# *Gnarly Computation*

## by *Rudy Rucker*

Industrial Light and Magic

May 18, 2006

The Lifebox, the Seashell and the Soul

**What Gnarly Computation
Taught Me About
Ultimate Reality,
The Meaning of Life, and
How to be Happy**

**(Thunder's Mouth Press, 2005)**

THE LIFEBOX,
THE SEASHELL,
AND THE SOUL

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RUDY RUCKER
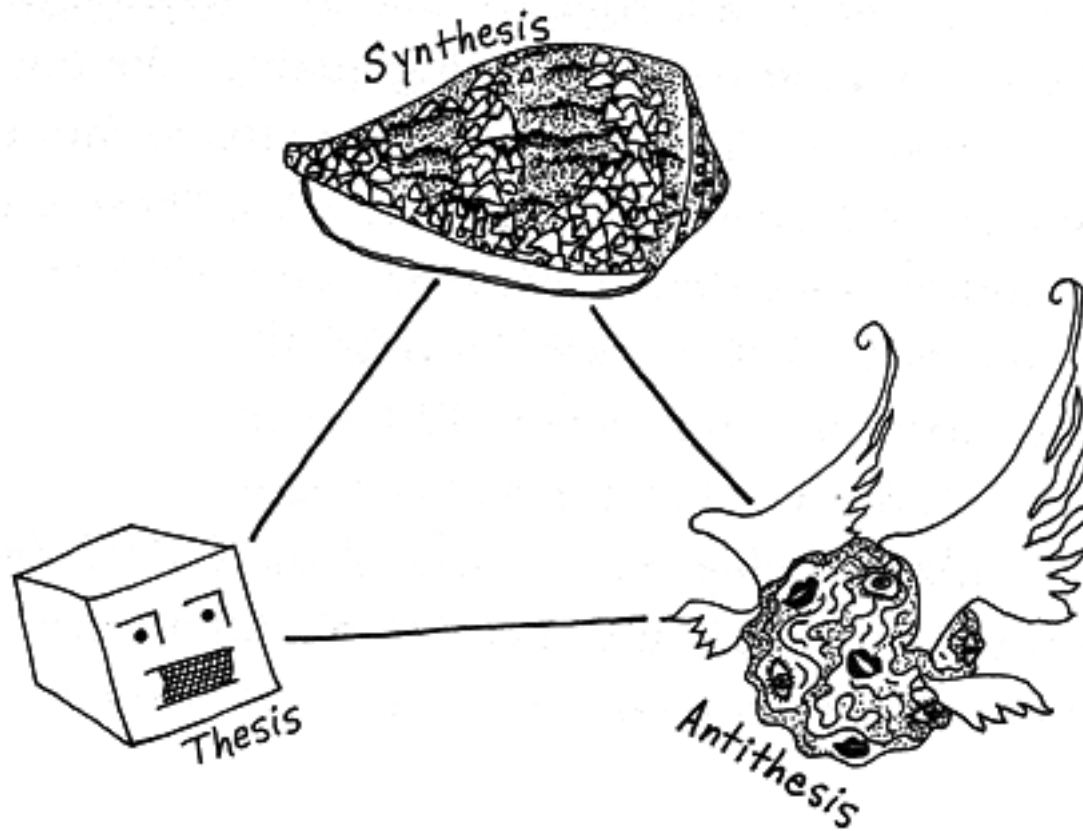
My Book Title is a Dialectic Triad

