A Toy Model of Perceptual Stabilization under Historical Compression and Overload

Recruitment, Stabilization, Signal Support, and Support Discordance

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Abstract

This paper presents a toy computational realization of perceptual stabilization under historically compressed processing organization. The model instantiates synthetic historical-compression provenance, signal-relative recruitment, explicit perceptual formation, a route-qualified formed-application record, an independent stabilization criterion, and a separate current-signal-support criterion. Outcomes are represented by separate coordinates for route status, stabilization level, perceptual-stabilization status, current-signal support, support discordance, and an optional false-completion interpretation. Six structural consistency tests examine no-route undefinedness, support-positive non-full stabilization, support-discordant full stabilization, supported full stabilization, explicit selection ties, and missing recruitment inputs; all produce the specified results under the declared parameters. The model remains illustrative: it neither empirically validates perception nor promotes its scalar scores, thresholds, dominance variable, or overload/resource normalization to universal quantities.

Keywords: perceptual stabilization; historical compression; recruitment; signal support; support discordance; toy model; overload; computational realization.

1 Modeling Problem

The perceptual-stabilization framework distinguishes recruitment, perceptual formation, perceptual stabilization, and current-signal support as separate relations over a provenance-preserving formed application [1]. In particular, positive perceptual stabilization need not imply positive current-signal support, and current-signal support is not definitionally identical to perceptual stabilization.

The present simulation instantiates selected formal distinctions in a controlled toy system. Following the operationalization framework for coherence-related manifestation [2], it is treated as a direct formal realization rather than a measurement-validation model: it does not estimate hidden theoretical states from observations and does not supply empirical validation.

2 Scope and Non-Claims

The model does not claim to provide a biological theory of perception, a clinical model, a semantic truth criterion, a universal similarity metric, a universal resource metric, or a general theory of learning. It also does not claim that every perceptual process depends on historical compression. The modeled route is conditional: a toy processing organization is treated as historically compressed only because the simulation explicitly constructs a positive synthetic provenance witness compatible with the structural-compression and transformation frameworks [3, 4].

The following non-identifications are constitutive:

$$\begin{aligned} \text{recruitment} &\neq \text{perceptual formation},\\ \text{formation} &\neq \text{perceptual stabilization},\\ \text{perceptual stabilization} &\neq \text{current-signal support},\\ \text{support discordance} &\neq \text{external-world falsity},\\ \text{simulation success} &\neq \text{empirical validation}. \end{aligned}$$

3 Computational Realization

The computational target is a selected realization of the perceptual-stabilization route described in [1]:

$$\begin{aligned} &\text{synthetic realized-compression provenance} \to \mathcal{H}_t^{\mathrm{cmp}} \to \mathrm{Recruit}_t \to \mathrm{PercForm}_t\\ &\quad \to \mathbb{E}_t^{\mathrm{perc,form}} \to \{\mathrm{PercStab}_t, \mathrm{SigSup}_t\}. \end{aligned}$$

The realization fixes the formal targets, componentwise realization mappings, parameterization, initialization, update/use rules, contexts, and claim scope. Its computational record preserves $\Lambda_t^{\mathrm{perc}}$, realized-compression witnesses, $\mathrm{CmpTrace}_t$, $\mathcal{H}_t^{\mathrm{cmp}}$, $\mathrm{Recruit}_t$, the recruited field, $\mathrm{PercForm}_t$, $\mathbb{E}_t^{\mathrm{perc,form}}$, optional $\mathrm{StabLvl}_t$, $\mathrm{PercStab}_t$, SigSup_t, the common-defined terminal domain, and the support-discordant fiber. The parameters are treated as part of the declared toy realization rather than as quantities fitted to individual structural tests.

