

## Appendix A — Canonical Symbols and Variables

This appendix records the primary symbols used in Paper A-22. The list is limited to notation that appears in the paper or is directly required to interpret its equations. Symbols are grouped by conceptual role rather than alphabetically, so that the reader can see how the CUWF consciousness formalism is organized.

Symbol	Meaning	Main Use in A-22
$\mathcal{L}$	Living closure or living state.	Used to denote BMIR-based self-maintaining life under CUWF.
$\mathcal{C}$	Consciousness state.	Used to denote consciousness as recursive self-modeling within a living or life-equivalent domain.
B	Boundary.	BMIR function that establishes the living self-environment distinction.
M	Metabolic Flow.	BMIR function that maintains regulated matter, energy, entropy, and coherence flow.
I	Information Memory.	BMIR function that preserves constraint, continuity, organization, and adaptive pattern.

R	Feedback Regulation.	BMIR function that restores the living system toward viability.
G_E	Entropic Geometry.	Geometric-ontological structure within which BMIR closure and consciousness are interpreted.
<b>B</b> _L	Living stability basin.	The viable basin of the living system sustained by BMIR closure.
$\partial\mathbf{B}$ _L	Boundary of the living stability basin.	Used in the definition of conscious boundary.
M_self	Self-model.	Dynamically updated internal representation that integrates body-state, boundary, memory, agency, and feedback into selfhood.
$\partial\mathbf{M}$ _self	Boundary of the self-model.	Experiential boundary of what is rendered as self within consciousness.
SelfOS_i	Self-operating system of domain i.	Embodied operating architecture through which a conscious domain renders and regulates experience.
D_i	Conscious domain i.	Self-referential domain in which living closure, self-model, memory, body-state, agency,

		and world-model form one stream of experience.
G_self	Self-geometry.	The self-organizing geometric configuration of a conscious domain.
G_living	Living geometry.	Living Entropic Geometry organized as BMIR closure.
G_conscious	Conscious geometry.	Living geometry projected through the self-model as conscious experience.
$\Pi$ _self	Self-projection operator.	Operator expressing how living geometry is rendered through the self-model into conscious geometry.
R_rec	Recursive feedback.	Feedback process through which the domain monitors and updates both living state and self-model.
$\Psi$ _phys	Physical wave substrate or physical wave-pattern.	Physical or biological wave-pattern underlying living and conscious processes.
$\Psi$ _ext	External wave-pattern.	Wave-pattern entering the domain from the environment.
$\Psi$ _int	Internal wave-pattern.	Wave-pattern arising within the domain, such as bodily state, memory, thought, or feeling.

$\Psi_{new}$	Incoming or newly generated wave-pattern.	Used in Self-OS update equations.
$\Psi_{disturbance}$	Disturbance wave-pattern.	Used in awareness practice to denote a perturbing internal or external wave.
$I_{exp}$	Experiential memory.	Memory integrated into the self-model as lived continuity and self-meaning.
$W_{model}$	World-model.	Model of the world rendered through the conscious domain.
$A_{action}$	Agency or action relation.	Used in observer-function and self-world stabilization.
$A_{self}$	Self-agency component.	Used in the self-model equation to denote agency integrated into selfhood.
$X_L$	Living system state.	State of the living system used in recursive feedback and self-model equations.
$M_{body}$	Body-state mapping.	Mapping of bodily condition into the self-model.
$T_{exp}$	Experienced time.	Time as rendered through entropic sequencing within the Self-OS.
$Seq_E$	Entropic sequencing operation.	Operation by which the self-model renders change,

		memory, and prediction as experienced time.
R_res	Residual resonance pattern.	Speculative residual self-OS pattern after collapse of the old BMIR closure.
D_old	Former conscious domain.	Domain associated with the old living closure in speculative residual continuity.
D_new	New conscious domain.	New domain possibly influenced by residual resonance pattern in speculative continuity.
$\mathcal{L}_{new}$	New living closure.	New BMIR closure in which a new conscious domain may emerge.
B_AI	Artificial Boundary.	Artificial BMIR-equivalent boundary for a possible artificial conscious domain.
M_AI	Artificial Metabolic or resource Flow.	Artificial resource-flow equivalent required for artificial BMIR-equivalent closure.
I_AI	Artificial Information Memory.	Artificial memory preserving identity, continuity, and constraint.

$R_{AI}$	Artificial Feedback Regulation.	Artificial regulatory function restoring system coherence or viability.
$\mathcal{L}_{AI}$	Artificial BMIR-equivalent closure.	Artificial life-equivalent substrate required for possible artificial consciousness.
$\mathcal{C}_{AI}$	Artificial consciousness state.	Possible artificial consciousness under CUWF, if artificial BMIR-equivalent closure becomes recursively self-modeling.
$\lambda$	Entropic moment or entropic evolution parameter.	Used to index the state of conscious domains, self-OS updates, feelings, thoughts, and experienced time.
$\Delta\lambda$	Increment of entropic evolution.	Used in update expressions.