The *Thesis*, the *Synthesis*, and the *Antithesis*

~

The *Lifebox*, the *Seashell*, and the *Soul*

Dialectic Triad
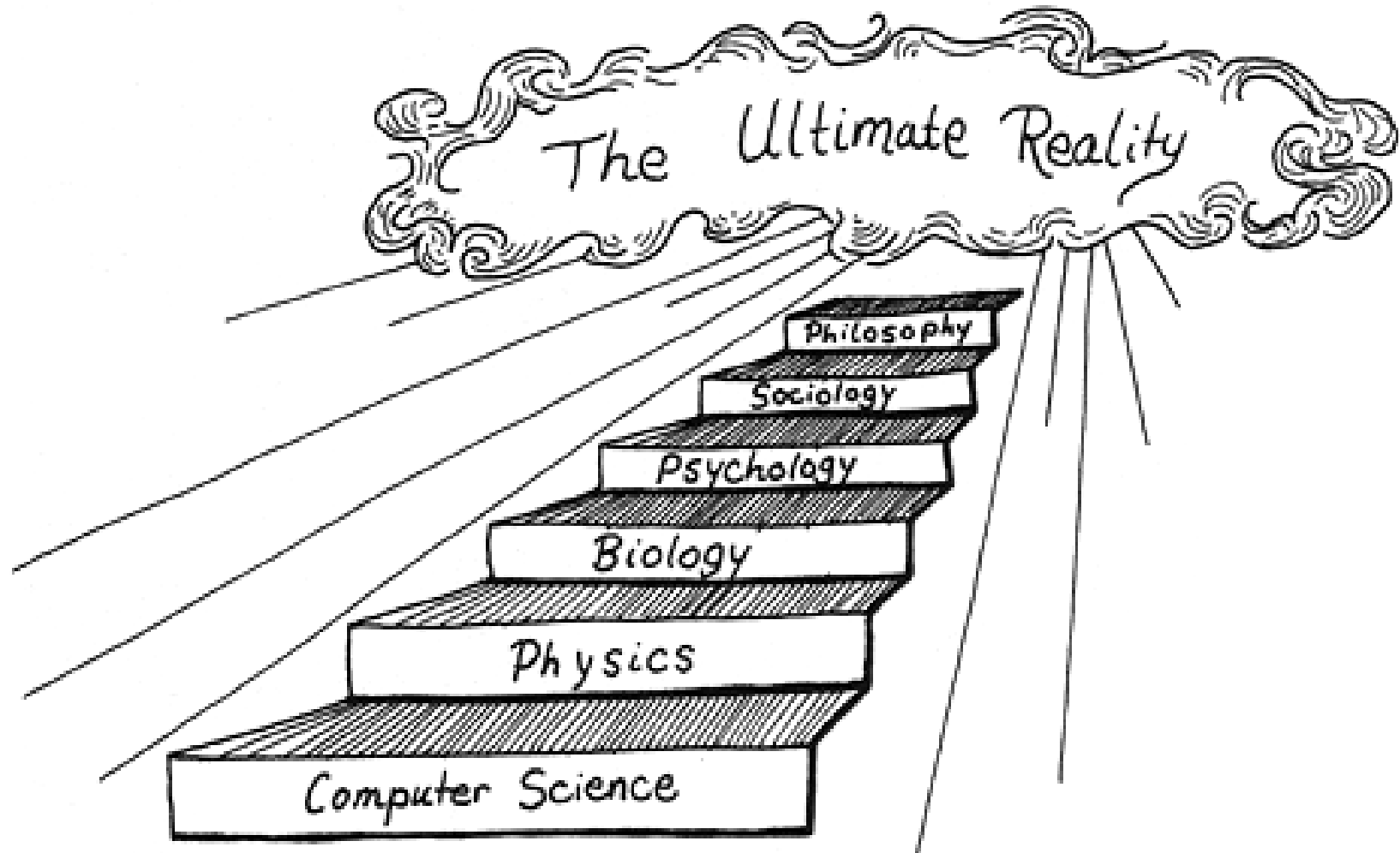
THESIS: "Universal Automatism" The world is made of computations.

❑ A *computation* is a process that obeys finitely describable rules.

❑ The world consists of *many* computations at high and low levels. There need not be a single underlying master computation.

❑ The *human mind* is made of computations: percepts, emotions, intentions, plans, consciousness as a self-symbol in a feedback loop. The "**lifebox**" simulation.