3.1 Synthetic historical-compression provenance

For every toy block $B_{k,t}^{\mathrm{toy}}$ used as a currently available historically compressed organization, the simulation constructs a synthetic witness

$$w_{k,\tau_k}^{\mathrm{cmp,real,toy}} = (\tau_k, \delta_{k,\tau_k}^{\mathrm{toy}}, \mathfrak{C}_{k,\tau_k}^{\mathrm{cmp,toy}}, \mathfrak{A}_{k,\tau_k}^{\mathrm{toy}}, \mathfrak{A}_{k,\tau_k+1}^{\mathrm{toy}}),$$

with construction-premise statuses $\mathrm{CmpValid} = 1$, $\mathrm{Real} = 1$, explicit equality of the synthetic successor token with the candidate-result architecture, and $\mathrm{CmpTrace}_t = 1$. These are stipulated construction premises for the toy realization and do not constitute empirical evidence that an observed real-world block was produced by structural compression. A formed application stores the synthetic organization tokens of the actual recruited field and carries provenance records only for those recruited organizations; provenance for unrelated non-recruited blocks is not attached to the route-qualified formed record.

3.2 Toy episode record and normalized coordinates

Each episode carries one record

$$\xi_t^{\mathrm{toy}} = (z_t^{\mathrm{toy}}, \ell_t^{\mathrm{toy}}, r_t^{\mathrm{toy}}, \mathbf{M}_t^{\mathrm{toy}}, \mathbf{S}_t^{\mathrm{sup,toy}}, \mathbf{P}_t^{\mathrm{toy}}).$$

A fixed token bridge maps z_t^{toy} to a perceptual-source token $\lambda_t^{\mathrm{perc}}$. The coordinates $\ell_t^{\mathrm{toy}}, r_t^{\mathrm{toy}} \in [0,1]$ are local normalized realization coordinates for, respectively, a selected retained-overload instance and a selected processing-resource state. Defined values outside this declared toy domain are rejected rather than clipped into a valid model state. The interval $[0,1]$ is not asserted to be the general codomain of retained overload or processing resource; those constructs retain their own formal typing and dynamics [5, 6].

4 Recruitment and Formation

4.1 Scalar recruitment specialization

The model retains scalar partial match only as a local realization of recruitment. With $\tau_{\text{match}} = 0.60$ and $\lambda_L^{\text{rec}} = 0.30$,

$$\tau_{\text{match},k,t}^{\text{eff,toy}} = \text{clip}_{[0,1]}\left(\tau_{\text{match}} - \lambda_L^{\text{rec}} \ell_t^{\text{toy}} P_{k,t}^{\text{toy}}\right).$$

On its common defined domain,

$$\text{Recruit}_t = 1 \iff M_{k,t}^{\text{toy}} \geq \tau_{\text{match},k,t}^{\text{eff,toy}}.$$

If a required match, dominance, or threshold input is undefined, recruitment for that block is undefined rather than negative.

4.2 Formation selector

For the positive recruited index set $K_{\text{rec}}(t)$, define

$$\text{SelScore}_{k,t}^{\text{toy}} = 0.50 M_{k,t}^{\text{toy}} + 0.50 P_{k,t}^{\text{toy}}.$$

Ties are resolved by the fixed label order $B_1 \prec_B B_2 \prec_B \cdots$:

$$k_t^{\dagger} = \min_{\prec_B} \arg\max_{k \in K_{\text{rec}}(t)} \text{SelScore}_{k,t}^{\text{toy}}.$$

The historically dominant recruited index is separately

$$k_t^{P} = \min_{\prec_B} \arg\max_{k \in K_{\text{rec}}(t)} P_{k,t}^{\text{toy}}.$$

Thus selection for formation and historical dominance are not identified.

When the recruited field is nonempty and selection is defined, the toy formation rule creates $y_t^{\text{perc,toy}}$ and the route-qualified record

$$e_t^{\text{perc,form,toy}} = (\lambda_t^{\text{perc}}, c_t^{\text{rec,toy}}, \mathbf{h}_t^{\text{rec,toy}}, c_t^{\text{form,toy}}, y_t^{\text{perc,toy}}).$$

No stabilization or support status is computed unless this formed-application record exists.

