

An abstract graphic design featuring a dark blue gradient background. On the left side, there is a complex, vertical circuit-like pattern composed of light blue lines and small circles, resembling a stylized tree or a network diagram. This pattern extends from the top to the bottom of the frame. On the right side, there are a few smaller, isolated circuit elements. In the center, the title 'WHAT IS LIFE?' is written in a large, white, sans-serif font. Below it, the author's name 'LENKA PITONAKOVA' is written in a smaller, light blue, sans-serif font.

# WHAT IS LIFE?

LENKA PITONAKOVA

# SPECIAL CREDITS

- University of Sussex, Inman Harvey

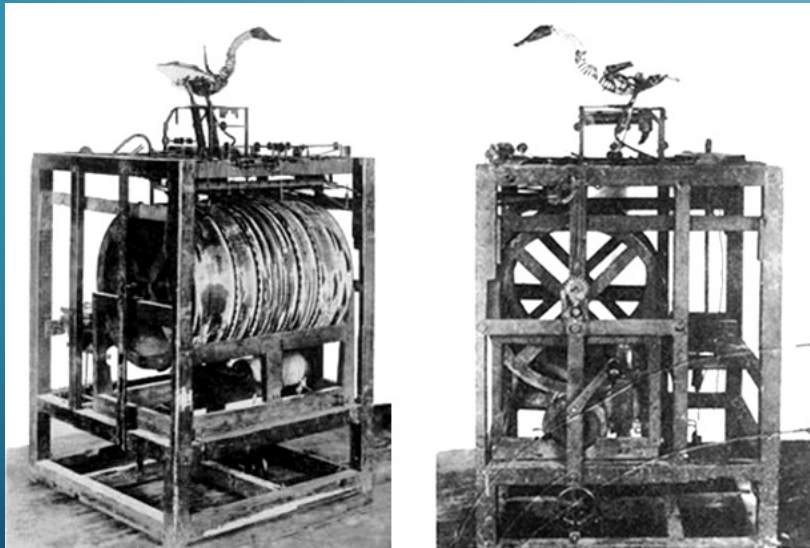


# ARTIFICIAL LIFE (ALIFE)

- “Life-as-it-is”
- “Life-as-it-could-be”
- Chris Langton
- What distinguishes life from no-life?
- Does life have to be carbon-based?
- Can life exist inside of a computer?

How do we know that what we perceive  
as “living” truly “lives”?

## THE DIGESTING DUCK (1739)



The machine



The imaged mechanisms

The **actual** mechanism was very simple!

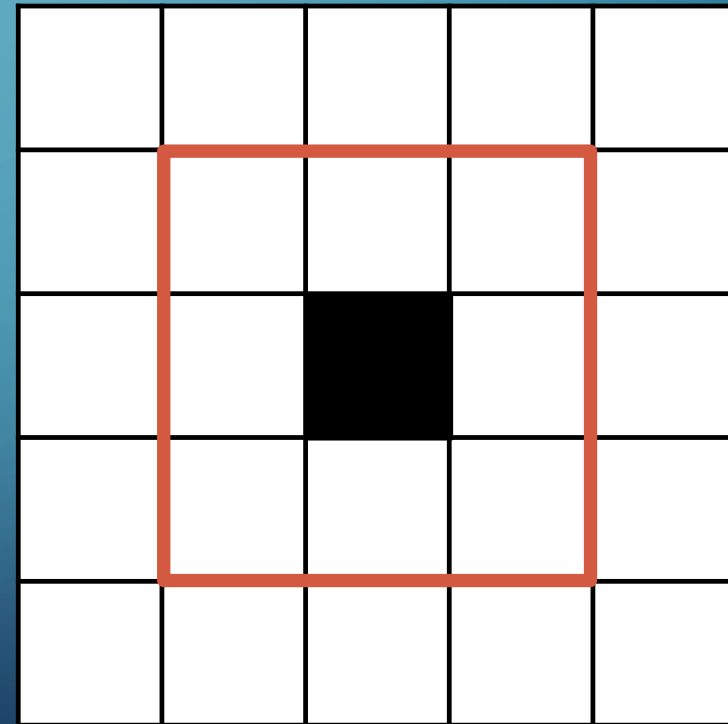
The slide features a dark blue gradient background. In the corners, there are decorative white line art elements resembling electronic circuit boards, with lines and small circles representing components.

