

mcfeedback — Iteration 7: Connectivity Diagnostic

experiment-007.mjs · No mechanism changes — structural analysis only · N = 10 seeds · Config: experiment-004 base (flag gate + linear reward)

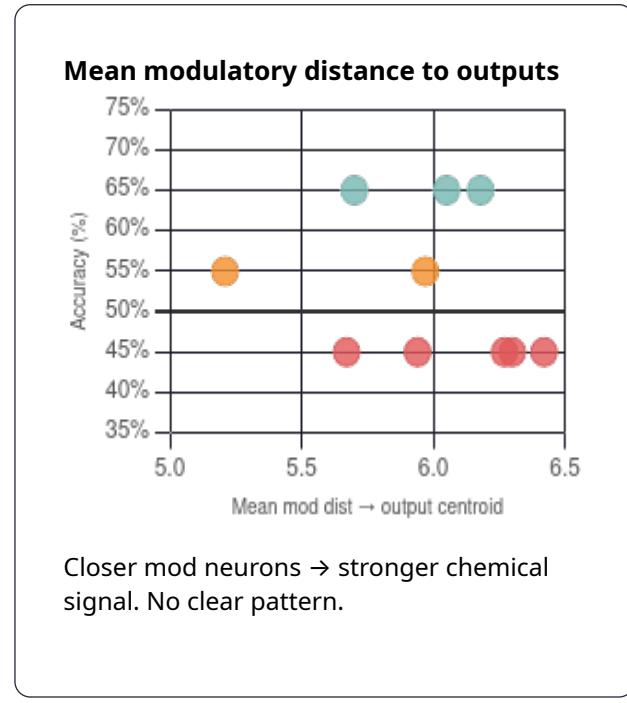
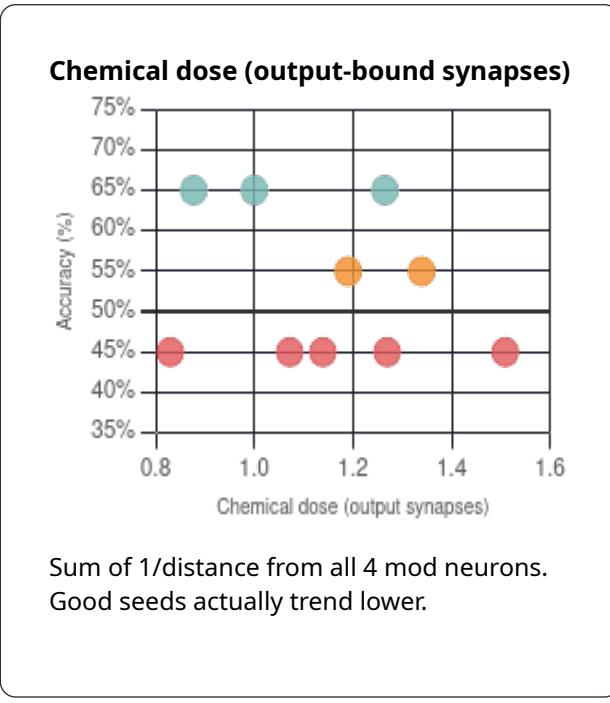
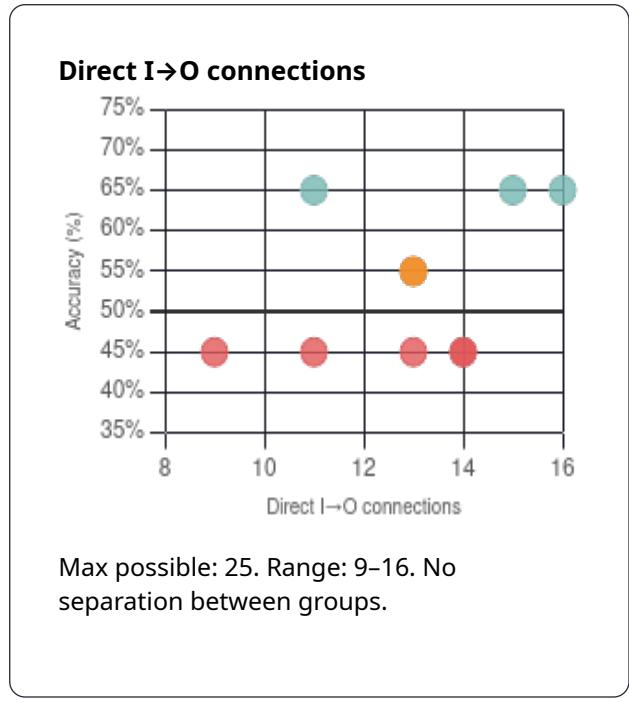
Key finding: the failure mode is not structural.

No pre-training connectivity metric correlates meaningfully with final accuracy. Direct I \rightarrow O connections differ by only 1.4 on average between good and poor seeds (13.6 vs 12.2). Chemical dose budget and modulatory distance to outputs are essentially identical across groups. 2-hop path counts are nearly the same (344 vs 349 — poor seeds are *marginally higher*). The network graph is not the bottleneck.

