mcfeedback — Iteration 10b: Propagation Cycles

experiment-010b.mjs · N = 10 seeds · Seeds: 42, 137, 271, 314, 500, 618, 777, 888, 999, 1234 · 1000 training episodes · Frozen-weight evaluation · Random chance = 50%

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Change from experiment-010: run 3 accumulate-and-fire cycles per training step.
propagationCycles  3  — forward pass runs 3× before flagging/learning; all other params from exp-010
consistencyThreshold  5  ·  flagStrengthGain  0.15  ·  flagDecayOnFlip  0.5  ·  flagDecayRate  0.9  (unchanged)
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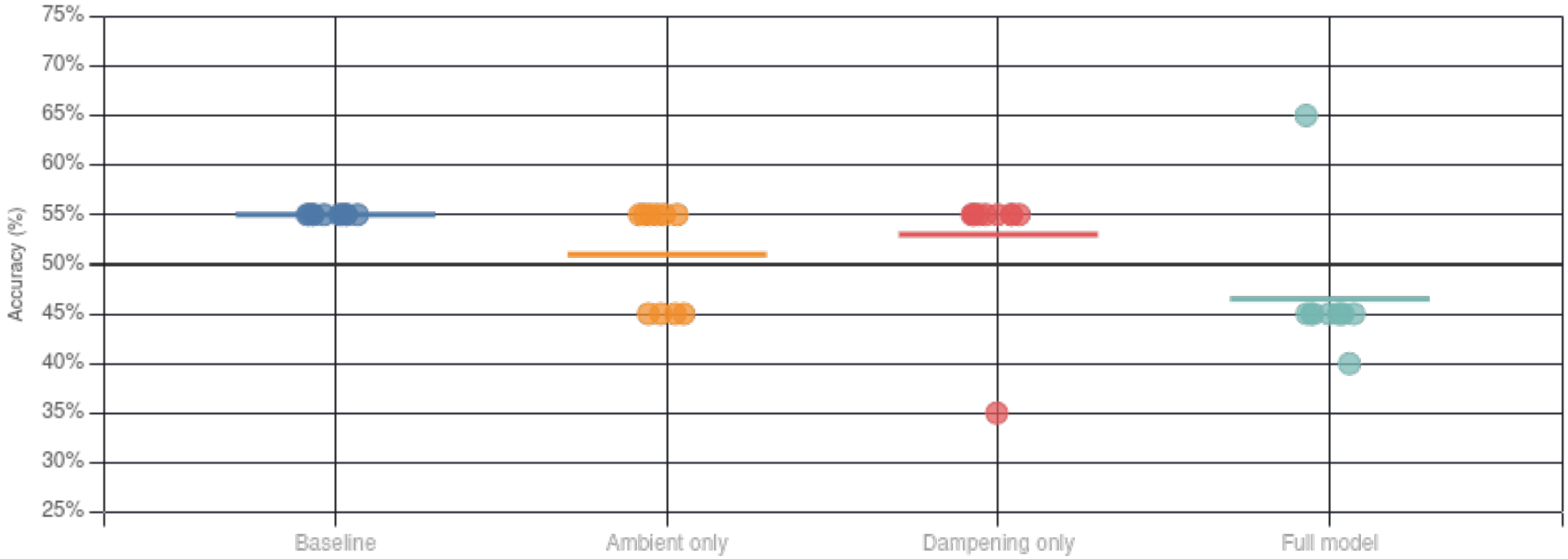
Verdict: propagationCycles=3 is significantly worse — p<0.01 for Full model.
Full model dropped to 46.5% mean (vs 49.0% in exp-010, vs 53.0% in exp-004). Ambient only is now also significantly worse (p<0.05). Only seed 888 escaped at 65%; the other 9 seeds are stuck at 40–45%.

