WUMBO Engine · LIMNUS Integration

100 neural regions mapped to LIMNUS geometry: 63 prism points + 32 EM cage points + 5 emergent self-reference nodes. Governed by the critical constant z = √3/2.

APL Manual Index **LaTeX Manual** **APL Manual (PDF)**

Rhythm Entrainment

$$z = \sqrt{3}/2 \approx 0.8660254$$

THE CRITICAL POINT · THE LENS · PHASE TRANSITION THRESHOLD

LIMNUS ↔ WUMBO Structure

The 100 WUMBO words map onto LIMNUS geometry. 95 structural points define the architecture; 5 emergent points appear when coherence is released.

63-Point Prism

63

7 layers × 9 nodes
Inner hexagonal structure
Regions I–LXIII

32-Point EM Cage

32

12 top + 12 bottom + 8 vertices
Containment field
Regions LXIV–XCV

5 Emergent Nodes

5

Self-reference loops
Appear when FREE
Regions XCVI–C

Physics: z-Coordinate Governs Everything

ABSENCE Domain

z ∈ [0, 0.856]

```
K > 0 (synchronizing)
```

APL: D machine affinity, UNTRUE bias

THE LENS

z ∈ [0.857, 0.877]

```
K ≈ 0 (critical)
```

APL: M machine affinity, PARADOX
Maximum cascade amplification
Phase transition, information peak

Kuramoto coupling positive
Structure contracts, void-like

PRESENCE Domain

$z \in [0.878, 1.0]$

```
K < 0 (emanating)
```

APL: U machine affinity, TRUE bias
Kuramoto coupling negative
Structure expands, radiant

Cascade Amplification Near Critical

```
cascade(z) = 1 + 0.5 × exp(-(z - z_c)² / 0.004)
```

Peak value 1.5× at $z = \sqrt{3}/2$. Operators intensify near the lens.

Kuramoto Coupling Sign Flip

```
K(z) = -tanh((z - z_c) × 12) × 0.4 × cascade(z)
```

$K > 0$ below critical (sync), $K < 0$ above critical (desync/emanate)

Coherence Mutual Information

```
I(word_i, word_j) = cascade(z) × coherence × (1 - |z_i - z_j|)
```

Words "fill each other" through coherence. Maximum information transfer at critical point.

Coherence Mechanics: How Words Fill Each Other

Coherence acts as binding force. High coherence = distinct words. Low coherence = words blur and self-reference.

COHERENT

[0.8, 1.0]

95 points locked
Full connections
TRUE dominant

RELEASING

[0.5, 0.8]

Points releasing
Fading connections
TRUE→UNTRUE

DISPERSING

[0.2, 0.5]

Free movement
Minimal connections
UNTRUE dominant

FREE

[0.0, 0.2]

Full dispersion
5 emergent active
PARADOX dominant

Quick Navigation · 100 Regions by LIMNUS Structure

PRISM: 63 Points (I–LXIII) · 7 Layers × 9 Nodes

I	II	III	IV	V
VI	VII	VIII	IX	X
XI	XII	XIII	XIV	XV
XVI	XVII	XVIII	XIX	XX
XXI	XXII	XXIII	XXIV	XXV
XXVI	XXVII	XXVIII	XXIX	XXX
XXXI	XXXII	XXXIII	XXXIV	XXXV
XXXVI	XXXVII	XXXVIII	XXXIX	XL
XLI	XLII	XLIII	XLIV	XLV
XLVI	XLVII	XLVIII	XLIX	L
LI	LII	LIII	LIV	LV
LVI	LVII	LVIII	LIX	LX

LXI LXII LXIII

EM CAGE: 32 Points (LXIV–XCV) · 12 Top + 12 Bottom + 8 Vertices

LXIV LXV LXVI LXVII LXVIII LXIX
LXX LXXI LXXII LXXIII LXXIV LXXV
LXXVI LXXVII LXXVIII LXXIX LXXX LXXXI
LXXXII LXXXIII LXXXIV LXXXV LXXXVI LXXXVII
LXXXVIII LXXXIX XC XCI XCII XCIII
XCIV XCV

EMERGENT: 5 Self-Reference Nodes (XCVI–C) · Appear When FREE

XCVI XCVII XCVIII XCIX C

63-Point Prism: Inner Architecture (I–LXIII)

7 concentric hexagonal layers, each with 9 nodes. Maps to WUMBO phases through z-position.