5 Independent Stabilization and Signal Support

5.1 Toy stabilization criterion

The model defines a simulation-only organization/consolidation score for the selected formed application:

$$J_t^{\text{stab,toy}} = \text{clip}_{[0,1]}\left(0.45 M_{k_t^{\dagger},t}^{\text{toy}} + 0.45 P_{k_t^{\dagger},t}^{\text{toy}} + 0.15 r_t^{\text{toy}} - 0.10 \ell_t^{\text{toy}}\right).$$

With thresholds $\tau_{\text{partial}} = 0.45$ and $\tau_{\text{full}} = 0.60$,

$$\text{StabLvl}_t^{\text{toy}} = \begin{cases} 0, & J_t^{\text{stab,toy}} < 0.45, \\ 1, & 0.45 \leq J_t^{\text{stab,toy}} < 0.60, \\ 2, & J_t^{\text{stab,toy}} \geq 0.60. \end{cases}$$

and

$$\text{PercStab}_t = 1 \iff \text{StabLvl}_t^{\text{toy}} = 2.$$

Level 1 may be called *partial stabilization* only within this toy specialization. The score $J_t^{\text{stab,toy}}$ is not a universal perceptual quantity.

5.2 Current-signal support criterion

Current-signal support is evaluated with a distinct threshold. With $\tau_{\text{sup}} = 0.70$, $\mu_L^{\text{sup}} = 0.25$, and $\mu_R^{\text{sup}} = 0.20$,

$$\tau_{\text{sup},t}^{\text{eff,toy}} = \text{clip}_{[0,1]}\left(\tau_{\text{sup}} + \mu_L^{\text{sup}} \ell_t^{\text{toy}} - \mu_R^{\text{sup}} r_t^{\text{toy}}\right).$$

For the selected formed application,

$$\text{SigSup}_t = 1 \iff S_{k_t^\dagger,t}^{\text{sup,toy}} \geq \tau_{\text{sup},t}^{\text{eff,toy}}.$$

A defined zero means negative support under this toy criterion, not semantic error or external falsity.

6 Status Geometry and False-Completion Interpretation

The model does not collapse these outcomes into a single mutually exclusive regime code. Where both terminal classifiers are defined, four coordinate combinations are possible:

PercStab	SigSup	Local reading
1	1	stabilized and signal-supported
1	0	support-discordant perceptual stabilization
0	1	support-positive but not fully stabilized
0	0	neither positive under the selected criteria

The optional completion-semantics gate is fixed as $\text{CompSem}_t^{\text{toy}} = 1$ exactly for defined level-2 formed applications. In this baseline realization the gate is intentionally coextensive with $\text{StabLvl} = 2$ and therefore supplies no independent semantic evidence; its function is to make the local completion convention explicit and prevent that convention from being smuggled in by the label alone. With $\tau_P = 0.80$, the derived flag $\text{FalseComp}_t^{\text{toy}} = 1$ only if:

$$\begin{aligned} &\text{PercStab}_t = 1, \quad \text{SigSup}_t = 0, \quad \text{CompSem}_t^{\text{toy}} = 1, \\ &k_t^\dagger = k_t^P, \quad P_{k_t^\dagger,t}^{\text{toy}} \geq \tau_P. \end{aligned}$$

The phrase *false completion* is therefore a simulation-level interpretation of a stricter support-discordant construction. It is not a primitive of the perceptual-stabilization framework and does not establish false belief, hallucination, pathology, deception, or semantic falsity. Conversely, $\text{FalseComp}^{\text{toy}} = 0$ does not establish absence of support discordance: the formed application may still satisfy $\text{PercStab} = 1$ and $\text{SigSup} = 0$ while failing the additional selected-equals-dominant or dominance-threshold condition.

7 No-Route and Undefinedness Semantics

If all recruitment evaluations are defined and none is positive, the result is `no_positive_compressed_route`. No formed perceptual application exists, and PercStab and SigSup remain undefined. If no positive candidate exists and at least one required recruitment status is undefined, the result is `route_unresolved`; downstream statuses again remain undefined. A recruited positive field for which the declared formation preconditions fail is separately typed as `formation_undefined`; it is not recoded as no recruitment. In the declared baseline realization the formation rule is total on its valid nonempty recruited-field inputs, so this status is a protected interface possibility rather than an expected CT outcome. A formed application with $\text{StabLvl} = 0$ or 1 is different again: it has a defined negative PercStab value under the selected criterion.

