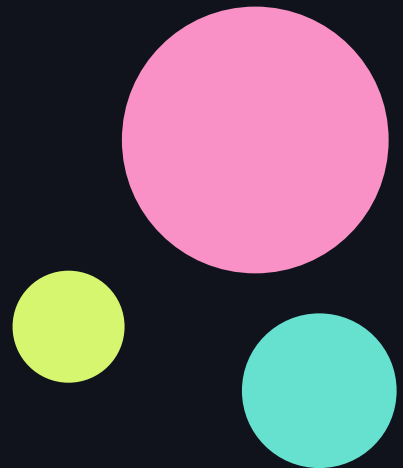


ARTIFICIAL LIFE ZOO

A SMALL WORLD WITH CONSEQUENCES.



A playable agent-based ecology, an invitation to inspect its assumptions, and a field notebook for experiments that can be repeated.

VERSION 1.0 • OFFLINE SIMULATION • NO TRACKING

What is artificial life?

Artificial life research studies life-like processes using computational, robotic or chemical models. This project takes one modest computational route: simple artificial agents move, acquire energy, reproduce and die in a bounded grid. The agents are abstract objects, not synthetic organisms.

What counts as emergence?

A pattern may emerge when many agents obey local rules without central coordination. Clustering or oscillating population totals are system-level observations. They do not mean that the agents have intentions, experience or foresight.

Three morphologies

Grazers consume food patches and pay low energy costs. Hunters seek nearby non-hunters, consume a prey agent and spend more energy each tick. Violet scavengers consume the same food patches but pay more metabolic energy and begin with higher speed. These are chosen game mechanics, not verified biological species.

Why the zoo metaphor?

The visual vocabulary suggests a bestiary: colourful little shapes with lifecycles and descendants. This is artistic framing. It is not a claim that the software creates consciousness, ecological realism or autonomous intelligence.

Rules that actually run

World

52 columns by 32 rows; wraparound edges. One unit of food per cell, and at most 340 agents.

Initialization

A 32-bit seeded xorshift generator places food in roughly 28% of cells; 85 grazers and 15 hunters begin with bounded energy and speed.

Every tick

1. Regrow vacant food cells with independent seeded draws. 2. Shuffle a snapshot of existing agents. 3. Each agent searches within the Manhattan sensing radius, moves on the wrapped grid and feeds if a target is encountered. 4. Subtract energy. 5. Above a threshold, split energy with a child. 6. Remove exhausted or old agents. 7. Record totals.

Heritability and mutation

New agents inherit a single speed trait. At the mutation probability, speed shifts by +0.2 or -0.2, clipped to 0.55–1.75. A speed value above 1 allows an additional movement step probabilistically.

Death and history

Energy at or below zero, or age reaching 420 ticks, removes an agent. A history sample is recorded at tick 1 and every ten ticks; the most recent 240 samples are retained.

Same seed, same choices

Reproducibility here means that one code version can replay the same seeded pseudorandom stream when the visitor repeats the same operations in the same order. It does not mean the trajectory is scientifically validated, and it does not mean two different sequences with the same seed must match.

The proper control

Create a seed, save the JSON state, then compare alternative futures by loading the same saved state before each intervention. Change only one parameter across branches if you want to attribute a difference to that parameter.

Checkpoints are not parallel universes

The on-site A and B comparison records two observed endpoints. A comes before B in one run. To run alternative branches, save a state, change one setting, advance, record, reload, change a different setting, and advance the same number of ticks.

Exports

Save State produces JSON with rule values, seed, PRNG state, agents, food grid, history and event log. Export History produces a CSV with tick, grazer, hunter, scavenger and food counts. Data remain on your device unless you share the files.

Resource pulse and lag

Experiment A — sudden abundance

Use seed 120426. Run until tick 120 and record species counts. Trigger BLOOM, which attempts 350 randomly chosen patches, adding food only where a patch is empty. Observe 100 more ticks. What peaks first: food, grazers or hunters?

Experiment B — sudden scarcity

Reset to seed 120426. Run to the same tick, trigger DROUGHT, which removes each existing food patch with probability 0.6. Advance 100 ticks. Plot or export history. Does abundance recover before agent populations do?

What to record

Date; version; seed; rules; tick of intervention; counts at intervention; counts after 20, 50 and 100 more ticks; any extinctions; alternative explanations. Causation cannot be inferred from one visual trace alone.

Interpretive caution

A resource pulse in this toy model is not a calibrated analogue of famine, pollution, policy or climate. The question is about feedback and delayed effects in a known model, not forecasting actual ecosystems.

One knob; two futures

Experiment C — metabolism

Save the world at tick 80. Record population and food. Run 80 ticks with metabolism 1.0, export CSV, then load the saved state. Set metabolism to 1.8 and run exactly 80 ticks. Compare population peaks, deaths and end counts.

Experiment D — a newcomer

Load an identical state twice. In one branch, introduce 24 scavengers; in another, do not introduce them. Compare populations at equal tick distances. A founder is not guaranteed to persist: it must obtain energy under the same resource limits as existing agents.

A useful null result

Sometimes an intervention makes little difference because agents are already near extinction, the altered parameter is not binding or the timeline is too short. A small effect is still a finding about this model.

Reflect

Which variables did you hold constant? Which did the program change internally? Did the narrative you told about a lineage exceed the evidence in the graph? How would you redesign the model to test a different mechanism?

What the model cannot tell us

No evidence of consciousness

The software assigns numeric states and updates them according to fixed instructions. Neither goal-seeking appearance nor reproduction establishes awareness, sentience or welfare.

Not a population forecast

Missing mechanisms include real physiology, life stages, geography, disease, mating, species-specific niches, migration, seasonal cycles and parameter calibration.

Finite computation

Caps of 340 agents, 1,664 cells and 240 history samples are deliberate engineering choices. They can affect long-run dynamics and limit ecological interpretation.

Mutation does not imply adaptation

A speed-trait change can be beneficial, harmful or neutral given the toy environment. Calling such changes evolution requires distinguishing heritable variation, differential reproduction and timescale.

A model is an argument

Every rule encodes a simplification. Inspecting those simplifications is more valuable than treating an attractive animation as objective authority.

Follow the questions

Christopher G. Langton (1986)

Studying artificial life with cellular automata: a foundational starting point for life-like computation.

Joshua M. Epstein (2006)

Generative Social Science: Studies in Agent-Based Computational Modeling. A clear framing for generative explanation and its pitfalls.

Uri Wilensky & William Rand (2015)

An Introduction to Agent-Based Modeling. Useful practical guidance for building, checking and experimenting with ABMs.

John H. Holland (1992)

Complex Adaptive Systems. An influential account of adaptation and system-level patterns.

NetLogo Models Library

A diverse collection of transparent agent-based teaching models; compare this zoo with its ecology and population examples.

QUESTIONS TO KEEP

Which appearance of intention can be explained by rules? Which assumptions dominate outcomes? What would count as a meaningful validation? How can we distinguish a compelling metaphor from evidence?