# WHEN WE CONSIDER SOMETHING TO BE "ALIVE", HOW DO WE KNOW IT IS TRUE?

- "Food" consumption / waste?
- Purposeful motion?
- Reproduction?
- Death?
- Homeostasis?
- Agency? (Embodiment? Situatedness?)

# GAME OF LIFE

- Simulation of “life” based on a cellular automaton
- 2D grid world
- A cell can be on or off
- It looks at immediate neighbors to determine its next state



# GAME OF LIFE

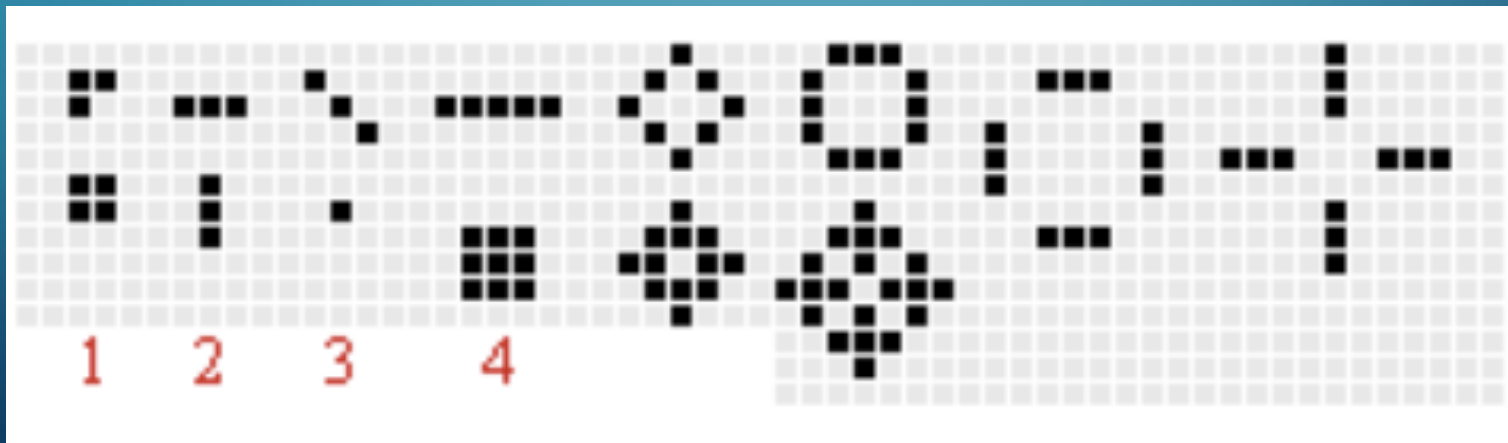
Only 3 rules:

- If you have exactly 2 'on' neighbours (i.e., 2 blacks) stay the same
- If you have exactly 3 'on' neighbours you will be 'on' (black) the next time step (i.e., change to on if you are blank, and remain on if you already are)
- If you have less than 2, or more than 3 on neighbours you will be off (blank) the next time step



