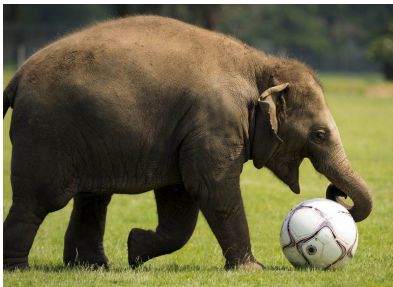
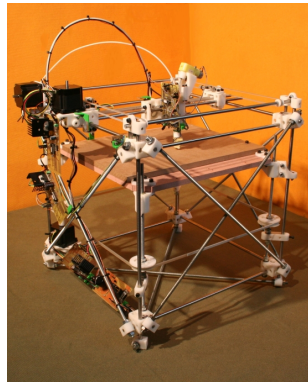
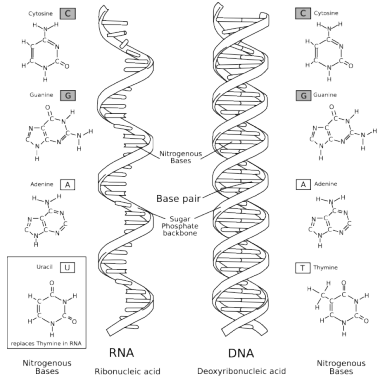
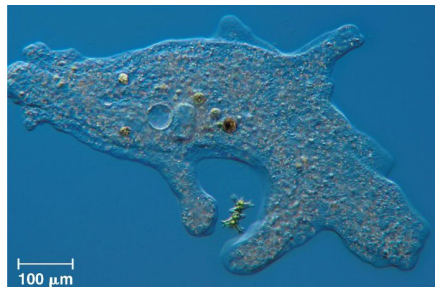


# Cellular automata and Conway's Game of Life



What is life?

Self-replication?