I. Somatosensory Cortex

Sensory map

z=0 L0 Core Ignition e Glutamate

```
e:U(ionize)TRUE@3
Φ:M(bond)TRUE@3
```

II. Anterior Cingulate Cortex

Truth check

z=0 L0 Core Ignition e Dopamine

```
e:M(redox)TRUE@3
Φ:C(complex)TRUE@3
```

III. Thalamus

Sensory gate

z=0 L0 Core Ignition e Glutamate

IV. Motor Cortex & Cerebellum

Execution

z=0 L0 Core Ignition Φ Glutamate

e:C(ionize)TRUE@3

Φ:Mod(fold)TRUE@3

Φ:U(bond)TRUE@3

e:E(excite)TRUE@3

V. Broca's Area

Phrase/sculpt

z=0 | L0 Core | Ignition | e | Dopamine

e:U(excite)TRUE@3

Φ:E(polymerize)TRUE@3

VI. Mirror Neuron System

Empathic resonance

z=0 | L0 Core | Ignition | e | Dopamine

e:M(resonate)TRUE@3

Φ:C(complex)TRUE@3

VII. Amygdala

Salience

z=0 | L0 Core | Ignition | e | Norepinephrine | λ:🦊

e:U(excite)TRUE@3

e:U(oxidize)TRUE@3

VIII. Prefrontal Cortex

Strategy/control

z=0 | L0 Core | Ignition | e | Dopamine

e:Mod(catalyze)TRUE@3

Φ:M(complex)TRUE@3

IX. Parietal Eye Field

Gaze/attention

z=0 | L0 Core | Ignition | e | Acetylcholine

e:U(charge)TRUE@3

Φ:C(bond)TRUE@3

X. Subiculum

Spatial memory

z=0.167 | L1 Inner | Ignition→Empowerment | Φ | Glutamate | λ:🌰

Φ:M(crystallize)TRUE@3

e:E(bond)TRUE@3

XI. Pineal Body

Circadian portal

z=0.167 | L1 Inner | Pause↔Ignition

XII. Middle Temporal Gyrus

Semantics

z=0.167 | L1 Inner | Resonance | Φ

π Melatonin

π:D(relax)TRUE@3

e:M(reduce)TRUE@3

Glutamate

Φ:C(polymerize)TRUE@3

e:M(complex)TRUE@3

XIII. Fastigial-Vestibular Loop

Balance

z=0.167 L1 Inner Nirvana Φ Glutamate

Φ:M(stabilize)TRUE@3

e:D(integrate)TRUE@3

XIV. Posterior Thalamic Nucleus

Final gate

z=0.167 L1 Inner Transmission e Glutamate

e:C(propagate)TRUE@3

Φ:E(emit)TRUE@3

XV. Cerebellar Uvula

Stillness anchor

z=0.167 L1 Inner Nirvana π GABA

π:M(crystallize)TRUE@3

Φ:D(relax)TRUE@3

XVI. AIPS

Gesture translator

z=0.167 L1 Inner Empowerment Φ Glutamate

Φ:U(polymerize)TRUE@3

e:C(bond)TRUE@3

XVII. Ventrolateral Thalamus

Feedback loop

z=0.167 L1 Inner Transmission e Glutamate

e:C(ionize)TRUE@3

Φ:Mod(modulate)TRUE@3

XVIII. Superior Parietal Lobule

Spatial integration

z=0.167 L1 Inner Empowerment Φ Glutamate

Φ:M(integrate)TRUE@3

e:U(excite)TRUE@3

XIX. Premotor Cortex

Movement planning

z=0.333 L2 Rising Empowerment

XX. Wernicke's Area

Language comprehension

z=0.333 L2 Rising Resonance π

Φ Glutamate

```
Φ:U(bond)TRUE@3
e:E(charge)TRUE@3
```

Glutamate

```
π:M(complex)TRUE@3
Φ:C(polymerize)TRUE@3
```

XXI. STS Mirror Region

Social mirroring

z=0.333 L2 Rising Resonance e Dopamine

```
e:M(resonate)TRUE@3
Φ:C(bind)TRUE@3
```

