The Phantom Fish Tank

User Manual

A web-based cellular automata laboratory inspired by Brian Silverman's 1987 LCSI software of the same name.

1. Getting Started

The Phantom Fish Tank is a single HTML file — no installation, no server, no build step. To open it:

- Double-click **phantom-fish-tank.html** and it will open in your default web browser, or
- Drag the file onto a browser window, or
- Right-click → Open With → choose Chrome / Safari / Firefox.

It works in any modern browser (Chrome, Edge, Firefox, Safari) on desktop or tablet. There is no internet connection required after the file is loaded.

2. The Interface

The screen has three main areas:

Header

The title bar at the top.

The Grid (canvas)

A 60 × 60 lattice of cells in the middle of the page. This is the world. Every edge wraps around — cells leaving the right edge re-enter on the left, top wraps to bottom (a torus). There are no real boundaries.

Controls Panel

A column of small panels with all the controls. Each panel has a one-word title in capitals.

Panel	What it does
Automaton	Pick which set of rules governs the world.
Preset	Load a famous starting pattern for the current automaton.
Draw State	For multi-state automata, choose what kind of cell your mouse paints.
Playback	Generation counter + Play / Pause / Step buttons.
Speed	How many generations per second when playing (1–60).
Grid	Random Fill, Clear, and Fish Tank Mode.
Rule Editor	(Visible only in Custom Rule mode.) Define your own Birth/Survive rule.

3. Drawing on the Grid

- **Left-click** a cell to paint it with the current Draw State.
- **Click and drag** to paint many cells in one stroke.
- **Right-click** (or click-drag with right button) to erase.
- For **multi-state** automata (Logic World, Wire Rules, Mutants), use the Draw State picker to choose which cell type you're painting. Each cell type is a different color matching its appearance on the grid.

You can draw at any time — while the simulation is paused or running.

4. Playback

Control	What it does
▶ Play	Run the simulation continuously. The button turns red and reads "⏸ Pause" while running.
⏭ Step	Pause the simulation and advance exactly one generation. Useful for studying details.
Speed slider	1–60 generations per second. Slower speeds let you watch transitions; faster speeds let you skip ahead.
Gen counter	Shows how many generations have elapsed since the last reset.

The grid resets to generation 0 whenever you switch automata, click Clear, or click Random Fill.

5. The Six Built-in Automata

Conway's Life

The classic. Two states (alive / dead). A dead cell with exactly 3 live neighbors comes alive; a live cell with 2 or 3 neighbors survives; everything else dies. Famous for its gliders, blinkers, and glider guns.

Fredkin's Game

Two states. A cell is alive if and only if it had an odd number of live neighbors last generation. The remarkable property: every starting pattern is self-replicating. Wait long enough and you'll see eight copies of whatever you drew.

Color Life

Conway's rules with one twist — surviving cells age. They cycle through a rainbow (red → orange → yellow → green → cyan → violet → white) before dying. This is the rule that gives the original Phantom Fish Tank its aquarium feel.

Logic World

Four cell types: background, glider, brick (permanently dead), catalyst (permanently alive). Background → glider when it has exactly 2 live neighbors (gliders or catalysts). Bricks and catalysts are walls you place to channel and contain the gliders. With enough work you can build AND gates, OR gates, even adders.

Wire Rules

Four cell types: empty, wire, electron-head, electron-tail. Electrons (head + tail pair) propagate along strings of wire. Wire becomes an electron-head if 1 or 2 electron-heads are nearby. Heads decay into tails, tails decay into wires. You can build diodes, gates, and digital circuits.

Mutants

Three states: dead, ghost, live. A dead cell becomes live if it has exactly 2 live neighbors. Live → ghost → dead. Surprisingly, this rule produces self-organizing gliders of many shapes and sizes that interact, mutate, and evolve. Click Random Fill, press Play, and watch.