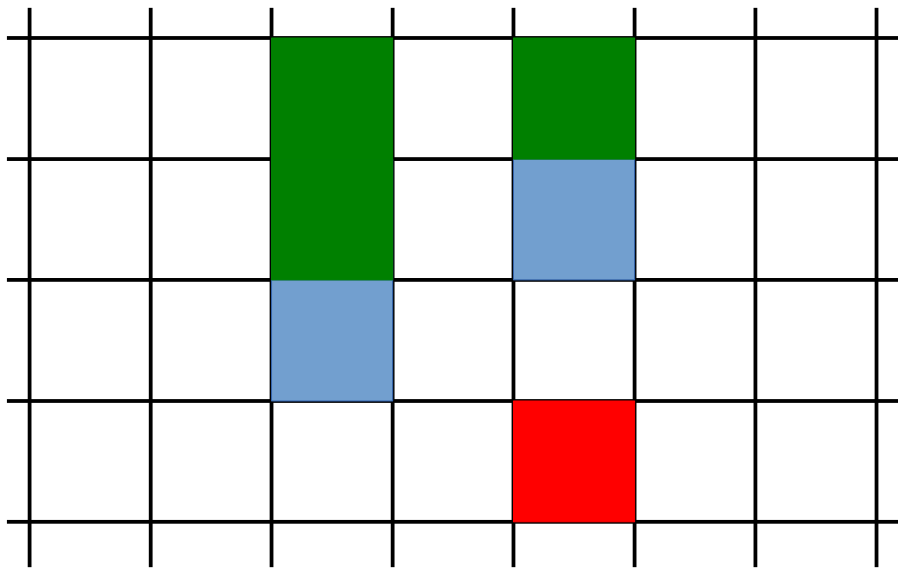
John von Neumann



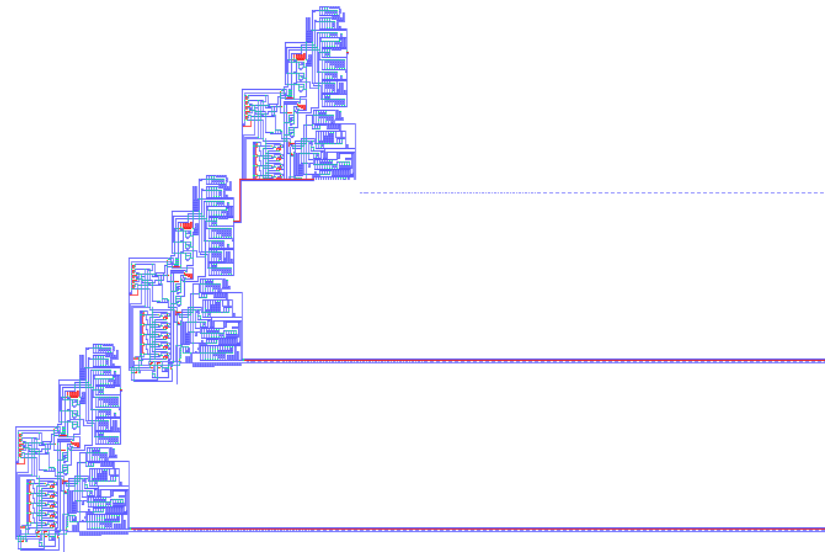
Stanisław Ulam

Replicators have:

- A coded representation of the replicator
- A mechanism to copy the coded representation
- A mechanism for affecting construction within the host environment of the replicator

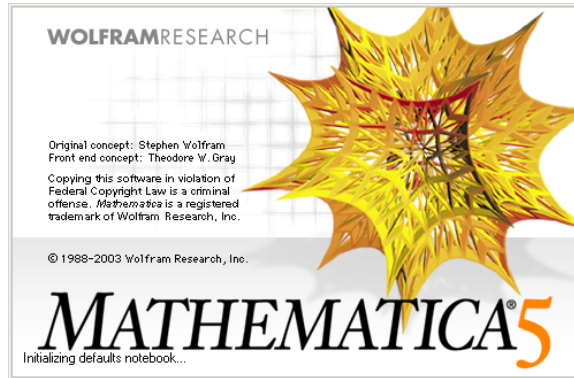


Cellular automaton





Stephen Wolfram

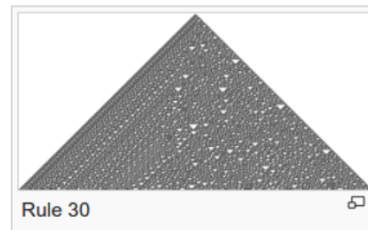


Class 1: Nearly all initial patterns evolve quickly into a stable, homogeneous state. Any randomness in the initial pattern disappears.

Class 2: Nearly all initial patterns evolve quickly into stable or oscillating structures. Some of the randomness in the initial pattern may filter out, but some remains. Local changes to the initial pattern tend to remain local.

Rule 30 cellular automaton

current pattern	111	110	101	100	011	010	001	000
new state for center cell	0	0	0	1	1	1	1	0



Rule 110 cellular automaton

current pattern	111	110	101	100	011	010	001	000
new state for center cell	0	1	1	0	1	1	1	0