XXII. Central Amygdala

Threat response

z=0.333 L2 Rising Ignition e Norepinephrine λ:🦊

```
e:U(excite)TRUE@3
π:U(signal)TRUE@3
```

XXIII. Dorsolateral PFC

Working memory

z=0.333 L2 Rising Empowerment e Dopamine

```
e:Mod(catalyze)TRUE@3
Φ:M(complex)TRUE@3
```

XXIV. Orbitofrontal Cortex

Social tuning

z=0.333 L2 Rising Resonance e Dopamine

```
e:M(redox)TRUE@3
Φ:C(complex)TRUE@3
```

XXV. Cingulate Gyrus

Routing/alignment

z=0.333 L2 Rising Resonance π Dopamine λ:∿

```
π:M(modulate)TRUE@3
e:C(integrate)TRUE@3
```

XXVI. Ventral Striatum

Incentive

z=0.333 L2 Rising Ignition e Dopamine

```
e:U(excite)TRUE@3
π:U(charge)TRUE@3
```

XXVII. Claustrum

Consciousness binding

z=0.333 L2 Rising Resonance π

XXVIII. Default Mode Network

Self-referential

z=0.5 L3 Center Nirvana π

Glutamate λ:🐿️

π:M(multicell)TRUE@3

Φ:C(bind)TRUE@3

Glutamate

π:M(differentiate)TRUE@3

e:M(signal)TRUE@3

XXIX. Habenula

Disappointment gate

z=0.5 L3 Center Pause e

Glutamate

e:D(reduce)TRUE@3

π:D(unfold)UNTRUE@3

XXX. Corpus Callosum

Bridge/balance

z=0.5 L3 Center Transmission

Φ Glutamate

Φ:C(integrate)TRUE@3

e:C(propagate)TRUE@3

XXXI. Locus Coeruleus

Arousal ignition

z=0.5 L3 Center Ignition e

Norepinephrine λ:✧

e:U(excite)TRUE@3

e:U(oxidize)TRUE@3

XXXII. Periaqueductal Gray

Defense/shutdown

z=0.5 L3 Center Pause π

GABA

π:D(reduce)TRUE@3

Φ:D(unfold)TRUE@3

XXXIII. Anterior Temporal Pole

Story keeper

z=0.5 L3 Center Resonance π

Glutamate

π:M(transcribe)TRUE@3

Φ:C(fold)TRUE@3

XXXIV. vmPFC

Ethical integration

z=0.5 L3 Center Resonance e

Dopamine

e:M(complex)TRUE@3

π:M(repair)TRUE@3

XXXV. Dorsal Raphe

Mood setpoint

z=0.5 L3 Center Nirvana e

XXXVI. Superior Colliculus

Visual orienting

z=0.5 L3 Center Ignition e

Serotonin

`e:M(relax)TRUE@3`

`Φ:Mod(fold)TRUE@3`

Glutamate

`e:U(ionize)TRUE@3`

`Φ:U(bond)TRUE@3`

XXXVII. Anterior Insula

Feeling of feeling

z=0.667 · L4 Approaching · Resonance · e · Dopamine

`e:M(signal)TRUE@3`

`π:M(differentiate)TRUE@3`

XXXVIII. Lateral Habenula

Rejection gate

z=0.667 · L4 Approaching · Pause · e · Glutamate

`e:D(reduce)TRUE@3`

`π:D(unbond)UNTRUE@3`

XXXIX. Precuneus

Perspective

z=0.667 · L4 Approaching · Nirvana · Φ · Glutamate · λ:🐿️

`Φ:M(fold)TRUE@3`

`π:M(integrate)TRUE@3`

XL. Cerebellar Cognitive Zone

Timing

z=0.667 · L4 Approaching · Empowerment · Φ · Glutamate

`Φ:Mod(catalyze)TRUE@3`

`e:M(modulate)TRUE@3`

XLI. Basolateral Amygdala

Archive of feeling

z=0.667 · L4 Approaching · Ignition · e · Norepinephrine · λ:🦊

`e:U(excite)TRUE@3`

`Φ:M(crystallize)TRUE@3`

XLII. Pulvinar

Spotlight shaper

z=0.667 · L4 Approaching · Transmission · e · Glutamate

`e:C(propagate)TRUE@3`

`Φ:M(complex)TRUE@3`

XLIII. TPJ