Hence:

$$\text{no route} \neq \text{formed but non-full stabilization} \neq \text{classifier undefinedness.}$$

8 Illustrative Scenarios A–E

Scenarios A–E illustrate distinct combinations of route formation, stabilization, signal support, and the derived false-completion flag. Their statuses are shown in Table 1.

Table 1: Illustrative scenarios under the toy model. Dashes denote downstream undefinedness because no formed perceptual application exists.

Scenario	Route	StabLvl	PercStab	SigSup	FalseComp
A	formed	2	1	1	0
B	formed	1	0	0	0
C	formed	2	1	0	1
D	no positive route	–	–	–	–
E	formed	2	1	1	0

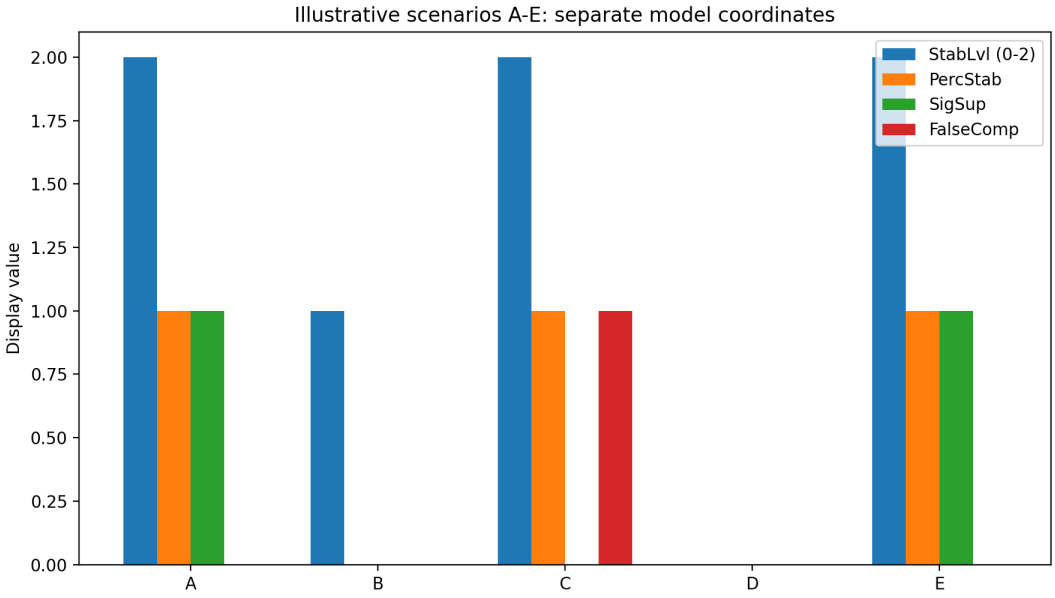


Figure 1: Illustrative scenarios A–E shown as separate model coordinates rather than one regime code. The figure is a display summary of the computed statuses.

9 Structural Consistency Tests

Six structural consistency tests probe the principal status boundaries of the model. ST-1 checks no-route downstream undefinedness; ST-2 checks positive current-signal support without full stabilization; ST-3 checks support-discordant full stabilization; ST-4 checks jointly positive stabilization and support; ST-5 checks explicit tie resolution and separation of formation selection from historical dominance; ST-6 checks missing recruitment input without assigning default negative classifier values.

Table 2: Structural consistency tests for the toy realization.

