

# WUMBO Engine · APL-Mirrored Index

Cross-links the WUMBO Engine to the APL Operator's Manual so engineering artifacts (machines, fields, operators, states) mirror how the engine is built and used.

[Open Manual Index](#)[Open LaTeX Manual \(HTML\)](#)[Download APL Manual \(PDF\)](#)[Download WUMBO Engine \(PDF\)](#)[Rhythm Entrainment Demo](#)

## How This Mirrors APL

Engine creation in WUMBO maps 1-to-1 onto APL: machines define processing contexts, fields define physical domains, operators define transformations, and UMOL states define regime/phase behavior.

### Machines

Conductor (clock), Oscillator Bank (reactor), Coupling Controller (regulator), Output Multiplexer (encoder).

[APL: Machines](#)

### Domains

Wave timing (AudioContext), geometric rhythm (CSS/animation), embodied feedback (haptic/bio).

[APL: The Three Fields · Domains](#)

### Operators

`schedule()`, `couple $\times$` , `integrate $+$` , `amplify $^$` , `decohere $\%$` , `gate()`, `emit $\rightarrow$` .

### States (UMOL)

Ignition ( $u \uparrow$ ), Empowerment ( $u \rightarrow$ ), Resonance ( $m \approx$ ), Nirvana ( $m \equiv$ ),

APL: Universal Operations

Shutdown ( $d\downarrow$ ), Pause ( $d\perp$ ),  
Re-entry ( $u\cup$ ).

APL: Operator States

## WUMBO → APL Engineering Map

### Clock & Scheduler

AudioContext master clock + look-ahead/Worklet.

Machine: Conductor

Op: schedule()

Field: Wave

### Kuramoto Solver

Coupled oscillator bank + order parameter  $r, \psi$ .

Machine: Reactor

Op: couple $\times$ , integrate+

State:  $m$  (modulation)

### Adaptive Controller

Closed-loop K adaptation by coherence/phase error.

Machine: Regulator

Op: amplify $^{\wedge}$  / decohere%

State: regime shifts

### Biosignal I/O

HRV (BLE), keystroke cadence, latency compensation.

Machine: Sensor/Encoder

Op: gate(), reduce $\perp$

Field: Bio  $\leftrightarrow$  Wave

### Multi-Modal Output

Audio/visual/haptic emission locked to master time.

Machine: Emitter

Op: emit $\rightarrow$ , align $\approx$

Field: Wave/Geom/Body

### Network Sync

WebSocket + timesync, WebRTC DataChannels.

Machine: Conductor (distributed)

Op: sync $\leftrightarrow$ , sample()

State: coherence  $r$

## Roman Numeral Cross-Links

### I. Atlas Entry

Manual:  
Domains/Fields ·

### II. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

### III. Atlas Entry

Manual:  
Domains/Fields ·

States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

**IV. Atlas Entry**

Manual: Machines ·  
Operators ·  
Domains/Fields ·  
States

Focus: Machines

Operators

Why: execution/clock →  
transformation/sculpt

**V. Atlas Entry**

Manual: Operators ·  
Machines · States ·  
Domains/Fields

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

**VI. Atlas Entry**

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

**VII. Atlas Entry**

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

**VIII. Atlas Entry**

Manual: Operators ·  
States · Machines ·  
Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

**IX. Atlas Entry**

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

**X. Atlas Entry**

Manual:  
Domains/Fields ·  
States · Operators ·  
Machines

**XI. Atlas Entry**

Manual: States ·  
Domains/Fields ·  
Machines · Operators

Focus: States

**XII. Atlas Entry**

Manual: Operators ·  
Machines ·  
Domains/Fields ·  
States

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

Domains/Fields

Why: regime/alignment  
→ sensory/context

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

### XIII. Atlas Entry

Manual: Machines ·  
Domains/Fields ·  
States · Operators

Focus: Machines

Domains/Fields

Why: execution/clock →  
sensory/context

### XIV. Atlas Entry

Manual:  
Domains/Fields ·  
States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

### XV. Atlas Entry

Manual: States ·  
Machines ·  
Domains/Fields ·  
Operators

Focus: States

Machines

Why: regime/alignment  
→ execution/clock

### XVI. Atlas Entry

Manual: Operators ·  
Machines ·  
Domains/Fields ·  
States

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

### XVII. Atlas Entry

Manual:  
Domains/Fields ·  
Machines · Operators ·  
States

Focus: Domains/Fields

Machines

Why: sensory/context →  
execution/clock

### XVIII. Atlas Entry

Manual:  
Domains/Fields ·  
States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