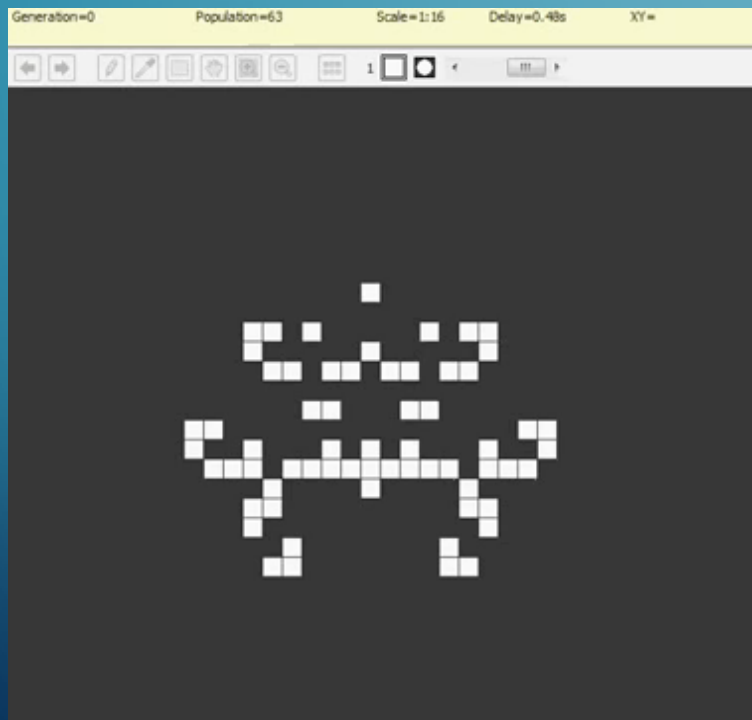
# GAME OF LIFE

"Sequences" appear

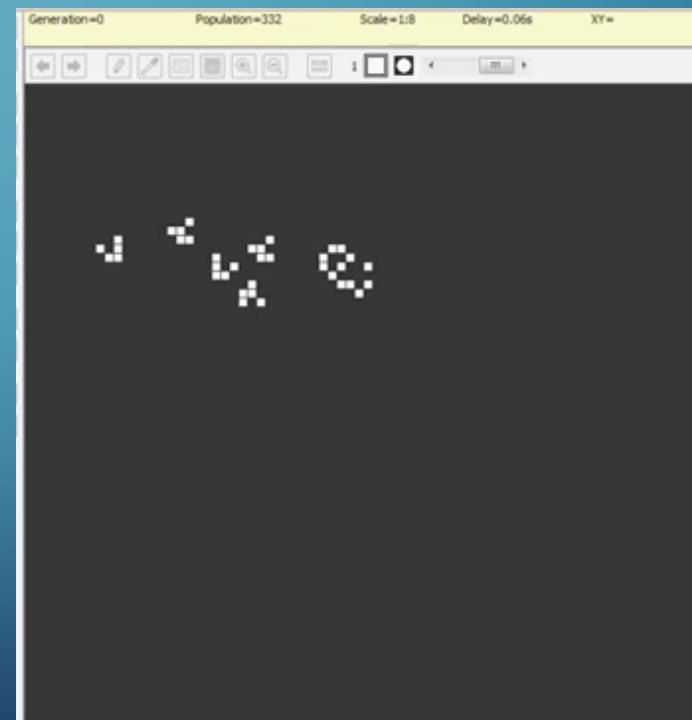




