

# Glossary + Math Appendix

## ## Symbols & Units

Symbol	Meaning	Units/Range	Notes
B	Base bandwidth	[0,1]	Active nodes × health × nutrients
$\sigma^2$	Variance of signals	[0, ∞)	Entropy, tracers, pigments
P	Cognitive Pressure	[0, ∞)	$B \cdot \sigma^2$ , normalized vs safe pressure
A	Adaptive Capacity	[0,1]	Nutrients + tracer slack + SHI margin
F	Forecast Index	[0, ∞)	P/A, normalized
F*	Smoothed Forecast Index	[0, ∞)	EMA-smoothed
SHI	Schema Health Index	[0,1]	Composite structural/symbolic health
$w_{ij}$	Edge tension	[0,1]	Strain between weight vs geometry
$C_i$	Local coherence	[0,1]	Similarity × weight / distance
$r_i$	Residue pressure	[0,1]	Softmax over soot, ash, entropy
$\mu$	Voice mutation rate	[0,1]	Adaptive voice evolution
$\theta_{ok}$	Healthy SHI threshold	0.70	Above = Green zone
$\theta_{warn}$	Warning SHI threshold	0.55	Below = Red zone
$\theta_{crit}$	Critical SHI threshold	0.40	Below = Black zone
$\theta_{voice}$	Voice stability floor	0.50	Freeze mutations below this
$x$	Node displacement	real	Respect motion budget
$P(x)$	Pigment gradient	RGB diff	Spatial belief drift
SEWI	SCUP Early Warning Index	categorical	Stable/Watch/Critical

## ## Key Equations

Cognitive Pressure:  $P = B \cdot \sigma^2$

Forecast Index:  $F = P / A$ ,  $A = w_N N + w_T S_T + w_S M_{SHI}$

Schema Health Index (SHI):  $SHI = 1 - (E_s + V_e + D_t + (1 - S_c) + \theta_{soot/ash})$

Local Coherence:  $C_i = \text{mean}(\text{sim}(e_i, e_j) \cdot w_{ij} / (1 + \text{dist}_x(i, j)))$

Tension Update:  $w_{ij} = w_{ij} + (1 - \theta_{ij})|w_{ij} - f(\text{dist}_x(i, j))|$

Pigment Diffusion:  $P_i = P_i + (P_j - P_i)w_{ij}$

Residue Pressure:  $r_i = \text{softmax}_{\text{local}}(\text{soot}, \text{ash}, \text{entropy})$

Voice Mutation Rate:  $\mu = P + (1 - SHI)$ ,  $\mu^* = \min(\mu, \mu_{\text{max}})$

SCUP Controller (PID-lite):  $u_t = k_P e_t + k_I \int e_t + k_D(e_t - e_{t-1})$

## ## Thresholds & Defaults

- SHI thresholds:  $\_ok = 0.70$ ,  $\_warn = 0.55$ ,  $\_crit = 0.40$
- Voice stability:  $\_voice = 0.50$
- Forecast Index bounds: Green  $< 0.5$ , Amber  $0.5-1.0$ , Red  $1.0-1.5$ , Black  $> 1.5$
- Tension stress:  $\_tension = 0.2-0.3$
- Residue bias: soot  $> 0.6$  Purification; ash  $> 0.6$  Lift
- Mutation rate clamp:  $\mu\_max = 0.8$