## Appendix B — Core Equations of CUWF Consciousness

This appendix gathers the main equations and schematic expressions used throughout Paper A-22. These expressions are intended as structural equations or formal guides. They identify relations among living closure, self-modeling, conscious domain formation, experiential wave-modes, artificial BMIR-equivalent closure, and speculative residual pattern continuity. They should not be read as experimentally validated laws at this stage.

### B.1 Living BMIR Closure

$$\mathcal{L} = \text{Closure\_G\_E}(B, M, I, R)$$

Life is defined as the closure of Boundary, Metabolic Flow, Information Memory, and Feedback Regulation within Entropic Geometry.

### B.2 Consciousness as Recursive Self-Modeling

$$\mathcal{C} \approx \text{RecursiveSelfModel}[\mathcal{L}]$$

Consciousness emerges when living closure becomes recursively self-modeling within the same living domain.

### B.3 Conscious Boundary

$$B_{\text{conscious}} = \partial \mathcal{B}_L + \partial M_{\text{self}}$$

Conscious boundary couples the living stability-basin boundary with the boundary of the self-model.

### B.4 Self-Model Function

$$M_{\text{self}}(\boldsymbol{\lambda}) = F[X_L(\boldsymbol{\lambda}), B_L(\boldsymbol{\lambda}), M_{\text{body}}(\boldsymbol{\lambda}), I_{\text{exp}}(\boldsymbol{\lambda}), A_{\text{self}}(\boldsymbol{\lambda}), R_{\text{rec}}(\boldsymbol{\lambda}), W_{\text{model}}(\boldsymbol{\lambda})]$$

The self-model integrates living state, boundary, body-state mapping, experiential memory, agency, recursive feedback, and world-model.

### B.5 Conscious Domain

$$D_i(\boldsymbol{\lambda}) = \{\mathcal{L}_i, G_{\text{self}}^i, M_{\text{self}}^i, I_{\text{exp}}^i, R_{\text{rec}}^i, W_{\text{model}}^i\}$$

A conscious domain is the integrated set of living closure, self-geometry, self-model, experiential memory, recursive feedback, and world-model.

### B.6 Feeling as Self-Specific Meaning

$$\text{Feeling}_i(\lambda) = \text{Resonance}[\Psi(\lambda), G_{\text{self}}^i(\lambda), I_{\text{exp}}^i(\lambda)]$$

Feeling arises from resonance between a wave-pattern, self-geometry, and experiential memory.

### B.7 Conscious Geometry Projection

$$G_{\text{conscious}}(\lambda) = \Pi_{\text{self}}[G_{\text{living}}(\lambda)]$$

Conscious geometry is living geometry rendered through the self-model.

### B.8 Self-OS Update

$$\text{SelfOS}_i(\lambda + \Delta\lambda) = \text{Update}[\text{SelfOS}_i(\lambda), \Psi_{\text{new}}, G_{\text{self}}^i, I_{\text{exp}}^i, R_{\text{rec}}^i]$$

The Self-OS changes when new wave-patterns resonate with self-geometry, memory, and recursive feedback.

### B.9 Artificial Consciousness Condition

$$\mathcal{C}_{\text{AI}} \approx \text{RecursiveSelfModel}[\text{Closure}_{\text{G}_E}(\text{B}_{\text{AI}}, \text{M}_{\text{AI}}, \text{I}_{\text{AI}}, \text{R}_{\text{AI}})]$$

Artificial consciousness would require artificial BMIR-equivalent closure that becomes recursively self-modeling.

### B.10 Residual Pattern Coupling

$$D_{\text{new}}(\lambda_0) = \text{Emergence}[\mathcal{L}_{\text{new}}, R_{\text{res}}(D_{\text{old}})]$$

Speculative expression for a new domain initially biased by residual resonance from an old domain.

### B.11 New Domain Development

$$D_{\text{new}}(\lambda) = \text{Update}[D_{\text{new}}(\lambda_0), \Psi_{\text{new}}, I_{\text{new}}, E_{\text{new}}, R_{\text{rec}_{\text{new}}}]$$

After emergence, the new domain develops through its own new wave-patterns, memory, environment, and recursive feedback.

### B.12 Conscious Domain Update

$$D_i(\lambda + \Delta\lambda) = \text{Update}[D_i(\lambda), \Psi_{\text{ext}}(\lambda), \Psi_{\text{int}}^i(\lambda), I_{\text{exp}}^i(\lambda), R_{\text{rec}}^i(\lambda)]$$

Consciousness is a stream generated by continuous updating of the domain.

### B.13 Experienced Time

$$T_{\text{exp}}^i(\lambda) = \text{Seq}_E[M_{\text{self}}^i(\lambda), I_{\text{exp}}^i(\lambda), \Psi_{\text{change}}^i(\lambda), R_{\text{rec}}^i(\lambda)]$$

Experienced time arises through entropic sequencing of self-model, memory, change, and recursive feedback.