### XIX. Atlas Entry

Manual: Machines ·  
Operators ·  
Domains/Fields ·  
States

Focus: Machines

### XX. Atlas Entry

Manual: Operators ·  
Machines · States ·  
Domains/Fields

Focus: Operators

### XXI. Atlas Entry

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

### Operators

Why: execution/clock →  
transformation/sculpt

### Machines

Why:  
transformation/sculpt →  
execution/clock

### Operators

Why: regime/alignment  
→ transformation/sculpt

## XXII. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

## XXIII. Atlas Entry

Manual: Operators ·  
States · Machines ·  
Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

## XXIV. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Operators · Machines

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

## XXV. Atlas Entry

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

## XXVI. Atlas Entry

Manual: Operators ·  
States · Machines ·  
Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

## XXVII. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Operators · Machines

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

## XXVIII. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Operators · Machines

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

## XXIX. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Machines · Operators

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

## XXX. Atlas Entry

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XXXI. Atlas Entry

Manual: Operators ·  
States · Machines ·  
Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

### XXXII. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XXXIII. Atlas Entry

Manual: Operators ·  
Domains/Fields ·  
States · Machines

Focus: Operators

Domains/Fields

Why:  
transformation/sculpt →  
sensory/context

### XXXIV. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XXXV. Atlas Entry

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XXXVI. Atlas Entry

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

### XXXVII. Atlas Entry

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XXXVIII. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XXXIX. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Operators · Machines

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context



**XL. Atlas Entry**

Manual: Machines ·  
Operators ·  
Domains/Fields ·  
States

Focus: Machines

Operators

Why: execution/clock →  
transformation/sculpt

**XLI. Atlas Entry**

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

**XLII. Atlas Entry**

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

**XLIII. Atlas Entry**

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

**XLIV. Atlas Entry**

Manual: Machines ·  
Domains/Fields ·  
States · Operators

Focus: Machines

Domains/Fields

Why: execution/clock →  
sensory/context

**XLV. Atlas Entry**

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

**XLVI. Atlas Entry**

Manual: Operators ·  
States · Machines ·  
Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

**XLVII. Atlas Entry**

Manual:  
Domains/Fields ·  
States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

**XLVIII. Atlas Entry**

Manual: States ·  
Operators ·  
Domains/Fields ·  
Machines

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

**XLIX. Atlas Entry**

**L. Atlas Entry**

**LI. Atlas Entry**



Manual: Operators · States · Machines · Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt → regime/alignment