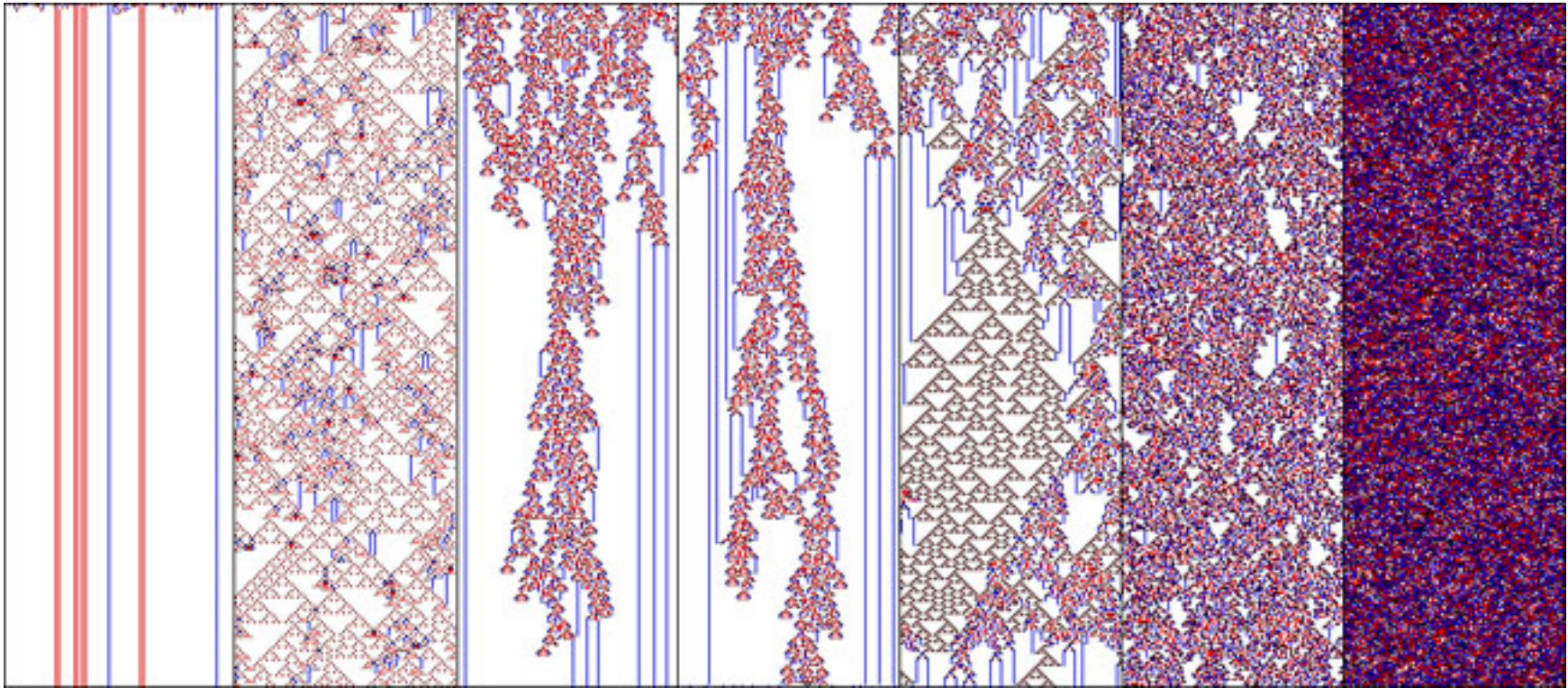


Class 3: Nearly all initial patterns evolve in a pseudo-random or chaotic manner. Any stable structures that appear are quickly destroyed by the surrounding noise. Local changes to the initial pattern tend to spread indefinitely.

Class 4: Nearly all initial patterns evolve into structures that interact in complex and interesting ways, with the formation of local structures that are able to survive for long periods of time.

Rule 110 is Turing complete.