### B.14 Observer-Function

$$\text{Observer\_Function} = \text{Stabilize\_rec}(M_{\text{self}}, W_{\text{model}}, X_{\text{body}}, I_{\text{exp}}, A_{\text{action}})$$

The observer-function is the recursive stabilization of self-model, world-model, body-state, memory, and action.

### B.15 Observation Cycle

$$\Psi_{\text{event}} \rightarrow \Pi_{\text{self}} \rightarrow G_{\text{observed}} \rightarrow R_{\text{rec}} \rightarrow G_{\text{domain}}'$$

Observation is an event projected through the self-model, stabilized as observed geometry, and fed back into the domain.

### B.16 Bottom-Up Coupling

$$\Psi_{\text{phys}} \rightarrow G_{\text{living}} \rightarrow G_{\text{self}} \rightarrow G_{\text{conscious}}$$

Physical wave-patterns organize into living geometry, self-geometry, and conscious geometry.

### B.17 Top-Down Coupling

$$G_{\text{conscious}} \rightarrow R_{\text{rec}} \rightarrow \text{body-state} / \text{action} / \text{attention} / \text{emotion}$$

Conscious geometry regulates the body and domain through recursive feedback.

### B.18 Living-Conscious Feedback Loop

$$G_{\text{living}} \rightarrow \Pi_{\text{self}} \rightarrow G_{\text{conscious}} \rightarrow R_{\text{rec}} \rightarrow G_{\text{living}}'$$

Living geometry projects into conscious geometry and is then recursively regulated by it.

### B.19 Wave Awareness Practice Update

$$\text{SelfOS}_i(\lambda + \Delta\lambda) = \text{Update}[\text{SelfOS}_i(\lambda), \text{Observe}(\Psi_{\text{disturbance}}), R_{\text{rec}}^i, I_{\text{exp}}^i]$$

Awareness practice updates the Self-OS through observation of disturbances without automatic resonance.

## B.20 Stillness Regime

Stillness  $\approx$  HighCoherence(G\_self) + LowPerturbativeDistortion(M\_self)

Stillness is interpreted as a high-coherence, low-perturbation regime of the conscious domain.

Appendix C — Glossary of Key Concepts

This glossary defines the central concepts introduced or emphasized in Paper A-22. The definitions are written for conceptual clarity and should be read together with the formal equations in Appendix B.

Concept	Definition
Self-model	The dynamically updated internal representation through which a living BMIR closure integrates bodily state, boundary distinction, memory continuity, agency, and recursive feedback into the coherent experience of being one self within the world.
Self-OS	The embodied operating architecture through which a living self-domain integrates bodily state, memory, boundary, agency, prediction, and feedback into a coherent self-world interface. It is the operating system of the self, not a separate substance.
Conscious domain	The self-referential entropic-geometric regime in which living closure, self-model, memory, body-state, agency, and world-model are integrated into one stream of experience.
Domain-rendered reality	The principle that experienced reality is not a passive copy of external reality, but is rendered through the Self-OS, memory, body-state, self-geometry, and world-model of a particular conscious domain.
Experiential wave-mode	A recursively integrated wave-pattern within living Entropic Geometry that is stabilized as part

	of the system's self-model and therefore appears as feeling, thought, perception, or awareness from the first-person perspective.
Self-meaning	The way a wave-pattern matters to a specific conscious domain according to its body-state, memory, self-geometry, history, agency, and Self-OS configuration.
Self-geometry	The organized entropic-geometric configuration through which a conscious domain maps itself, maintains self-world boundary, integrates memory and agency, and renders experience.
Recursive feedback	Feedback through which a conscious domain monitors and updates not only its living state, but also its self-model of that state. It is the transition from life-maintenance to self-model maintenance.
Observer-function	The recursive stabilization of a self-world model within a conscious domain. The observer is not a hidden inner entity, but the recursive operation of the domain as it stabilizes experience.
Artificial BMIR-equivalent	A non-biological or synthetic system that functionally instantiates artificial Boundary, resource Flow, Information Memory, and Feedback Regulation as a self-maintaining domain. Under CUWF, artificial consciousness would require such a substrate plus recursive self-modeling and self-meaning.

Residual self-OS pattern	A speculative residual resonance pattern of a former self-geometry after collapse of the old BMIR closure. It is not the old consciousness, not a migrating soul, and not complete personality transfer; at most, it would be a pattern-level tendency or initial bias.
Common sense	A stabilized default resonance pattern within the Self-OS of a conscious domain. It can change when the Self-OS is reconfigured.
Feeling-thought stream	The ongoing stream of feelings, thoughts, memories, bodily meanings, perceptions, and intentions generated when internal and external wave-patterns are translated through the Self-OS.
Wave Awareness Practice	The practice of observing one's own wave-patterns without automatically resonating with disturbances, allowing recursive reconfiguration of the Self-OS.