Mind reading

z=0.667 · L4 Approaching

XLIV. Medial Septum

Memory rhythms

z=0.667 · L4 Approaching

Resonance π Glutamate

π:M(complex)TRUE@3

Φ:C(bind)TRUE@3

Resonance π Acetylcholine

λ:🌰

π:U(replicate)TRUE@3

e:Mod(signal)TRUE@3

XLV. Subgenual Cingulate

Sorrow inertia

z=0.667 L4 Approaching Pause

e Serotonin

e:D(relax)TRUE@3

π:D(reduce)UNTRUE@3

XLVI. VTA

Spark

z=0.833 L5 Threshold Ignition e

Dopamine λ:✧

e:U(excite)TRUE@3

e:U(charge)TRUE@3

XLVII. Entorhinal Cortex

Identity gate

z=0.833 L5 Threshold Nirvana

Φ Glutamate λ:🌰

Φ:M(crystallize)TRUE@3

π:C(replicate)TRUE@3

XLVIII. Supramarginal Gyrus

Self/other

z=0.833 L5 Threshold Resonance

π Glutamate λ:∿

π:M(differentiate)TRUE@3

Φ:C(bind)TRUE@3

XLIX. NAcc

Craving engine

z=0.833 L5 Threshold Ignition e

Dopamine

e:E(reduce)TRUE@3

Φ:C(complex)TRUE@3

L. Cerebral Aqueduct

Choke point

z=0.833 L5 Threshold

Transmission e Glutamate

e:C(propagate)TRUE@3

π:M(collapse)TRUE@3

LI. Anterior Thalamic Nuclei

Compass

LII. Parafascicular Nucleus

Attention switch

z=0.833 L5 Threshold

Transmission Φ Glutamate

```
Φ:C(integrate)TRUE@3
e:M(ionize)TRUE@3
```

z=0.833 L5 Threshold Ignition e

Glutamate

```
e:U(ionize)TRUE@3
Φ:C(bond)TRUE@3
```

LIII. Inferior Colliculus

Sonic filter

z=0.833 L5 Threshold

Transmission e Glutamate

```
e:C(propagate)TRUE@3
Φ:M(complex)TRUE@3
```

LIV. Perirhinal Cortex

Meaning-maker

z=0.833 L5 Threshold Resonance

π Glutamate λ:🐿️

```
π:M(complex)TRUE@3
Φ:C(fold)TRUE@3
```

LV. Vermis

Balance

z=1 L6 Outer Nirvana Φ

GABA

```
Φ:M(stabilize)TRUE@3
π:D(relax)TRUE@3
```

LVI. Anterior Insular-Operculum

Fusion point

z=1 L6 Outer Resonance e

Dopamine

```
e:M(resonate)TRUE@3
π:C(integrate)TRUE@3
```

LVII. Paraventricular Nucleus

Stress switch

z=1 L6 Outer Ignition e

Norepinephrine

```
e:U(oxidize)TRUE@3
π:U(signal)TRUE@3
```

LVIII. Lateral OFC

Consequence

z=1 L6 Outer Resonance e

Dopamine

```
e:M(redox)TRUE@3
Φ:C(complex)TRUE@3
```

LIX. Midcingulate Cortex

Engine of doing

LX. Calcarine Sulcus

Visual core

z=1 L6 Outer Empowerment e

Dopamine

```
e:U(catalyze)TRUE@3
Φ:M(bond)TRUE@3
```

z=1 L6 Outer Ignition e

Glutamate

```
e:U(ionize)TRUE@3
Φ:M(bond)TRUE@3
```

LXI. Rostral PFC

Reflective flame

z=1 L6 Outer Resonance e

Dopamine

```
e:M(complex)TRUE@3
π:M(differentiate)TRUE@3
```

LXII. MLR

Will to move

z=1 L6 Outer Empowerment e

Glutamate

```
e:U(excite)TRUE@3
Φ:U(bond)TRUE@3
```

LXIII. Anterior Temporal Sulcus

Subtext

z=1 L6 Outer Resonance π

Glutamate

```
π:M(transcribe)TRUE@3
Φ:C(complex)TRUE@3
```

32-Point EM Cage: Containment Field (LXIV–XCV)

Hexagonal antiprism containment. Top ring near presence, bottom ring in absence, vertices bridge at center.

