

CHROMEBOOK LAB- The Game of Life

The Game of Life is not your typical computer game. It is a 'cellular automaton', and was invented by Cambridge mathematician John Conway.

This game became widely known when it was mentioned in an [article](#) published by Scientific American in 1970. It consists of a collection of cells which, based on a few mathematical rules, can live, die or multiply. Depending on the initial conditions, the cells form various patterns throughout the course of the game. For an introduction, you can watch the [video fragment from Stephen Hawking's The Meaning of Life](#).

The basic idea is to start with a simple configuration of counters (organisms), one to a cell, then observe how it changes as you apply Conway's "genetic laws" for births, deaths, and survivals. Conway chose his rules carefully, after a long period of experimentation, to meet three desiderata:

1. There should be no initial pattern for which there is a simple proof that the population can grow without limit.
2. There should be initial patterns that *apparently* do grow without limit.
3. There should be simple initial patterns that grow and change for a considerable period of time before coming to end in three possible ways: fading away completely (from overcrowding or becoming too sparse), settling into a stable configuration that remains unchanged thereafter, or entering an oscillating phase in which they repeat an endless cycle of two or more periods.

In brief, the rules should be such as to make the behavior of the population unpredictable.

Conway's genetic laws are delightfully simple. First note that each cell of the checkerboard (assumed to be an infinite plane) has eight neighboring cells, four adjacent orthogonally, four adjacent diagonally. The rules are:

1. Survivals. Every counter with two or three neighboring counters survives for the next generation.
2. Deaths. Each counter with four or more neighbors dies (is removed) from overpopulation. Every counter with one neighbor or none dies from isolation.
3. Births. Each empty cell adjacent to exactly three neighbors--no more, no fewer--is a birth cell. A counter is placed on it at the next move.

It is important to understand that all births and deaths occur *simultaneously*. Together they constitute a single generation or, as we shall call it, a "move" in the complete "life history" of the initial configuration.

How to play:

1. Start with a unique shape of your own choosing. Click on the grid to turn the color ON or OFF to create a unique shape.
2. Draw the shape you started with:
3. Click the next button to see how the shape changes over time.
4. Did your shape stay the same or change?
5. Did it continue to change or did it reach a point of equilibrium where it bounces back and forth between just a few shapes?
6. Did it move or stay stationary?
7. Did it go extinct or survive?
8. Draw the shape you end with and how many generations you went through to get there: