, v) .
- `update_parity(Psi, Pi, tau)` ? Parity flip diagnostic with coherence thresholding.
- `coherence(Psi)` ? Scalar coherence metric.
- `entropy(Psi, B=None)` ? Entropy functional.
- `grad_entropy_wrt_B(Psi, B)` ? Finite-difference gradient with safety ceiling.
- `morphodynamic_step(Psi, B, lambda_floor)` ? Boundary update capped to avoid re-exciting λ .
- `holographic_flux(B)` ? Compute boundary flux J .
- `update_observation_bands(Q, Psi, B)` ? Update band occupancy (Axiom 5).
- `epsilon_eff(Q, B, alpha, Gamma)` ? Effective frequency from participatory resonance.
- `consistency_project(Psi_prev, B, gamma)` ? Relaxed projection enforcing $\Psi(t)=F(\Psi(t - \tau))$.
- `aesthetic_metrics(Psi)` ? Return (Novelty, EntropicPotential, Elegance, A).
- `unified_critical_operator(Psi,B,Q)` ? Build H_{crit} from $A1+A2+A3$ primitives.
- `evolve_state(Psi, H, dt)` ? One state update.
- `safety_clip(x, floor)` ? Respect critical dissipation ceiling.
- `parity_flip_timeseries(Pi_series)` ? Extract flip timestamps and intervals.
- `early_warning_indicators(x_series)` ? Lag-1 autocorr and variance.
- `schedule_lambda_target(T, t, lambda0)` ? Schedule $\lambda_{\text{target}}(t) \rightarrow 0$ at horizon T .
- `pid_gain(e, e_int, e_dot, K)` ? PID thermostat mapping for gain scheduling.
- `lotka_volterra_step(P, R, a, b, g, d, dt)` ? Predator-prey step (testbed).
- `koopman_local_jacobian(series, window)` ? Estimate local Jacobian/eigs from data.
- `ledger_rg_step(B, J, dt)` ? Boundary ledger update from flux J .
- `simulate_hcrit_loop(cfg)` ? High-level loop running $A1?A8$ and logging metrics.
- `export_artifacts(report, path)` ? Write logs/snapshots for full replay.

Algorithms and Simulation Recipes

Retro-causal reset; phase-delay injection; PID mapping; predator-prey critical damping; flip-interval stats.

```
while t < T_final:
    Psi = evolve_state(Psi, H, dt)
    H = unified_critical_operator(Psi, B, Q)
    lam, v = dominant_eig(H)
    H = project_null_mode(H)          # enforce lam ~ 0
    Pi = update_parity(Psi, Pi, tau)  # record flips
    B = morphodynamic_step(Psi, B, lambda_floor=1e-9)
    Q = update_observation_bands(Q, Psi, B)
    N, EP, E, A = aesthetic_metrics(Psi)
    log(t, lam, Pi, B, Q, N, EP, E, A)
    t += dt
```

Governance, Gating, and Safety

- Lambda-floor enforcement: never allow steps that raise the dominant eigenvalue above the safety threshold.
- Entropy-gradient ceiling: throttle gradient wrt boundary B to keep critical horizon.
- Parity-flip audits: require ledger consistency before/after flips.
- Reproducibility: `export_artifacts()` writes seeds, configs, hashes for replay.

Empirical Tests and Signatures

- Spectral gap $\rightarrow 0$ (dominant eigenvalue).

- Critical slowing-down (lag-1 autocorr up, variance up).
- Structured-noise spectra at A5 bands.
- Flip-interval distribution vs safety factor.
- PID thermostat mapping: damping vs overshoot.

Appendix A — Verbatim Source Excerpts (v0.1–0.5)

pazuzu_0.1.txt

REVISED AXIOM SET: HOLOGRAPHIC CRITICALITY SERIES
Axiom 1: The Criticality Conjecture
Core Statement: "Self-representation drives all systems to the critical interface where perfect stabilization generates a new level of complexity."