Key finding: flag saturation is finally broken — but accuracy is not improving.
Ep-500 latch rates are now 25–81%, down from 87–93% in exp-010 and uniformly 90%+ in exp-008. The additional propagation cycles are creating more direction flips in the eligibility traces (signals bounce through the recurrent graph 3× instead of 1×), which penalises streak-building and prevents the flags from saturating. This is the selective pressure we were looking for.

The problem: seed 888 (65% final, 32.9% latch) confirms the pattern — lower saturation correlates with better performance. But the other 9 seeds still get 45% even with low latch rates (25–53%). Something else is blocking them.

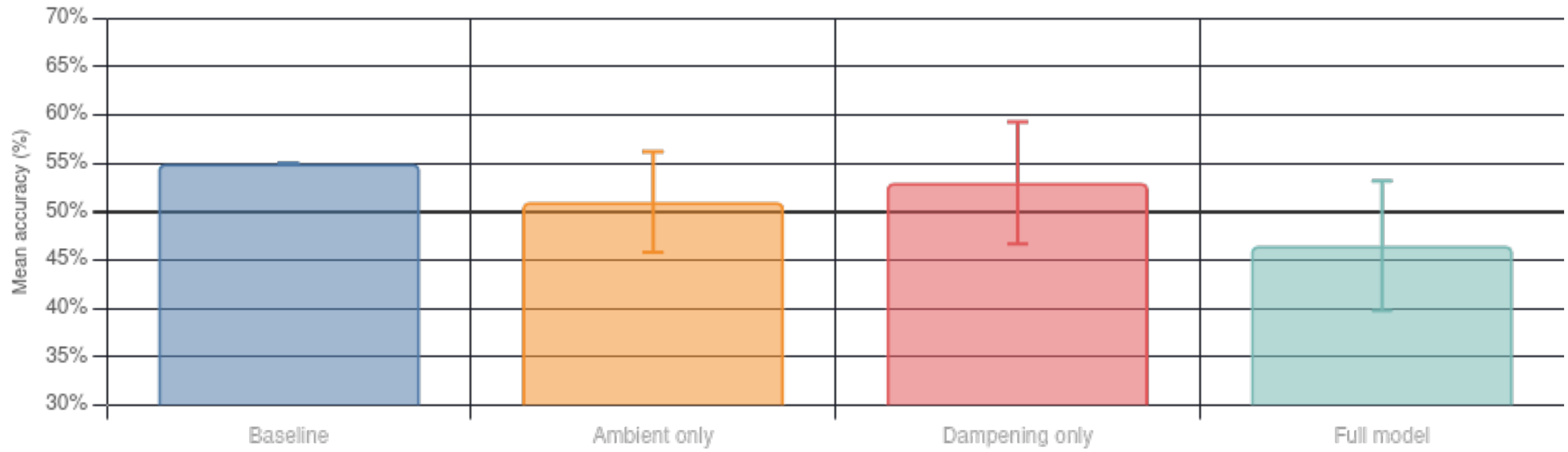
Baseline Ambient only Dampening only Full model

1 — ACCURACY DISTRIBUTION ACROSS SEEDS



Full model: one outlier at 65% (seed 888), rest collapsed to 40–45%. Baseline still uniformly 55% — the reward pathway alone can find a stable attractor but the Full model cannot.

2 — MEAN ± 1 STD



Full model (46.5% ± 6.7%) is significantly below Baseline (p<0.01). Ambient only also significantly degraded. Dampening only (53% ± 6.3%) is the best non-Baseline condition.