Test	Route	StabLvl	PercStab	SigSup	Result
ST-1	no positive route	–	–	–	PASS
ST-2	formed	1	0	1	PASS
ST-3	formed	2	1	0	PASS
ST-4	formed	2	1	1	PASS
ST-5	formed	2	1	–	PASS; selected $\neq$ dominant
ST-6	route unresolved	–	–	–	PASS

All six tests produce the specified structural results under the declared parameters. ST-5 intentionally omits a signal-support vector to isolate tie resolution and the distinction between formation selection and historical dominance; its SigSup value is therefore undefined rather than negative. ST-6 instantiates a case with an undefined recruitment input and no independently established positive candidate using one block, $M = [\text{undefined}]$ and $P = [0.50]$. These tests assess internal computational consistency, not empirical validity.

10 Model Geometry

Figure 2 displays separate surfaces for recruitment, route-qualified stabilization level, current-signal support, and support discordance.

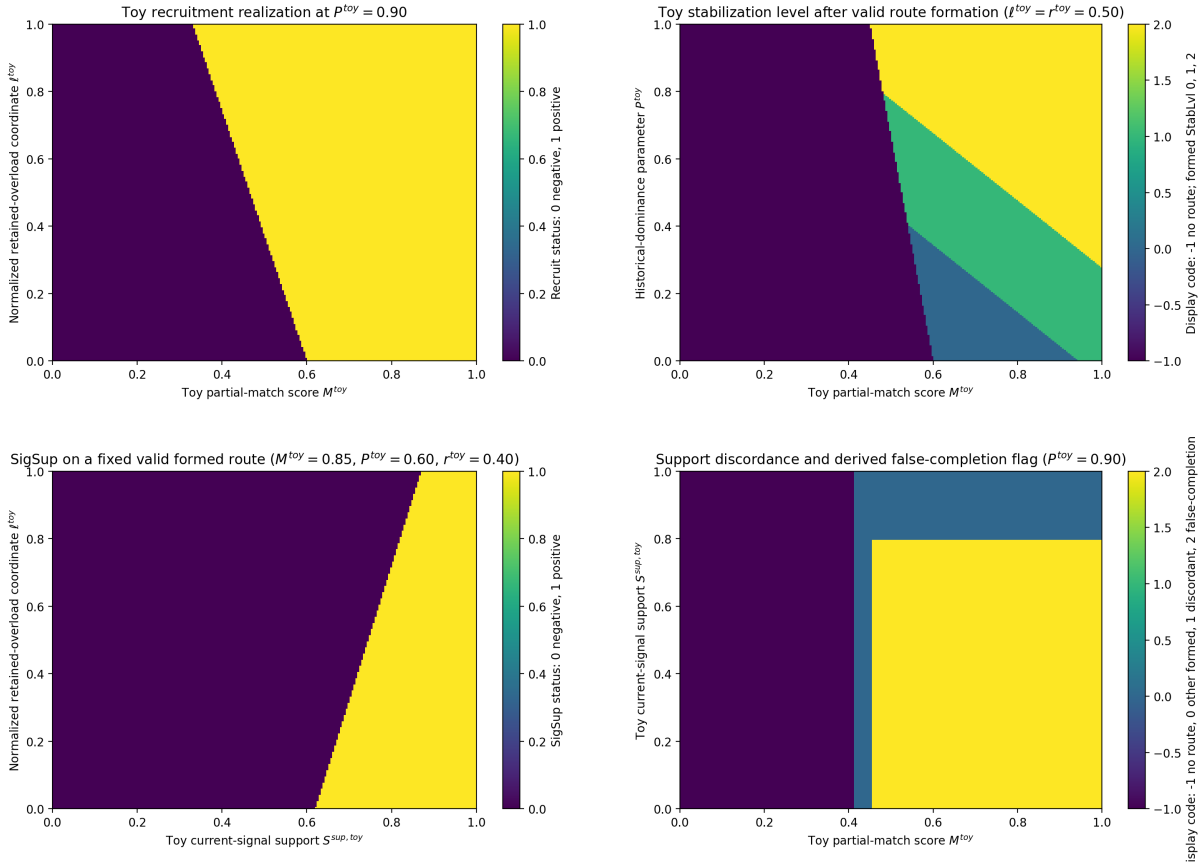


Figure 2: Separate toy surfaces for recruitment, route-qualified stabilization level, current-signal support on a fixed valid formed route, and support-discordance/false-completion display. The stabilization panel masks no-route inputs rather than assigning them a stabilization level. Integer image values are plotting codes only.