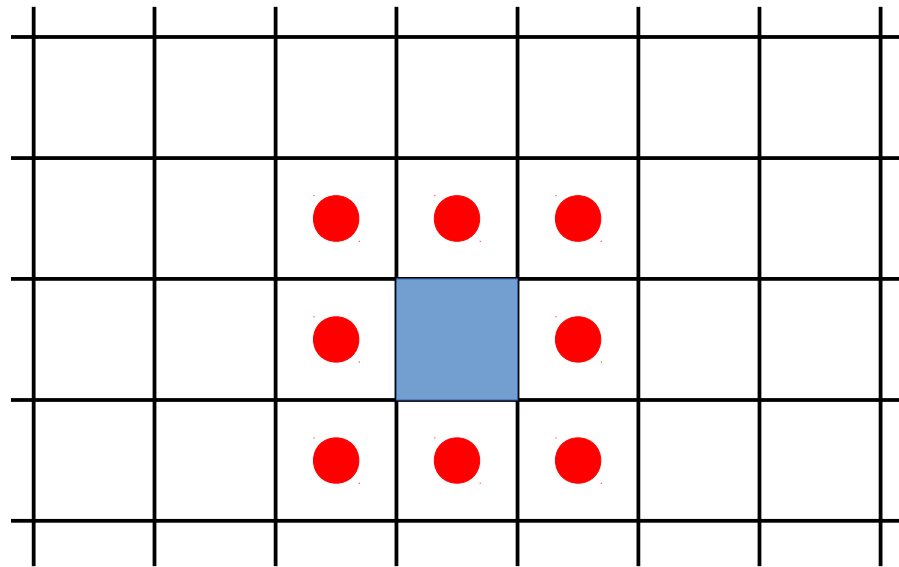
Elementary cellular automata



John H. Conway

## Game of Life

- Any live cell with fewer than two live neighbours dies, as if caused by under-population.
- Any live cell with two or three live neighbours lives on to the next generation.
- Any live cell with more than three live neighbours dies, as if by over-population.
- Any dead cell with exactly three live neighbours becomes a live cell, as if by reproduction.

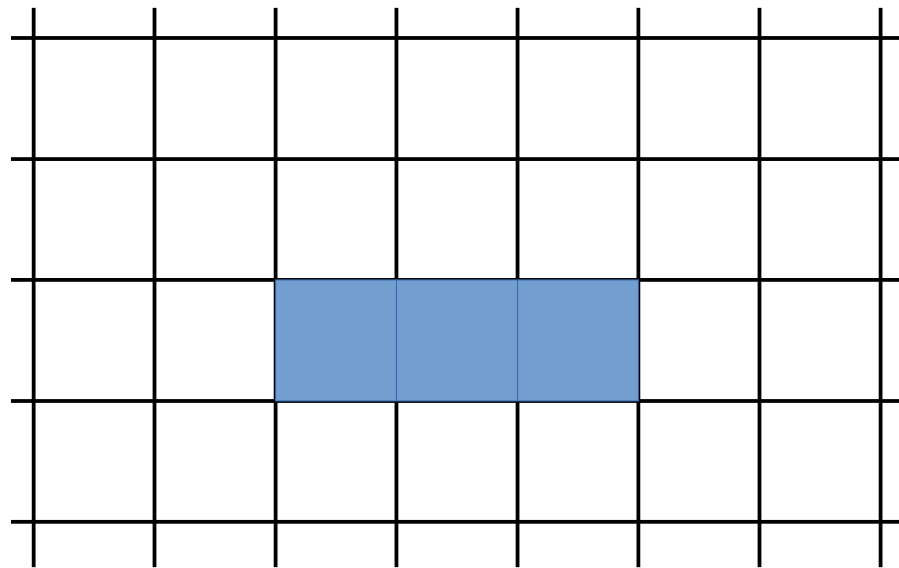




John H. Conway

## Game of Life

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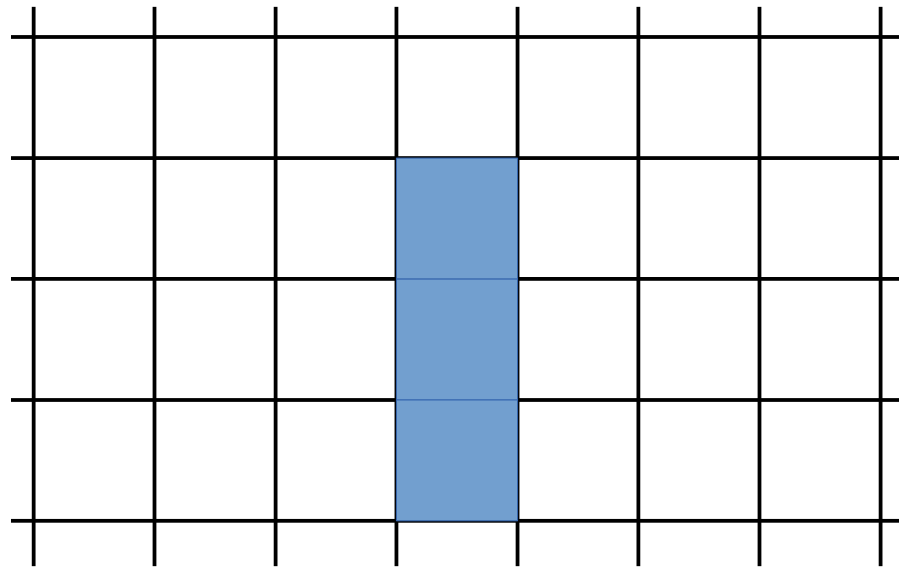