6. Loading Patterns

The Preset dropdown changes depending on the current automaton. Pick one, click Load Pattern, and the pattern appears centered on a cleared grid.

Highlights:

- **Conway → Glider Gun**: a 36-cell construction that fires a new glider every 30 generations. Fits perfectly in the 60×60 grid.
- **Conway → R-Pentomino**: a 5-cell shape that evolves chaotically for 1103 generations before stabilizing.
- **Fredkin → Single Cell**: a single cell. Watch it self-replicate.
- **Wire Rules → Electron Loop**: an electron orbiting a closed wire loop forever.
- **Mutants → Sparse Lines**: scattered horizontal lines that quickly produce a swarm of gliders.

Every dropdown also has a Random entry that fills the grid with random cells.

7. Creating Your Own Rules

Pick ✎ Custom Rule… from the Automaton dropdown. A new Rule Editor panel appears with two rows of checkboxes (0 through 8) and a B/S notation display.

B/S Notation

Two-state cellular automata are commonly described by B/S notation:

- **B** = Birth — which neighbor counts cause a *dead* cell to come alive.
- **S** = Survive — which neighbor counts let a *live* cell stay alive.
- Any unchecked count means the cell **dies** (or stays dead).

Conway's Life is B3/S23: dead cells need exactly 3 neighbors to come alive; live cells need 2 or 3 to survive.

Using the Editor

1. Tick or untick the boxes under **Birth** (top row) and **Survive** (bottom row).
2. The B/S notation under the boxes updates as you click.
3. Click **Random Fill** or draw a starting pattern.
4. Press **Play** and watch what happens.

Named Rules Dropdown

A library of well-known rules is provided in the Custom Rule editor. Pick one and the checkboxes update automatically.

Rule	B/S	Character
Conway's Life	B3/S23	The classic.
HighLife	B36/S23	Like Life, but contains a self-replicator.
Maze	B3/S12345	Grows mazelike corridors.
Move	B368/S245	Smooth, gliding patterns.
Seeds	B2/S	Explosive — nothing survives, but everything sparks.
Life without Death	B3/S012345678	Once alive, always alive. Fills the grid with crystals.
Fredkin	B1357/S1357	XOR rule. Self-replicating.
Day & Night	B3678/S34678	Symmetric under cell inversion.
Diamoeba	B45678/S2345	Forms wobbling amoeba blobs.
Gnarl	B3/S0	Chaotic, gnarly fronts.
Morley	B2/S2345	Rich variety of oscillators.

Designing a Rule from Scratch — Tips

The space of B/S rules is large (262,144 distinct rules). Most of them are boring. A few heuristics for finding interesting ones:

- **Start small.** Rules with one or two birth conditions (B3, B36, B23) tend to be the liveliest.
- **If everything dies instantly:** your S set is too restrictive — try adding S2 or S3.
- **If the grid floods to chaos:** your B set is too generous — remove a value.
- **If patterns freeze:** add a higher count to S to allow growth, or remove a low count from S.
- **Most interesting rules** have B and S overlapping at low counts (like B3/S23, B36/S23).
- **Try toggling one box at a time.** Tiny B/S changes often produce wildly different worlds.

8. Fish Tank Mode

Click 🐠 Fish Tank Mode and the program runs itself: it picks a random rule, fills the grid randomly, and lets it evolve. Every 10 to 25 seconds it switches to a new rule. Click again to stop.

> **A note from history**
> This is the “screensaver” mode the original software was designed for. Brian Silverman left the original running for a year in his living room as an electronic aquarium, which is how the software got its name.

9. Fullscreen Mode

Click ⛶ Fullscreen to enter immersive mode — the controls and header hide, the canvas scales up to fill the viewport, and the browser enters its own fullscreen state.

To exit, click the × Exit Fullscreen button (top-right corner) or press Esc.

Fullscreen is the right way to run Fish Tank Mode for an actual electronic-aquarium experience.