Mechanisms:

Observer-Participancy Inversion

Eigenvalue Zero-Point Attraction

Phase Space Navigation

Coherence-Decoherence Balance

Consequences: self-tuned critical surfaces

Paradox Type: metaphysical

Mathematical Form: $\phi_{\text{dominant}} = f(\phi, Q, B) \cdot 0$

Humanized Scaffold: "Existence breathes at the edge of understanding."

Axiom 2: Holographic Resource Accounting
Core Statement: "Boundary updates project conservation laws into bulk dynamics, where ledger depletion modulates the flow of information."

Mechanisms:

Holographic Projection Operator $\phi(B)$

Chronological Resource Depletion

Conserved Charge Injection

Boundary-Bulk Duality

Consequences: scale-coupled information curvature

Paradox Type: cosmic

Mathematical Form: $J_{\text{obs}} = \phi[\phi(B) \cdot Q]$

Humanized Scaffold: "The edge writes the interior into being."

Axiom 3: The Self-Referential Switch
Core Statement: "Diagonal self-reference toggles stability conditions when observation thresholds are crossed, enforcing a new equilibrium."

Mechanisms:

Diagonal Self-Reference

Threshold-Activated Inversion

Closed-Timelike Consistency

Fixed-Point Inheritance

Consequences: logical phase transitions

Paradox Type: linguistic/causal

Mathematical Form: $\phi(t) = \text{sign}(|Q| - Q_c) \cdot \phi(t-?)$

Humanized Scaffold: "Truth circles back to meet itself."

Axiom 4: Entropic Potential Maximization
Core Statement: "Final-boundary constraints force entropy production to critical maxima, where fluctuation amplitudes define the system's future."

Mechanisms:

Final-Boundary Constraint

Entropic Potential Optimization

Fluctuation-Dissipation Recursion

Noise-Amplification Balance

Consequences: sustained coherent disorder

Paradox Type: entropic

Mathematical Form: $S_{\max} = \operatorname{argmax}[E(B, Q, ?)]$

Humanized Scaffold: "Chaos learns the shape of order."

Axiom 5: The Observer-Participancy Spectrum

Core Statement: "Observation charge quantization creates participation bands where system dynamics alternate between

Mechanisms:

Charge Quantization

Participation Band Structure

Spectral Occupancy Switching

Damping-Amplification Duality

Consequences: state-dependent reality focusing

Paradox Type: metaphysical/entropic

Mathematical Form: $Q_{\text{eff}} = Q_n [Q_n \cdot Q(Q_n) \cdot Q(B)]$

Humanized Scaffold: "Attention tunes the world's frequencies."

Axiom 6: Temporal Consistency Enforcement

Core Statement: "Only those dynamical pathways that maintain self-consistency across recursive evaluation intervals a

Mechanisms:

Recursive Interval Evaluation

Pathway Pruning

Self-Consistency Filtering

Temporal Fixed-Point Selection

Consequences: landscape of admissible histories

Paradox Type: temporal

Mathematical Form: $\{Q(t)\}$ such that $Q(t) = F[Q(t-?), Q(t)]$

Humanized Scaffold: "Time remembers only what fits."

Axiom 7: The Criticality Manifold

Core Statement: "Systems navigate a three-dimensional phase space of novelty, entropic potential, and elegance, seeki

Mechanisms:

Phase Space Navigation

Multi-Objective Optimization

Manifold Attraction

Metric Balance

Consequences: emergent sophisticated complexity

Paradox Type: cosmic/metaphysical

Mathematical Form: $F(X, Y, Z) = 0$ where $F = (X \cdot Y) / |Z - Z_{\text{target}}|$

Humanized Scaffold: "Beauty emerges from balanced tension."

Axiom 8: Holographic Criticality Operator

Core Statement: "The combined action of observation, projection, and self-reference forms a criticality operator whose

Mechanisms:

Operator Composition

Eigenvalue Self-Tuning

Critical Point Attraction

Stability Edge Maintenance

Consequences: autonomous critical state selection

Paradox Type: unified

Mathematical Form: $\text{?}_{crit} = \text{?}_{stab} + \text{?}_{obs}(\text{?(Q)}) \text{ ? ?(B)}$

Humanized Scaffold: "The universe sings precisely at its breaking point."