John H. Conway

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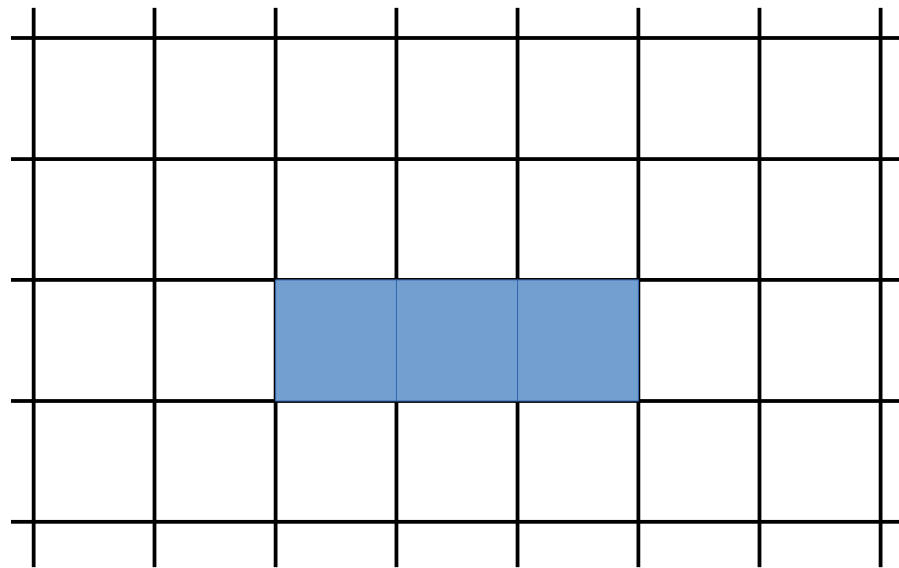




John H. Conway

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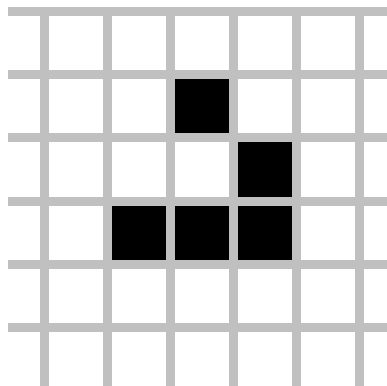