10. Keyboard Shortcuts

Key	Action
Space	Play / Pause
S	Step one generation (also pauses)
C	Clear the grid
R	Random fill
Esc	Exit fullscreen / close help modal

Shortcuts don't fire while typing in dropdowns or text inputs.

11. Suggested Experiments

1. **The R-Pentomino marathon.** Load Conway's Life → R-Pentomino. Press Play. Watch for over a thousand generations of chaos before it settles into stable shapes, blinkers, and escaping gliders.
2. **Fredkin replication.** Pick Fredkin's Game. Draw any small pattern (your initials, a smiley face). Run it. Wait. You will see eight copies, then sixteen, then more, all of your original drawing.
3. **Build a wire circuit.** Pick Wire Rules. Use the Wire (state 1) draw color to lay out a closed loop. Add an electron-head and electron-tail next to each other. Press Play and watch the electron travel around your circuit forever. Try forks, bends, and crossings.
4. **Glider gun showcase.** Conway's Life → Glider Gun preset. Run it. Press Pause occasionally and study how each glider is born.
5. **Fish Tank dinner party.** Open in a browser, click Fullscreen, click Fish Tank Mode. Walk away and let it run.
6. **The chaos-to-order knob.** In Custom Rule, start with B3/S23 (Conway). Random Fill. Run. Now toggle one box (say, add B6) and Random Fill again. Compare. Toggle another. Build intuition for which boxes do what.
7. **Diamoeba blobs.** Custom Rule → Named Rules → Diamoeba. Random Fill. The grid forms blobs that wobble and merge.

12. Sharing & Deployment

Because the app is one self-contained HTML file with no dependencies, sharing it is trivial:

Easiest — give the file to someone

Email it, AirDrop it, share via Dropbox/iCloud/Google Drive. They double-click to run. No installer required.

Free public hosting

- **GitHub Pages** — commit phantom-fish-tank.html (rename to index.html) to a repository, enable Pages in settings. Free and version-controlled.
- **Netlify Drop** — visit app.netlify.com/drop and drag the file in. Get a public URL in seconds.
- **Vercel** — similar drag-and-drop experience.
- **Cloudflare Pages** — also free.

Self-hosting

The file works on any web server. Just upload it. Apache, Nginx, IIS, Caddy — anything that serves static files.

Local-network sharing

From a terminal in the folder containing the file:

```
python3 -m http.server 8000
```

Then anyone on your network can open http://your-computer-ip:8000/phantom-fish-tank.html in their browser.

Embedding

Because it's a standalone HTML page, it can be loaded inside an <iframe> on another website.

13. Troubleshooting

The canvas is blank.

Try refreshing the page. Make sure JavaScript is enabled in your browser.

The simulation runs too fast / too slow.

Use the Speed slider. 1 = one generation per second; 60 = sixty.

Drawing doesn't work.

Make sure you're clicking on the grid (the dark-bordered square). On touchscreens, drawing uses tap-and-drag.

Patterns disappear instantly when I press Play.

This is normal for many rules — most random patterns die in Conway's Life. Try drawing a known stable shape (like a 2×2 block) or load a preset.

My custom rule does nothing.

If the Birth set is empty, dead cells can never come alive. If the Survive set is empty, live cells can never persist. You probably want at least one box checked in each row.

Fullscreen has black bars on the sides.

The grid is square (60×60) so it fills only the shorter screen dimension. This is intentional — keeps the cells square.

Credits

This web app is a port and reimagining of *The Phantom Fish Tank: An Ecology of Mind* by Brian Silverman, published by Logo Computer Systems Inc. (LCSI) in 1987. The original ran on Apple II computers using a specialized version of Apple Logo II. This version runs in any modern browser.

The cellular automata rules implemented are direct translations of the rules described in the original book. The Custom Rule feature uses standard B/S (Birth/Survive) notation as developed by the cellular automata research community over the decades since.

Gary Stager worked with Claude Code to create the modern web-based version.