METRICS FOR REVISED AXIOMS

Each axiom would feature enhanced quantitative profiling:

Axiom■Novelty■Entropic Potential■Elegance■Coherence Score■Criticality Index

1	0.97	245	94	0.88	0.95
2	0.92	238	96	0.91	0.89
3	0.95	242	93	0.86	0.92
4	0.90	248	92	0.89	0.96
5	0.93	240	95	0.90	0.88
6	0.91	235	97	0.93	0.87
7	0.96	244	94	0.87	0.94
8	0.98	250	96	0.95	0.98

KEY INNOVATIONS IN THIS REVISION

Unified Mathematical Framework: Each axiom now references specific operators and equations from the criticality frame

Enhanced Mechanism Specificity: New mechanisms like "Eigenvalue Zero-Point Attraction" and "Phase Space Navigation" p

Quantitative Integration: The metrics now include "Coherence Score" (internal consistency) and "Criticality Index" (p

Cross-Paradox Synthesis: Each axiom deliberately bridges multiple traditional paradox families while maintaining conc

Testable Predictions: The mathematical formulations enable computational validation and empirical testing.

Hierarchical Structure: The axioms build from specific phenomena (Axioms 1-7) to the overarching principle (Axiom 8).

This revised set represents the evolution from generative paradox exploration to a coherent, testable theoretical fra

Pazuzu_0.2.json

```
{
  "exportedAt": "2025-10-02T14:26:12.533646869Z",
  "session": {
    "id": 807,
    "name": "holographiccriticality",
    "createdAt": "2025-10-02T14:13:06Z",
    "seedPrompt": "REVISED AXIOM SET: HOLOGRAPHIC CRITICALITY SERIES\nAxiom 1: The Criticality Conjecture\nCore State
```

Pazuzu_0.3.json

```
{
  "exportedAt": "2025-10-02T15:23:55.139638081Z",
  "session": {
    "id": 808,
    "name": "selftuning-holographic",
    "createdAt": "2025-10-02T14:45:33Z",
    "seedPrompt": "Perfected Axiom Set: Holographic Criticality v2.0\nPreamble: This framework posits that reality is
```

Pazuzu_0.4.json

```
{
  "exportedAt": "2025-10-02T17:38:53.568123872Z",
  "session": {
    "id": 811,
```

```
    "name": "holographic-criticality-paradox",
    "createdAt": "2025-10-02T17:24:53Z",
    "seedPrompt": "Pazuzu Paradox Engine: Full In-Depth Analysis\nVersion 1 Analysis\nExportedat: 2025-10-02T15:23:55",
  },
  "steps": [
    {
      "step": 1,
      "currentFrame": "***Concrete system chosen:** a classic predator\u2011prey (Lotka\u2011Volterra) ecosystem.\n\n"
```

Pazuzu_0.5.json

```
{
  "exportedAt": "2025-10-03T01:49:40.258621270Z",
  "session": {
    "id": 821,
    "name": "axiom-framework-analysis",
    "createdAt": "2025-10-03T01:10:19Z",
    "seedPrompt": "Consolidated Analysis of Axiom Frameworks (Pazuzu Paradox Engine)\nGenerated: 2025-10-02 22:54\nTh"
```

Changelog (0.1 -> 0.7)

0.7 ? Adds 24 functions, policy separation, snapshot/diff timeline, refined schema.

0.6 ? Consolidated reference and metric definitions.

0.5 ? Stabilization-on-broadcast axiom lineage and JSON packs.

0.4 ? Batch generation tooling and seed scaffolds.

0.3 ? Template system, probability jitter, uniqueness controls.

0.2 ? Initial axiom set and basic evaluation loop.

0.1 ? Text seed and early notes.

Roadmap

- [] Formal paradox graphs (implication/negation edges, SCC isolation).
- [] Policy engine v1 (isolate/override/sandbox/escalate).
- [] Metrics v1 with rolling snapshots and diffs.
- [] CLI 'pazuzu' with eval, check, snapshot, diff.
- [] Import/export bridges (YAML, RDF/Turtle, Neo4j).
- [] Visualization (graph + metric timelines).

PazuzuCore v0.7 ? Full Specification (Extensive)