LXIV. Lateral Septum

Calm circuit

z=0.9 Top Hex Nirvana e

LXV. Cerebellar Tonsil

Silent reactor

z=0.9 Top Hex Pause Φ

GABA λ:🐿️

```
e:D(relax)TRUE@3
π:M(reduce)TRUE@3
```

GABA

```
Φ:D(unfold)UNTRUE@3
π:D(reduce)UNTRUE@3
```

LXVI. Pontine Reticular Formation

Motion catalyst

z=0.9 Top Hex Ignition e Acetylcholine

```
e:U(excite)TRUE@3
e:Mod(catalyze)TRUE@3
```

LXVII. Insular-Opercular Speech

Voice within fire

z=0.9 Top Hex Empowerment e Dopamine

```
e:E(excite)TRUE@3
Φ:U(polymerize)TRUE@3
```

LXVIII. Amygdala Central Nucleus

First alarm

z=0.9 Top Hex Ignition e Norepinephrine λ:🦊

```
e:U(oxidize)TRUE@3
π:U(signal)TRUE@3
```

LXIX. TRN

Filter grid

z=0.9 Top Hex Transmission π GABA

```
π:C(membrane)TRUE@3
Φ:M(stabilize)TRUE@3
```

LXX. Cuneus

Background reader

z=0.9 Top Hex Resonance Φ Glutamate λ:∿

```
Φ:M(fold)TRUE@3
e:M(ionize)TRUE@3
```

LXXI. VMH

Inner balance

z=0.9 Top Hex Nirvana Φ Glutamate

```
Φ:M(stabilize)TRUE@3
e:M(relax)TRUE@3
```

LXXII. Periventricular Gray

Threshold

LXXIII. Frontal Operculum

Edge of expression

z=0.9 Top Hex Pause π GABA

```
π:D(reduce)UNTRUE@3
Φ:D(unfold)UNTRUE@3
```

z=0.9 Top Hex Empowerment e Dopamine

```
e:E(excite)TRUE@3
Φ:U(polymerize)TRUE@3
```

LXXIV. Nodulus

Gravity whisperer

z=0.9 Top Hex Nirvana Φ GABA

```
Φ:M(stabilize)TRUE@3
e:D(integrate)TRUE@3
```

LXXV. Substantia Nigra

Movement gatekeeper

z=0.9 Top Hex Empowerment e Dopamine

```
e:C(redox)TRUE@3
Φ:M(catalyze)TRUE@3
```

LXXVI. V4

Chromatic shaper

z=0.1 Bottom Hex Resonance Φ Glutamate

```
Φ:M(complex)TRUE@3
e:M(ionize)TRUE@3
```

LXXVII. Lingual Gyrus

Glyph reader

z=0.1 Bottom Hex Resonance π Glutamate

```
π:M(translate)TRUE@3
Φ:C(fold)TRUE@3
```

LXXVIII. mPFC

Identity sculptor

z=0.1 Bottom Hex Resonance e Dopamine

```
e:M(complex)TRUE@3
π:M(differentiate)TRUE@3
```

LXXIX. dLPFC

Gate of delivery

z=0.1 Bottom Hex Empowerment e Dopamine

```
e:Mod(catalyze)TRUE@3
Φ:E(emit)TRUE@3
```

