

Grounding = immigration

fresh verified samples from a fixed external source enter the training mix every generation

Recombination = sex

a child inherits from several parents, reassembling variants that arose in different lineages

Epistasis (entangled skills)

a variant's fitness contribution depends on the variants present at the other loci

The composed society

selection, recombination, diversity preservation and grounding on one population

Speciation

reproductive isolation: diverged lineages no longer produce viable (mergeable) offspring

| Exact model                                                                                                          | Trained networks                                                                                                                     | Language models                                                                                             |
|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Wright-Fisher simulator (NumPy)<br><i>closed forms · bitwise-reproducible</i>                                        | RNN · MLP · VAE on a synthetic oracle;<br>convolutional VAE on MNIST<br><i>sign-level tests · exact oracles</i>                      | LoRA specialists on Qwen 0.5B & 7B;<br>exact-match verifier<br><i>seed-replicated signs</i>                 |
| immigration-drift equilibrium:<br>$g \approx 0.05$ retains $\geq 95\%$ diversity;<br>observation floor $1 - e^{-mp}$ | collapse & rescue in every<br>architecture; MNIST: dry 30 → 1 modes,<br>10% grounding holds 30/30;<br>estimator-bias learning kernel | <i>not tested at this tier</i>                                                                              |
| blending conservation law<br>(first-order cancellation);<br>union-operator gain; Fisher-Muller                       | merge rescues two forgetting<br>specialists ( $\approx 0.50 \rightarrow 0.955$ )                                                     | merged specialists beat every parent<br>(5 seeds at 0.5B; 7B); routing vs<br>averaging: the headroom rule   |
| NK landscapes: outbreeding<br>depression; directed sex restores<br>the gain; mate-pool breadth optimum               | <i>not tested at this tier</i>                                                                                                       | bred-and-screened offspring beat<br>the blind blend in every seed<br>(hard, unsaturated tasks)              |
| four-arm ablation: grounding, sex,<br>diversity each removed<br>→ three distinct failures                            | <i>not tested at this tier</i>                                                                                                       | <i>open — the stated gap</i>                                                                                |
| BDM incompatibility model:<br>isolation cliff; quadratic snowball                                                    | barrier decomposition under<br>permutation+rescaling; conflict<br>sweep 0.97 → 0.03; emergent null                                   | convention conflict → hybrid<br>breakdown; duration null; pre-merge<br>predictive test (13 cond. × 3 seeds) |