The 7-seed stall is a dynamical problem — it emerges from early training trajectories, not from wiring.

65% accuracy 55% accuracy 45% accuracy

1 — SCATTER: STRUCTURAL METRICS VS FINAL ACCURACY



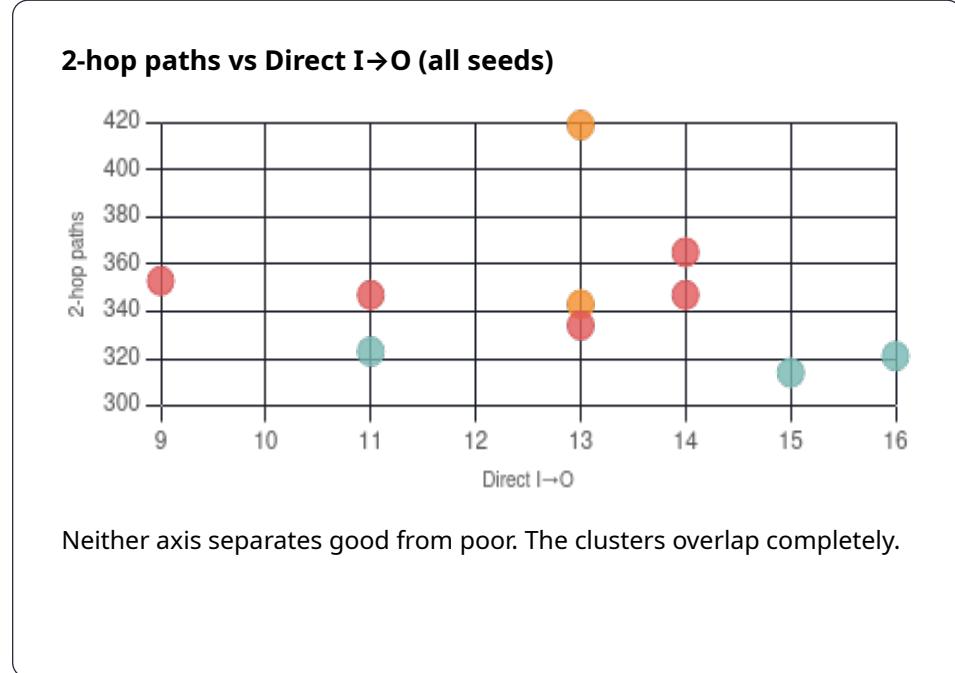
2 — FULL PER-SEED DATA

Seed	Acc%	Direct I→O	2-hop paths	Input fan-out	Output fan-in	Chem dose	Mod dist→out	Total synapses
888	65%	15	314	29.8	31.0	1.000	6.18	1676
999	65%	11	323	28.0	30.2	0.877	6.05	1648
1234	65%	16	321	30.0	30.0	1.265	5.70	1667
618	55%	13	419	31.8	34.2	1.339	5.21	1693
777	55%	13	343	27.0	33.6	1.190	5.97	1718
42	45%	13	334	27.4	32.4	1.072	5.67	1648

137	45%	14	347	30.0	33.2	1.509	5.94	1658
271	45%	14	365	31.0	31.4	1.270	6.42	1701
314	45%	9	353	32.0	28.2	0.830	6.30	1681
500	45%	11	347	29.4	30.6	1.139	6.27	1645

3 — GROUP COMPARISON: GOOD SEEDS ($\geq 55\%$) VS POOR SEEDS ($< 55\%$)

Metric	Good ($\geq 55\%$, n=5)	Poor ($< 55\%$, n=5)	Delta
Direct I \rightarrow O connections	13.60	12.20	+1.40
2-hop paths	344.00	349.20	-5.20
Input fan-out (mean)	29.32	29.96	-0.64
Output fan-in (mean)	31.80	31.16	+0.64
Chemical dose (output)	1.130	1.164	-0.03
Mod dist \rightarrow output centroid	5.82	6.12	-0.30



What the null result rules out:

- ✗ Insufficient direct input \rightarrow output pathways
- ✗ Too few 2-hop paths through hidden neurons
- ✗ Weak chemical dose — poor seeds get equal or slightly more reward signal

- ✗ Bad modulatory neuron positioning
- ✗ Sparse fan-out or fan-in

What this implies about the actual bottleneck:

The failure is in the *early training dynamics*. The flag gate requires ~2 turns of consistent same-direction trace to unlock a synapse.

Whether a synapse sees consistent traces depends on which patterns fire together in the first 50–100 episodes — a function of threshold initialisation and the specific input patterns presented, not the graph topology.

Next diagnostic: log flag strength distributions at episodes 100, 300, and 500. If good seeds show flags already latched ($\text{flagStrength} \geq 0.5$) on output-bound synapses by episode 100 while poor seeds are still at ~0, the bottleneck is flag gate bootstrapping speed. Fix: lower `flagStrengthThreshold` or raise `flagStrengthGain` so weak early signals can still accumulate — or add a short warm-up phase with the gate disabled.