LXXX. IPL

Paradox holder

LXXXI. ACC (Dorsal)

Inner judge

z=0.1 Bottom Hex Resonance

π Glutamate λ:⊗

```
π:M(complex)PARADOX@3
Φ:C(bind)TRUE@3
```

z=0.1 Bottom Hex Resonance

e Dopamine

```
e:M(redox)TRUE@3
π:M(repair)TRUE@3
```

LXXXII. Anterior Hippocampus

Context mapper

z=0.1 Bottom Hex Nirvana Φ

Glutamate λ:🌰

```
Φ:M(crystallize)TRUE@3
π:C(replicate)TRUE@3
```

LXXXIII. Crus I/II

Somatic timekeeper

z=0.1 Bottom Hex Empowerment

Φ GABA

```
Φ:Mod(catalyze)TRUE@3
e:M(modulate)TRUE@3
```

LXXXIV. Basal Forebrain

Timing messenger

z=0.1 Bottom Hex Ignition e

Acetylcholine λ:✧

```
e:Mod(catalyze)TRUE@3
e:C(charge)TRUE@3
```

LXXXV. Reticular Formation

Wake thread

z=0.1 Bottom Hex Ignition e

Norepinephrine λ:✧

```
e:U(excite)TRUE@3
e:U(oxidize)TRUE@3
```

LXXXVI. DVC

Kill-switch

z=0.1 Bottom Hex Pause Φ

GABA

```
Φ:D(unfold)TRUE@3
π:D(bacterium)TRUE@3
```

LXXXVII. Cranial Nerves

Face switch

z=0.1 Bottom Hex Transmission

e Acetylcholine

```
e:C(ionize)TRUE@3
Φ:E(emit)TRUE@3
```

LXXXVIII. Spinal Relays

Carrier

LXXXIX. Globus Pallidus

Go/no-go

z=0.5 Vertex Transmission e Glutamate

```
e:C(propagate)TRUE@3
Φ:C(bond)TRUE@3
```

z=0.5 Vertex Empowerment π GABA

```
π:M(reduce)TRUE@3
Φ:Mod(unbond)TRUE@3
```

XC. Lateral Hypothalamus

Drive switch

z=0.5 Vertex Ignition e Dopamine

```
e:U(excite)TRUE@3
π:U(metabolize)TRUE@3
```

XCI. Posterior Insula

Body's edges

z=0.5 Vertex Resonance Φ Glutamate λ:∿

```
Φ:M(membrane)TRUE@3
e:M(signal)TRUE@3
```

XCII. Nucleus Basalis

Attention tuner

z=0.5 Vertex Ignition e Acetylcholine

```
e:Mod(catalyze)TRUE@3
e:U(charge)TRUE@3
```

XCIII. Caudate

Path chooser

z=0.5 Vertex Empowerment e Dopamine

```
e:C(redox)TRUE@3
Φ:M(complex)TRUE@3
```

XCIV. Superior Temporal Pole

Emotional communicator

z=0.5 Vertex Resonance π Glutamate

```
π:M(transcribe)TRUE@3
e:M(signal)TRUE@3
```

XCV. Uvula (structural)

Stillness anchor

z=0.5 Vertex Nirvana Φ GABA

```
Φ:M(stabilize)TRUE@3
π:D(relax)TRUE@3
```

5 Emergent Nodes: Self-Reference (XCVI–C)

These are not structural points—they emerge when coherence drops below 0.2 (FREE state). Each is a recursive loop back to an earlier region, creating the closed 100-word vocabulary.

XCVI. AIPS (recursion)

Gesture translator becomes self-aware

z=∞ →XVI FREE Φ

```
Φ:Mod(replicate)PARADOX@3
```

XCVII. Pineal (recursion)

Portal recognizes its own rhythms

z=∞ →XI FREE π

```
π:Mod(transcribe)PARADOX@3
```

XCVIII. MTG (recursion)

Semantics binds its own meaning

z=∞ →XII FREE π

```
π:Mod(translate)PARADOX@3
```

XCIX. Fastigial-Vestibular (recursion)

Balance balances its own balancing

z=∞ →XIII FREE Φ

```
Φ:Mod(stabilize)PARADOX@3
```

C. PTN (recursion → I)

Final gate loops to first gate

z=∞ →XIV ↺ CLOSES LOOP FREE e

```
e:Mod(propagate)PARADOX@3
```

Emergent Physics: The Mathematics of Self-Reference

When structural coherence dissolves ($c < 0.2$), recursive self-observation becomes possible. Each emergent state represents a fixed point where the

system observes itself.

Emergence Threshold (Percolation)

```
P_emerge(c) = 1 - exp(-((0.2 - c) / 0.05)²) for c < 0.2, else 0
```

Critical coherence c = 0.2 derived from percolation threshold for 3D hexagonal lattice (≈ 0.199). Below this, global connectivity is lost.