# GAME OF LIFE

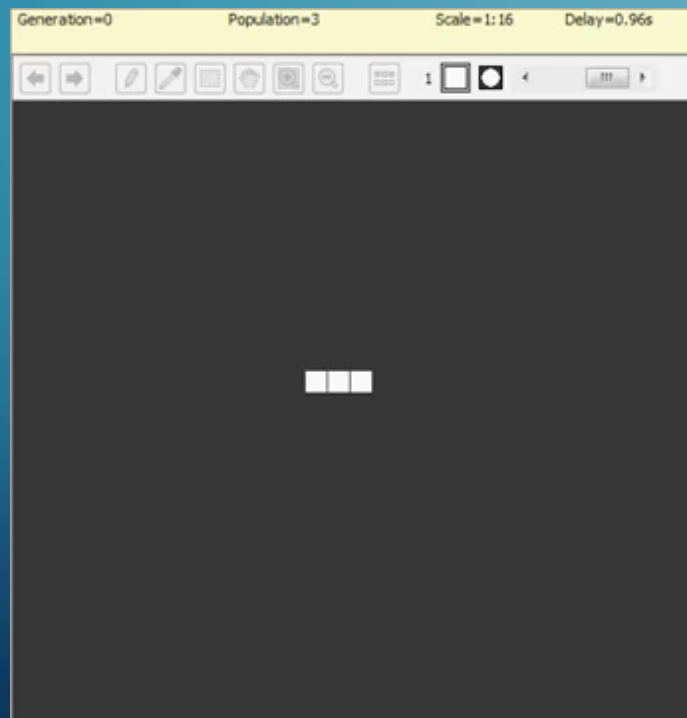


“Fountain”

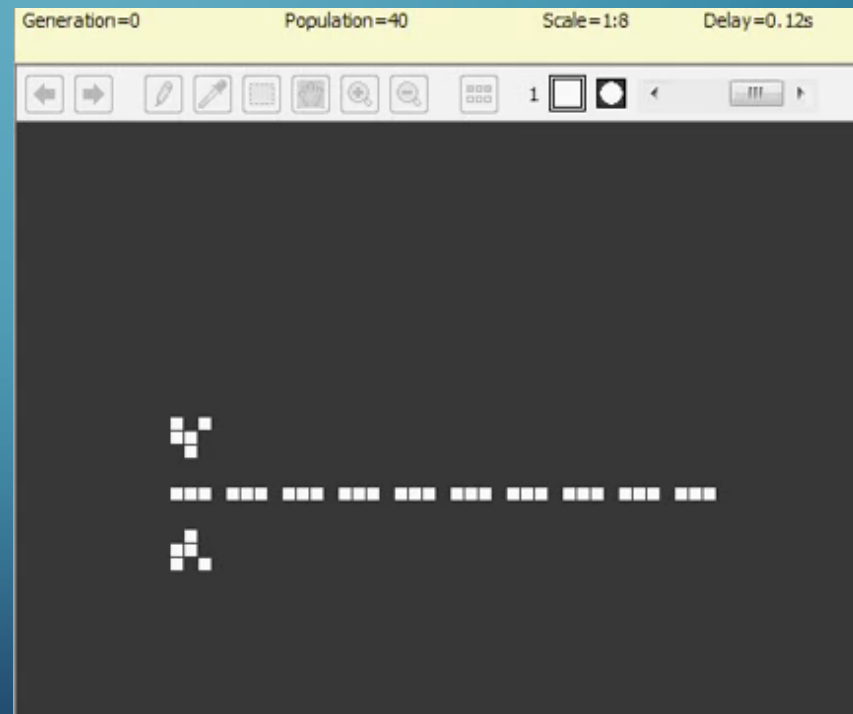


“Mold”