3 — PAIRED T-TESTS VS BASELINE

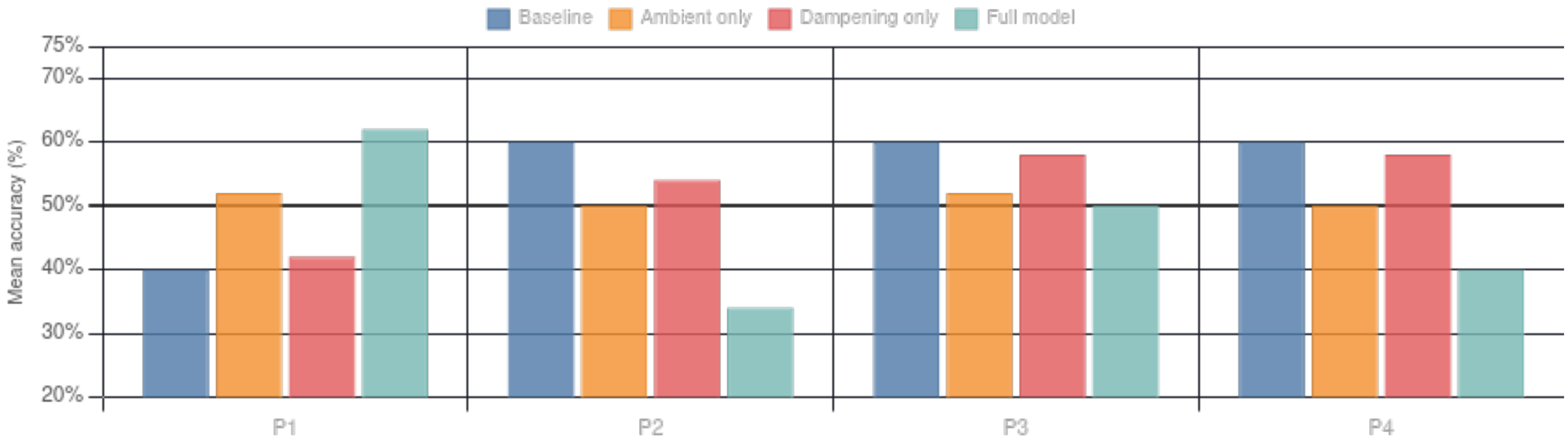
Comparison	Mean diff	t	p	Result
Ambient only vs Baseline	−4.0%	−2.4495	0.0271	* p<0.05
Dampening only vs Baseline	−2.0%	−1.0	0.2534	ns
Full model vs Baseline	−8.5%	−4.0194	0.0022	** p<0.01

Two-tailed paired t-test, df=9. Strongest negative effect yet for Full model (p<0.01). Multiple propagation cycles appear to destabilise the ambient + dampening + chemical combination.

4 — RAW DATA (ALL SEEDS)

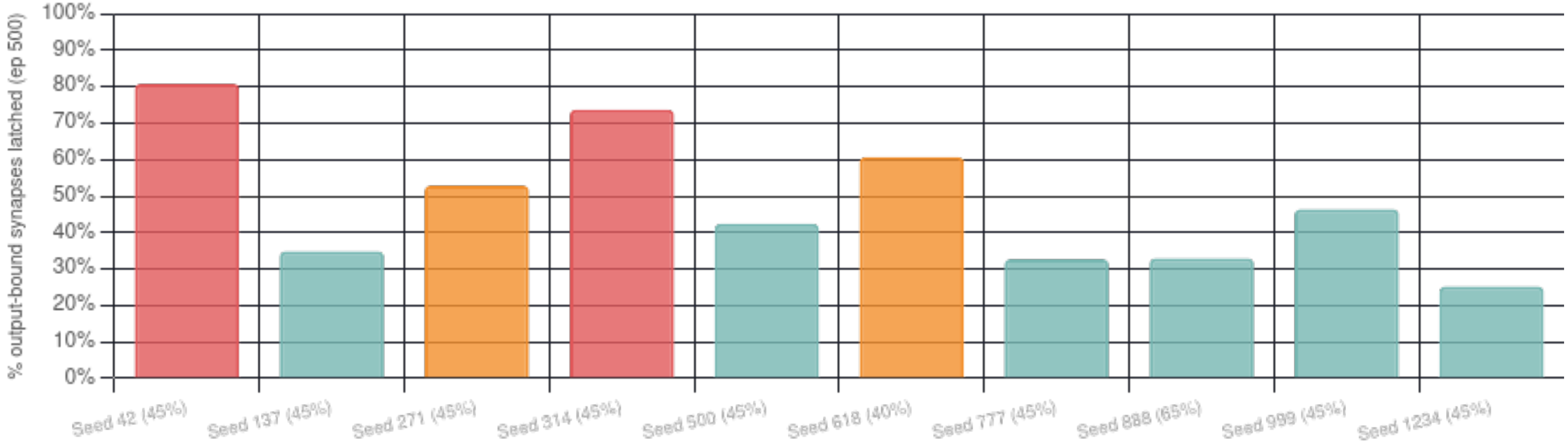
Seed	Baseline	Ambient	Dampening	Full
42	55%	45%	55%	45%
137	55%	55%	55%	45%
271	55%	55%	55%	45%
314	55%	55%	55%	45%
500	55%	45%	55%	45%
618	55%	55%	55%	40%
777	55%	55%	35%	45%
888	55%	45%	55%	65%
999	55%	55%	55%	45%
1234	55%	45%	55%	45%
Mean	**55.0%**	**51.0%**	**53.0%**	**46.5%**
Std	±0.0%	±5.2%	±6.3%	±6.7%