Manual: States · Machines · Domains/Fields · Operators

Focus: States

Machines

Why: regime/alignment → execution/clock

Manual: Domains/Fields · Operators · Machines · States

Focus: Domains/Fields

Operators

Why: sensory/context → transformation/sculpt

## LII. Atlas Entry

Manual: Domains/Fields · Operators · Machines · States

Focus: Domains/Fields

Operators

Why: sensory/context → transformation/sculpt

## LIII. Atlas Entry

Manual: Domains/Fields · Operators · Machines · States

Focus: Domains/Fields

Operators

Why: sensory/context → transformation/sculpt

## LIV. Atlas Entry

Manual: Operators · Domains/Fields · States · Machines

Focus: Operators

Domains/Fields

Why:  
transformation/sculpt → sensory/context

## LV. Atlas Entry

Manual: Machines · States · Domains/Fields · Operators

Focus: Machines

States

Why: execution/clock → regime/alignment

## LVI. Atlas Entry

Manual: Operators · Machines · States · Domains/Fields

Focus: Operators

Machines

Why:  
transformation/sculpt → execution/clock

## LVII. Atlas Entry

Manual: States · Operators · Machines · Domains/Fields

Focus: States

Operators

Why: regime/alignment → transformation/sculpt

## LVIII. Atlas Entry

Manual: States · Operators · Machines · Domains/Fields

## LIX. Atlas Entry

Manual: Machines · Operators · States · Domains/Fields

## LX. Atlas Entry

Manual: Domains/Fields ·

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

Focus: Machines

Operators

Why: execution/clock →  
transformation/sculpt

Operators · Machines ·  
States

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

### LXI. Atlas Entry

Manual: Operators ·  
States · Machines ·  
Domains/Fields

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

### LXII. Atlas Entry

Manual: Machines ·  
Operators ·  
Domains/Fields ·  
States

Focus: Machines

Operators

Why: execution/clock →  
transformation/sculpt

### LXIII. Atlas Entry

Manual: Operators ·  
States ·  
Domains/Fields ·  
Machines

Focus: Operators

States

Why:  
transformation/sculpt →  
regime/alignment

### LXIV. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Machines · Operators

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

### LXV. Atlas Entry

Manual: States ·  
Machines ·  
Domains/Fields ·  
Operators

Focus: States

Machines

Why: regime/alignment  
→ execution/clock

### LXVI. Atlas Entry

Manual: Machines ·  
States ·  
Domains/Fields ·  
Operators

Focus: Machines

States

Why: execution/clock →  
regime/alignment

### LXVII. Atlas Entry

Manual: Operators ·  
Machines · States ·  
Domains/Fields

### LXVIII. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

### LXIX. Atlas Entry

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

### LXX. Atlas Entry

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

### LXXI. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Machines · Operators

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

### LXXII. Atlas Entry

Manual: States ·  
Machines · Operators ·  
Domains/Fields

Focus: States

Machines

Why: regime/alignment  
→ execution/clock

### LXXIII. Atlas Entry

Manual: Operators ·  
Machines · States ·  
Domains/Fields

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

### LXXIV. Atlas Entry

Manual: Machines ·  
Domains/Fields ·  
States · Operators

Focus: Machines

Domains/Fields

Why: execution/clock →  
sensory/context

### LXXV. Atlas Entry

Manual: Operators ·  
Machines ·  
Domains/Fields ·  
States

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

### LXXVI. Atlas Entry

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Domains/Fields

### LXXVII. Atlas Entry

Manual: Operators ·  
Domains/Fields ·  
States · Machines

Focus: Operators

### LXXVIII. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

### Operators

Why: sensory/context → transformation/sculpt

### Domains/Fields

Why: transformation/sculpt → sensory/context

### Operators

Why: regime/alignment → transformation/sculpt

## LXXIX. Atlas Entry

Manual: Operators · States · Machines · Domains/Fields

Focus: Operators

States

Why: transformation/sculpt → regime/alignment

## LXXX. Atlas Entry

Manual: States · Operators · Domains/Fields · Machines

Focus: States

Operators

Why: regime/alignment → transformation/sculpt

## LXXXI. Atlas Entry

Manual: States · Operators · Machines · Domains/Fields

Focus: States

Operators

Why: regime/alignment → transformation/sculpt

## LXXXII. Atlas Entry

Manual: Domains/Fields · States · Operators · Machines

Focus: Domains/Fields

States

Why: sensory/context → regime/alignment

## LXXXIII. Atlas Entry

Manual: Machines · Operators · Domains/Fields · States

Focus: Machines

Operators

Why: execution/clock → transformation/sculpt

## LXXXIV. Atlas Entry

Manual: Domains/Fields · Operators · Machines · States

Focus: Domains/Fields

Operators

Why: sensory/context → transformation/sculpt

## LXXXV. Atlas Entry

Manual: Machines · States · Domains/Fields · Operators

Focus: Machines

States

## LXXXVI. Atlas Entry

Manual: States · Machines · Domains/Fields · Operators

Focus: States

Machines

## LXXXVII. Atlas Entry

Manual: Operators · Machines · States · Domains/Fields

Focus: Operators

Machines

Why: transformation/sculpt →

Why: execution/clock →  
regime/alignment

### LXXXVIII. Atlas Entry

Manual: Machines ·  
Operators ·  
Domains/Fields ·  
States

Focus: Machines

Operators

Why: execution/clock →  
transformation/sculpt

Why: regime/alignment  
→ execution/clock

### LXXXIX. Atlas Entry

Manual: Operators ·  
Machines ·  
Domains/Fields ·  
States

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

execution/clock

### XC. Atlas Entry

Manual: States ·  
Operators · Machines ·  
Domains/Fields

Focus: States

Operators

Why: regime/alignment  
→ transformation/sculpt

### XCI. Atlas Entry

Manual:  
Domains/Fields ·  
States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment

### XCII. Atlas Entry

Manual:  
Domains/Fields ·  
Operators · Machines ·  
States

Focus: Domains/Fields

Operators

Why: sensory/context →  
transformation/sculpt

### XCIII. Atlas Entry

Manual: Operators ·  
Machines · States ·  
Domains/Fields

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

### XCIV. Atlas Entry

Manual: Operators ·  
States ·  
Domains/Fields ·  
Machines

Focus: Operators

States

Why:  
transformation/sculpt →

### XCV. Atlas Entry

Manual: States ·  
Machines ·  
Domains/Fields ·  
Operators

Focus: States

Machines

Why: regime/alignment  
→ execution/clock

### XCVI. Atlas Entry

Manual: Operators ·  
Machines ·  
Domains/Fields ·  
States

Focus: Operators

Machines

Why:  
transformation/sculpt →

regime/alignment

execution/clock

### XCVII. Atlas Entry

Manual: States ·  
Domains/Fields ·  
Machines · Operators

Focus: States

Domains/Fields

Why: regime/alignment  
→ sensory/context

### XCVIII. Atlas Entry

Manual: Operators ·  
Machines ·  
Domains/Fields ·  
States

Focus: Operators

Machines

Why:  
transformation/sculpt →  
execution/clock

### XCIX. Atlas Entry

Manual: Machines ·  
Domains/Fields ·  
States · Operators

Focus: Machines

Domains/Fields

Why: execution/clock →  
sensory/context

### C. Atlas Entry

Manual:  
Domains/Fields ·  
States · Operators ·  
Machines

Focus: Domains/Fields

States

Why: sensory/context →  
regime/alignment