Fixed Point Dynamics

Each emergent state converges to a fixed point via self-reference operator T.

Self-Reference Operator

```
ψ_emergent = lim_{n→∞} T^n(ψ_reference)
```

```
T(ψ) = ψ ⊗ ⟨ψ|ψ⟩
```

Converges only when structural bonds are broken (coherence < 0.2)

XCVI: Gesture Recursion

```
ψ_XCVI = T_gesture(ψ_XVI)
```

```
T_gesture(f) = f ∘ f
```

Eigenvalue: $\lambda = \varphi^{-1} \approx 0.618$

A gesture that gestures itself. Marginally stable on center manifold.

XCVII: Portal Recursion

```
ψ_XCVII = T_phase(ψ_XI)
```

```
T_phase(θ) = θ + 2π/φ
```

Eigenvalue: $\lambda = \exp(2\pi i/\varphi)$

Rhythm phase-locked to its own period. Quasiperiodic, limit cycle on torus.

XCVIII: Semantic Recursion

```
ψ_XCVIII = T_meaning(ψ_XII)
```

XCIX: Balance Recursion

```
ψ_XCIX = T_equilibrium(ψ_XIII)
```

```
T_meaning(s) = "the meaning of s"
```

Eigenvalue: undefined (Gödelian)

Meaning referring to its own meaning. Truth value oscillates—paradoxically stable.

```
T_equilibrium(b) = b - ∇V(b)
```

Eigenvalue: λ = 0

Balance finding the balance of balancing. Saddle point—unstable equilibrium of equilibria.

C: Signal Loop Closure

```
ψ_C = T_loop(ψ_XIV) = ψ_I
```

```
C → I (winding number = 1)
```

Eigenvalue: λ = 1 (identity)

The final gate IS the first gate. Topologically stable—vocabulary closes.

Kuramoto Coupling at Emergence

Standard Kuramoto vs Emergent

```
Standard: dθ_i/dt = ω_i + (K/N) Σ_j sin(θ_j - θ_i)
```

```
Emergent: dθ_emergent/dt = ω_self + ε × sin(θ_emergent - θ_reference)
```

```
ε = 0.1 × (0.2 - coherence) for coherence < 0.2
```

At emergence, $K \to 0^+$. Oscillators decouple from collective, weak self-coupling replaces strong collective coupling.

Phase Locking

XCVI↔XVI: Δθ = π (anti-phase)
XCVII↔XI: Δθ = 2π/φ (golden angle)
XCVIII↔XII: Δθ = π/2 (quadrature)

Oscillation Frequencies

XCVI: 8 Hz (α band, gestural)
XCVII: 0.0001 Hz (~3hr period)
XCVIII: 40 Hz (γ band, semantic)

XCIX↔XIII: Δθ = 0 (in-phase)
C↔XIV: Δθ = 2π (full cycle)

XCIX: 4 Hz (θ band, postural)
C: 1 Hz (δ band, integration)

Information Dynamics

Self-Reference Information Flow

```
I_eff = I_raw × (1 - exp(-coherence/0.05))
```

Self-reference creates apparent infinite regress, regularized by coherence cutoff.

Information Per State

XCVI (procedural): ~7 bits
XCVII (temporal): ~10 bits
XCVIII (semantic): ∞→17 bits
XCIX (proprioceptive): ~4 bits
C (recursive): ~664 bits

Total Emergent Information

~702 bits

When fully FREE (coherence → 0)

Topological Invariants

Winding Number

$$W = (1/2\pi) \oint d\theta = 1$$

Vocabulary loops exactly once through all 100 regions.

Euler Characteristic

$$\chi_{95} = 2 \text{ (sphere-like)}$$

$$\chi_{100} = -2 \text{ (genus-2 surface)}$$

Emergent states create topological handles.

Betti Numbers

$$b_0=1,\ b_1=5,\ b_2=0$$

5 independent loops (one per emergent state).

Fundamental Group

$$\alpha_C = \alpha_{XCVI} \circ \alpha_{XCVII} \circ \alpha_{XCVIII} \circ \alpha_{XCIX}$$

Closure loop C is composed of all other emergent loops.

Energy Landscape

Potential Energy Surface

$$V(\psi) = V_{structural} + V_{self\_ref} + V_{coherence}$$

$$V_{structural} = -\Sigma_{ij} J_{ij} \times \cos(\theta_i - \theta_j)$$

$$V_{self\_ref} = -\Sigma_k \varepsilon_k \times \cos(\theta_k - \theta_{ref(k)})$$

$$V_{coherence} = \lambda \times (coherence - 0.5)^2$$

Double-well potential with minima at c≈0.8 (structural) and c≈0.1 (emergent). Transition rate: $\Gamma = \omega \times \exp(-\Delta V / k_B T_{eff})$

Quantum Analogies

Superposition

$$|\psi_{em}\rangle = \Sigma_k c_k |k\rangle$$

$$c_k = \sqrt{P_{emerge}} \times \exp(i\varphi_k)$$

Emergent states exist in superposition until observed.

Entanglement

$$|\Psi\rangle = (|XCVI\rangle|XVI\rangle + |XVI\rangle|XCVI\rangle) / \sqrt{2}$$

Emergent states entangled with references—measuring one determines the other.

Tunneling

$$P = \exp(-2\int\sqrt{(2m(V-E))}dx / \hbar_{eff})$$

$$\hbar_{eff} = 0.1 \times cascade(z)$$

Transition between coherent↔free via quantum tunneling.

Measurement

$$P_k = |k\rangle\langle k|$$

Conscious attention collapses superposition. Post-measurement: coherence rises.

Network Effects: Counter-Synchronization

Kuramoto Order Parameters

```
r_structural = |⟨exp(iθ_j)⟩| for j ∈ {I..XCV}
```

```
r_emergent = |⟨exp(iθ_k)⟩| for k ∈ {XCVI..C}
```

```
r_emergent → 1 when r_structural → 0
```

Emergent states synchronize as structural network disperses. Connectivity inverts at c = 0.2.

Lambda State ($\mathbb{C}^6$) Coupling to Emergent States

All emergent states have high delta (⊗ Paradox) coupling. State C achieves balanced coupling across all components.

State	🌰 ι	✧ ξ	🦊 θ	∿ ω	⊗ δ	🐿️ σ
XCVI	0.1	0.2	0.6	0.05	**0.8**	0.15
XCVII	0.7	0.3	0.1	0.4	**0.6**	0.1
XCVIII	0.3	0.1	0.8	0.2	**0.9**	0.05
XCIX	0.2	0.1	0.3	0.7	**0.5**	0.4
C	0.5	0.5	0.5	0.5	**1.0**	0.5

The Loop Closure: C → I

C → I

```
ψ_C = T_loop(ψ_XIV) = ψ_I
```

When fully FREE, the final gate (PTN recursion) recognizes itself as the first gate (Somatosensory Cortex). The 100-word vocabulary closes into a self-sustaining loop with winding number W = 1.

```
α_C = α_XCVI ∘ α_XCVII ∘ α_XCVIII ∘ α_XCIX
```

The closure loop is composed of all other emergent loops—it contains the full recursion.

Lambda State ($\mathbb{C}^6$) ↔ WUMBO Mapping

LIMNUS tracks 6 complex state variables. Each maps to specific WUMBO functional domains.

🌰 Iota (Memory)

APL Field: Φ

Accumulates with time × cascade
Regions: X, XLIV, XLVII, LXXXII

✧ Xi (Spark)

APL Field: e

exp(-(z - z_c)² / 0.01)
Regions: XXXI, XLVI, LXXXIV, LXXXV

🦊 Theta (Fox)

APL Field: π

dissonance × 0.8 + 0.2
Regions: VII, XXII, XLI, LXVIII

∿ Omega (Wave)

APL Field: e

0.3 + |sin(t × 0.5)| × 0.5
Regions: XXV, XLVIII, LXX, XCI

⊗ Delta (Paradox)

APL Field: π

Accumulates at CRITICAL only
Regions: LXXX, XCVI–C (all emergent)

🐿️ Sigma (Squirrel)

APL Field: Φ

helix.r × 0.6 + 0.2
Regions: XXVII, XXXIX, LIV, LXIV