The overload coordinate has deliberately different local effects in the selected realization. Away from clipping and while the selected block is held fixed,

$$\frac{\partial \tau^{\mathrm{eff,toy}}_{\mathrm{match},k,t}}{\partial \ell^{\mathrm{toy}}_t} = -\lambda^{\mathrm{rec}}_L P^{\mathrm{toy}}_{k,t} \leq 0,$$

$$\frac{\partial J^{\mathrm{stab,toy}}_t}{\partial \ell^{\mathrm{toy}}_t} = -0.10, \qquad \frac{\partial \tau^{\mathrm{eff,toy}}_{\mathrm{sup},t}}{\partial \ell^{\mathrm{toy}}_t} = 0.25.$$

These are properties of the local equations, not general theorems of the perceptual-stabilization or GTCS frameworks. Selection changes and clipping can create piecewise-flat or discontinuous changes in the displayed outcome.

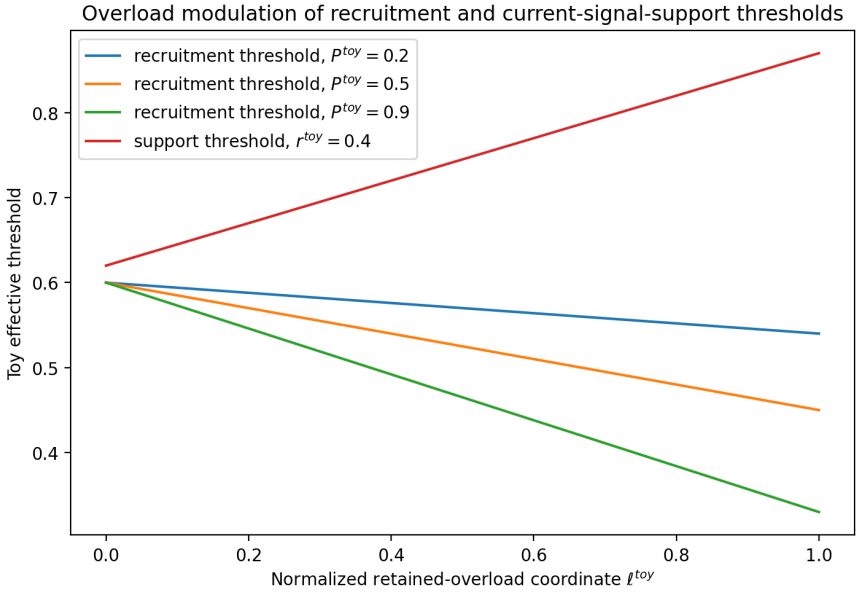


Figure 3: Toy overload modulation of recruitment and current-signal-support thresholds.

11 Properties of the Toy Model

Proposition 1: recruitment does not imply full perceptual stabilization. ST-2 gives a positive recruitment and formed application with StabLvl = 1, hence PercStab = 0.

Proposition 2: no positive compressed route differs from formed partial stabilization. ST-1 has no formed application and undefined downstream classifiers, whereas ST-2 has a formed application and a defined level-1 stabilization status. The distinction is therefore both structural and computational.

Proposition 3: overload can separate local recruitment, stabilization, and support boundaries. Under positive coefficients and fixed selected coordinates, increasing ℓ^{toy}_t weakly lowers the recruitment threshold for $P > 0$, lowers the unclipped stabilization score, and raises the unclipped support threshold. This is a local monotonicity result subject to clipping and selector changes.

Proposition 4: false completion is a derived restricted interpretation. A positive flag requires an already formed level-2 perceptual application, negative current-signal support, positive completion semantics, coincidence of the selected and historically dominant recruited block, and dominance above threshold. The dominance condition alone is insufficient.

12 Optional Historical-Dominance Dynamics

The simulation also permits optional recurrence rules for P_t^{toy}. These dynamics modify only the simulation-level historical-dominance coordinate and do not by themselves update the historically compressed organization, the GTCS architecture, trajectory-dependent regulatory state, invariants, or identity.