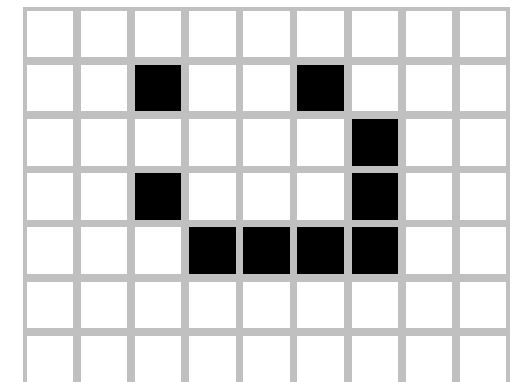
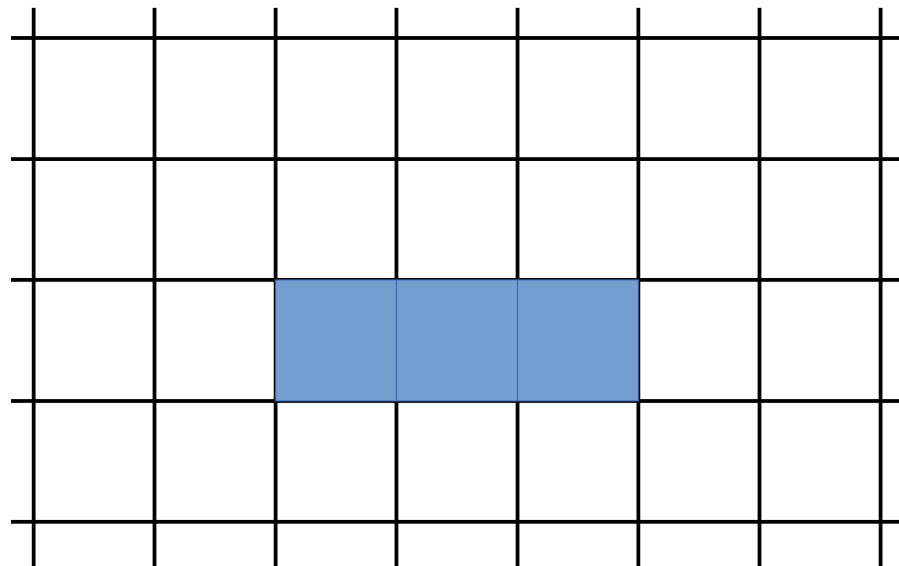
John H. Conway

## Game of Life

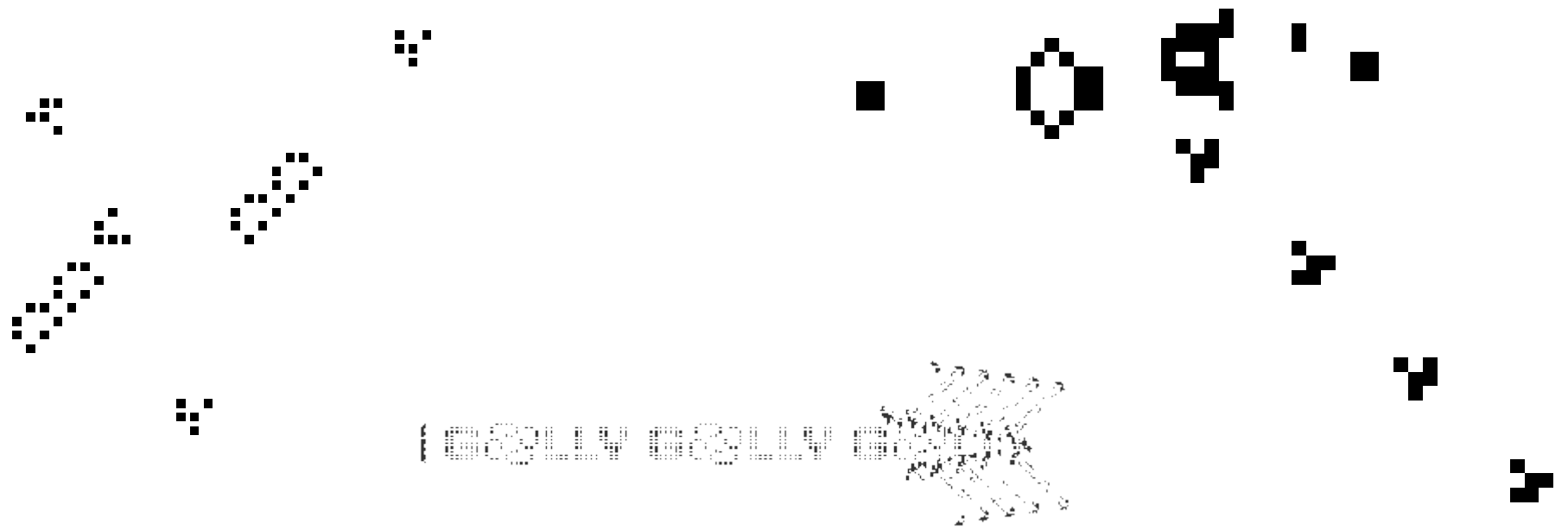
- Any live cell with fewer than two live neighbours dies, as if caused by under-population.
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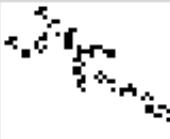
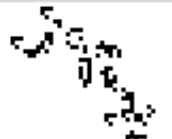