5 — PER-PATTERN ACCURACY (MEAN ACROSS SEEDS)



Full model P2 at 34% — well below chance. P1 at 62% compensates. The network is strongly biasing toward one output pattern regardless of input.

6 — EP-500 FLAG LATCH DIAGNOSTIC (FULL MODEL, OUTPUT-BOUND SYNAPSES)



Major improvement in selectivity: latch rates dropped to 25–81%, down from 87–93% in exp-010. The 3 propagation cycles create more direction flips in eligibility traces, making the 5-streak requirement genuinely hard to satisfy. Seed 888 (65% final acc, 32.9% latch) confirms the hypothesis — lower saturation → better performance. But seeds with 25–53% latch still score only 45%, suggesting that low latch alone is not sufficient.

Seed	Latched / Total	Latch %	Mean |f|	Final Acc
42	131 / 162	80.9%	0.696	45%
137	58 / 166	34.9%	0.408	45%
271	83 / 157	52.9%	0.513	45%
314	104 / 141	73.8%	0.817	45%
500	65 / 153	42.5%	0.443	45%
618	104 / 171	60.8%	0.611	40%
777	55 / 168	32.7%	0.435	45%
888	51 / 155	32.9%	0.411	65%
999	70 / 151	46.4%	0.524	45%
1234	38 / 150	25.3%	0.389	45%

Why low latch + 3 cycles still fails:

With 3 propagation cycles, signals bounce through the recurrent graph multiple times per step. This means output neurons receive compound, amplified signals — the same weight that produced a weak mismatch in 1 cycle may produce a strong one in 3. The eligibility traces become noisier, direction flips multiply, and the flag gate blocks too many synapses. The network can't stabilise because the chemical reward signal and the flag gate are both disrupted by the extra propagation noise. Seed 888 happened to have a topology where 3 cycles helped; the others were hurt.

Progress across iterations (Full model mean):

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Iter 4 (flag gate):                53.0%  max 65%  ← best mean
Iter 6 (flag + anneal):            51.0%  max 65%
Iter 10 (direction-consistent):    49.0%  max 65%
Iter 10b (+ propagationCycles=3):  46.5%  max 65%
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What 10b confirms: more propagation cycles successfully break flag saturation (25–81% vs 87–93%) — this is mechanistically useful. But propagation noise hurts the overall system. The path forward is likely to find propagationCycles that reduces saturation without introducing noise — or to separate the propagation and flagging concerns.

Candidate next steps:

A) Try propagationCycles=2 — less noise, still more signal reach
B) Revert to exp-004 flags (gain=0.3) + propagationCycles=3 — isolate which change helps
C) Diagnose why Baseline is stuck at 55% ceiling — the learning rule itself may be the bottleneck