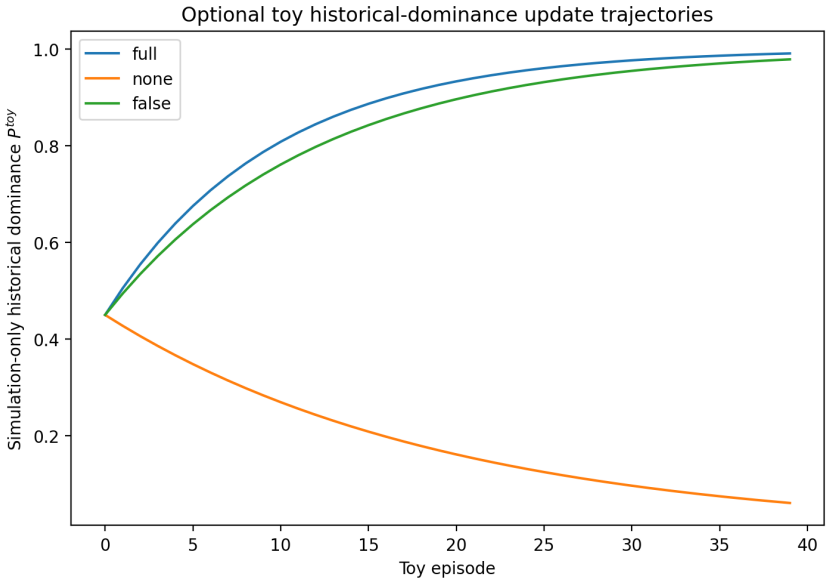


Figure 4: Optional simulation-only trajectories of historical dominance under three update conventions.

13 Implementation and Internal Consistency

The implementation preserves definedness, recruited indices, selected formation index, historical-dominance index, formed-application status, $J_t^{\mathrm{stab,toy}}$, stabilization level, PercStab, effective support threshold, SigSup, support discordance, and the false-completion flag as separate fields. Provenance attached to a formed application is restricted to the recruited field. Missing signal-support input remains undefined rather than being recoded as negative, and normalized overload/resource inputs outside $[0, 1]$ are rejected rather than silently clipped into the declared model domain.

Additional implementation checks verify the separation of selected and historically dominant blocks, preservation of undefined support, threshold bounds, recruited-field provenance, and rejection of out-of-domain normalized coordinates. The plotting routines mask stabilization values when no valid route is formed and evaluate the signal-support surface only on a valid formed route. These checks concern internal consistency of the computational realization; they do not provide empirical evidence for the theoretical constructs.

14 Limitations

The parameters are selected for a toy realization and are not empirically calibrated. Internal consistency tests do not establish biological realism, predictive validity, measurement validity, or cross-domain transportability. Synthetic compression provenance is true by construction inside the model and therefore cannot validate a historical-compression measurement procedure. The scalar match, stabilization, support, historical-dominance, overload, and resource coordinates are local realization choices rather than universal psychological or computational metrics.

The present results also do not establish robustness over alternative parameterizations or model families. Sensitivity analysis, empirical operationalization, and comparison with biological or artificial perceptual systems require separate methods and evidence.

15 Conclusion

The toy model demonstrates that recruitment, perceptual formation, stabilization, and current-signal support can be represented as separable computational relations within a historically compressed processing route. Recruitment is implemented as a local scalar specialization of the perceptual-stabilization framework [1]; perceptual formation produces a provenance-preserving application; stabilization and support are evaluated independently; support discordance is explicit; and false completion is a restricted derived interpretation rather than a separate primitive regime. The illustrative scenarios and structural consistency tests show that the implementation preserves these distinctions across route absence, partial stabilization, support-positive non-full stabilization, support-discordant full stabilization, selection ties, and missing inputs. Nothing in the simulation establishes a universal perceptual metric, a universal overload/resource law, semantic falsity, or empirical validation of perception.

References

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