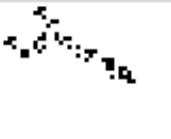






















Glider



Spaceship



 90P4H1Y1	 109P4H1Y1	 89P4H1Y1	 54P4H1Y1	 86P4H1Y1	 71P4H1Y1
 91P4H1Y1	 94P4H1Y1	 121P4H1Y1	 98P4H1Y1	 119P4H1Y1	 118P4H1Y1
 78P4H1Y1	 113P4H1Y1	 143P4H1Y1	 152P4H1Y1	 127P4H1Y1	 119P4H1Y1
 120P4H1Y1	 143P4H1Y1	 122P4H1Y1	 127P4H1Y1	 128P4H1Y1	 119P4H1Y1

# Linear propagator

**Linear propagator** is *arguably* the first explicit example of a replicator in Conway's Game of Life found by [Dave Greene](#) on November 23, 2013, depending on an exact definition of a replicator.<sup>[1]</sup>


As the pattern is too big to be displayed in detail using any reasonable scale (given one pixel were 1 mm, the whole pattern would be almost 15 km wide), the image on the right depicts only the underlying [universal constructor](#).

## References

- ↑ Dave Greene (November 23, 2013). "[Re: Geminoid Challenge](#)". Retrieved on October 18, 2015.

This article is a stub. You can help LifeWiki by [expanding it](#).

### Linear propagator



<b>Pattern type</b>	<a href="#">Puffer</a>
<b>Direction</b>	Orthogonal
<b>Period</b>	237228617
<b>Speed</b>	256c/237228617

## Re: Geminoid Challenge

by [dvgrn](#) » November 23rd, 2013, 12:29 am

“ dvgrn wrote:

The only thing left to do now is to put together the recipe for the northwest replicator unit, and splice it in in front of the Construction Stopper seed construction.

All done now. I've attached three versions. In all of them, the child copy of the replicator is delayed 277 ticks compared to its parent. It would take a fairly comprehensive redesign to change this.

In all three versions, the memory loop period is a multiple of 277. So a descendant replicator will eventually match the original ancestor's phase, and this will happen as soon as possible -- but even in the smallest version, this won't be for several hundred thousand replication cycles (!)

The first version is Replicator-p237228340.mc.gz (27K):

Ⓜ [Replicator-p237228340.mc.gz](#)

*Fastest-running linear replicator*

(26.59 KiB) Downloaded 3067 times

[dvgrn](#)

Moderator

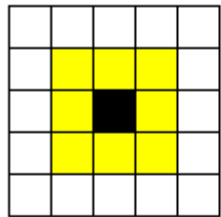
Posts: 2290

Joined: May 17th, 2009, 11:00 pm

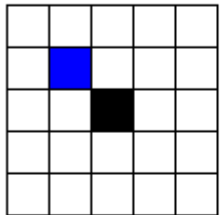
Location: Madison, WI



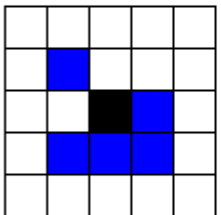
## Rules for the Cellular Automation Game 'Life'



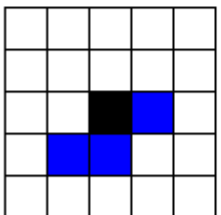
Each cell has 8 neighbors



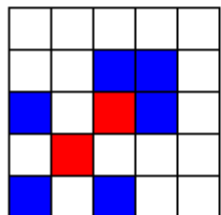
if an occupied cell has 0 or 1 neighbors, it dies (loneliness)



if an occupied cell has 4 to 8 neighbors, it dies (overcrowding)



if an occupied cell has 2 or 3 neighbors, it survives to the next generation



if an unoccupied cell has 3 occupied neighbors, it becomes occupied (birth)