# GAME OF LIFE

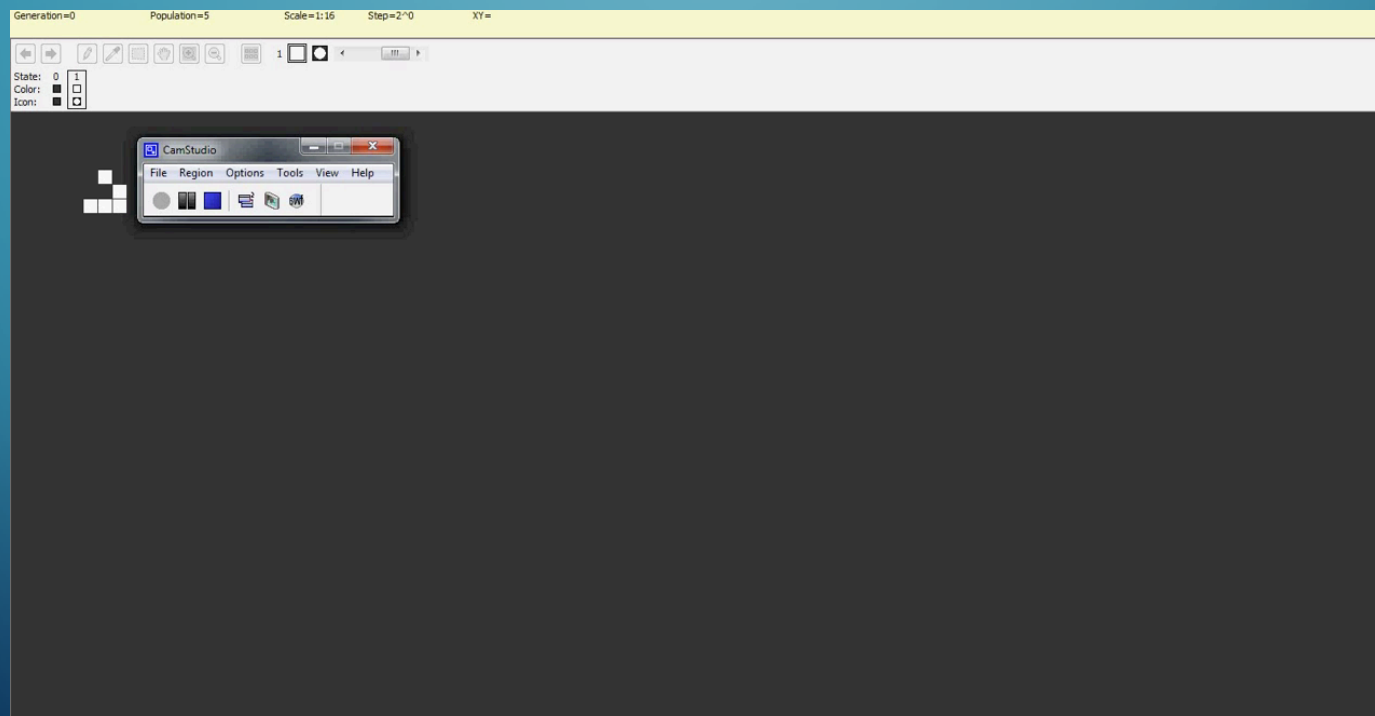


“Blinker”



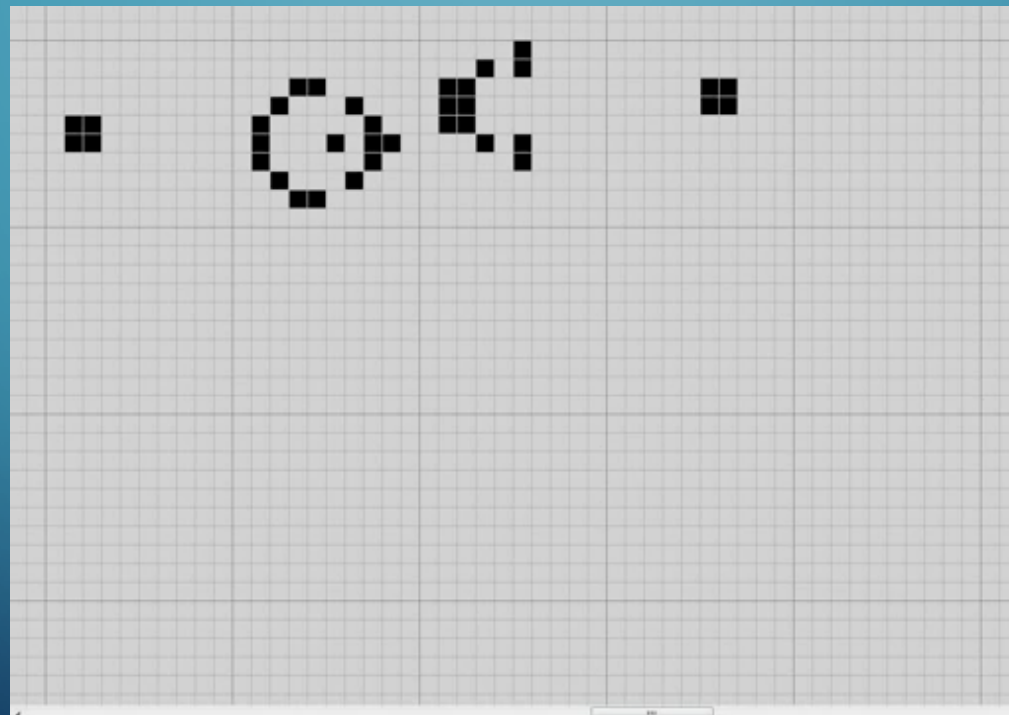
“Blinker Fuse”

# GAME OF LIFE



“Glider”

# GAME OF LIFE



"Glider gun"

# GAME OF LIFE

- Is Glider a good model for life?
  - Agency, movement, situatedness
- Is Glider alive?
- If you were a Glider, how would you test if you are inside of a cellular automaton?

# TIERRA

- A computer program from 80's, written in assembly language
- Artificial “organisms” (programs) competed for “existence” (space in the computer memory) and “food” (computer’s power)
  - Programs could move to different parts of memory
  - Programs could overwrite memory used by other programs, effectively “killing” them
  - Programs could replicate (copy themselves), with random mutations in their code, creating new “life forms”

# TIERRA

- Artificial evolution happened
  - Competition for resources = survival of the fittest
  - Replication + mutation = new species (new programs, new code, new behaviour)



# TIERRA

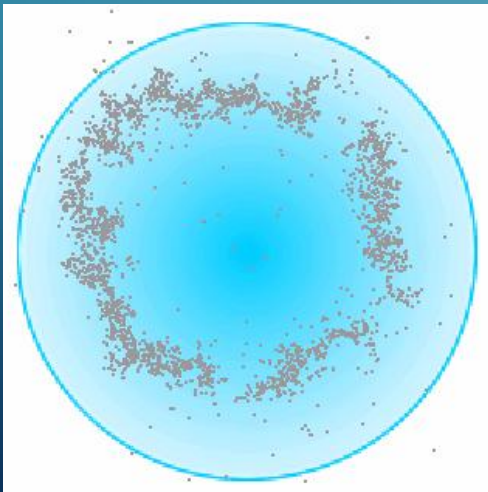
- Coevolution of survival strategies
  - Parasites appeared that could “borrow” replication code of other programs (by reading their code and executing it)
  - Some programs developed “immunity” against them

# TIERRA

- Is it a good model for evolution?
- Are the programs alive?
  - "Food" consumption, situatedness, replication, death
- Is there an analogy between "us and the Universe" and "tierra programs and the computer memory" ?

# APPLICATIONS OF ARTIFICIAL LIFE

- **Agent-based models** to explain biology, evolution, physics, chemistry
- **Study of artificial intelligence**
- **Swarm robotics:** control algorithms
- **Swarm cognition:** the analogy between brains and societies





# THANK YOU. QUESTIONS?

Video references:

Fountain: <https://www.youtube.com/watch?v=q73z9-l2-0g>

Mold: [https://www.youtube.com/watch?v=1-PZue1Cd\\_w](https://www.youtube.com/watch?v=1-PZue1Cd_w)

Blinker: <https://www.youtube.com/watch?v=OrCTmfQWCmQ>

Blinker fuse: <https://www.youtube.com/watch?v=Yeuz7RISsMI>

Glider: <https://www.youtube.com/watch?v=LA-RPmSmHg8>

Glider gun: <https://www.youtube.com/watch?v=GrIO5RJ76D0>