The "Stairway to Heaven" Pattern for Viewing Everything As a Computation

ANTITHESIS: Life Doesn't *Feel* Like a Computation

- The feeling of being alive. "I am."
- Consciousness as merging with the world.
- Dreams.
- Visions of God.
- The **soul**.
- And what about quantum mechanics?
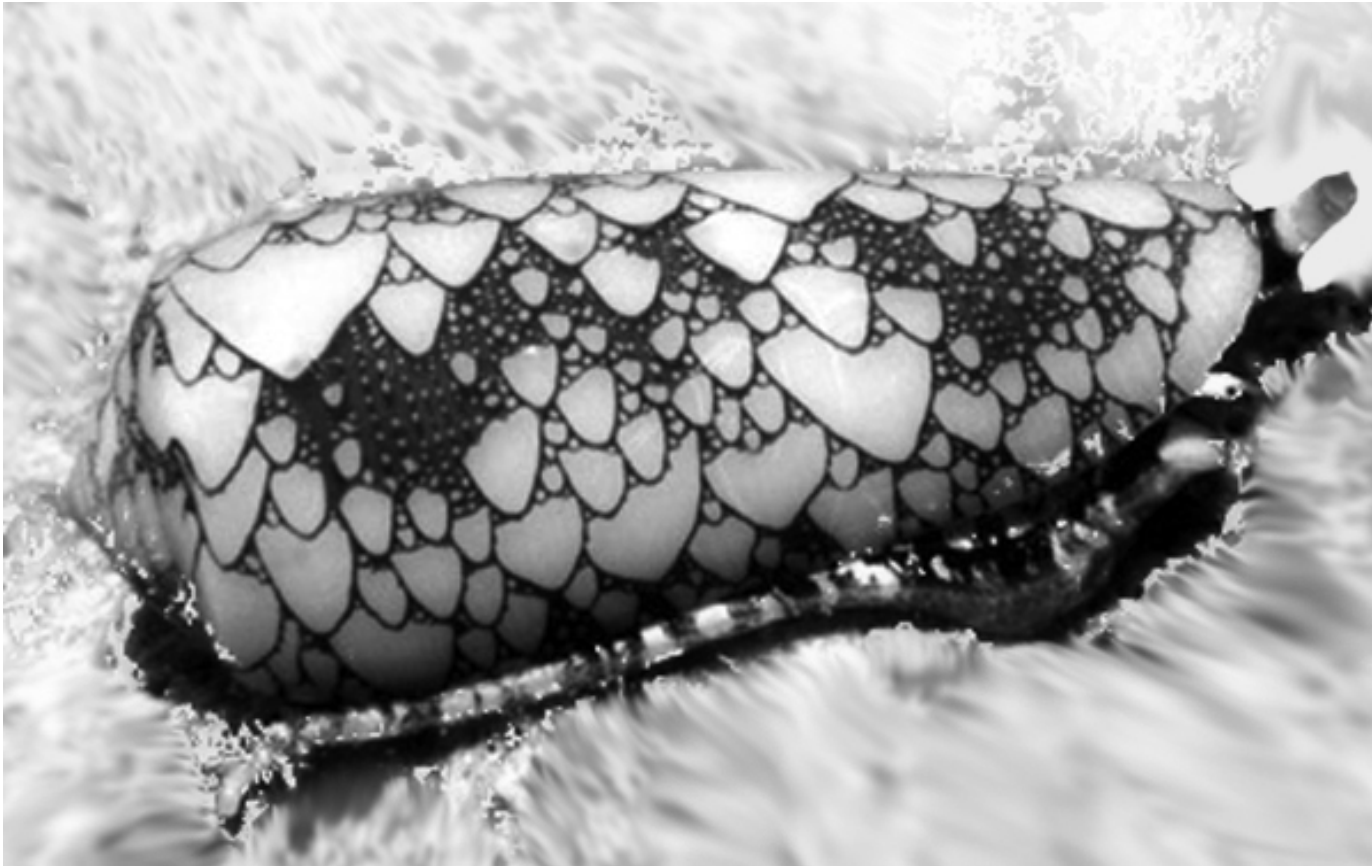
SYNTHESIS:
Gnarly Computations Are Lifelike.

Example: Free Will

- Suppose a gnarly AI lifebox simulates a person.

- Gnarly computations are *deterministic*.

- But gnarly computations are *unpredictable*.

- The AI can think it has free will.

Why "Seashell"?
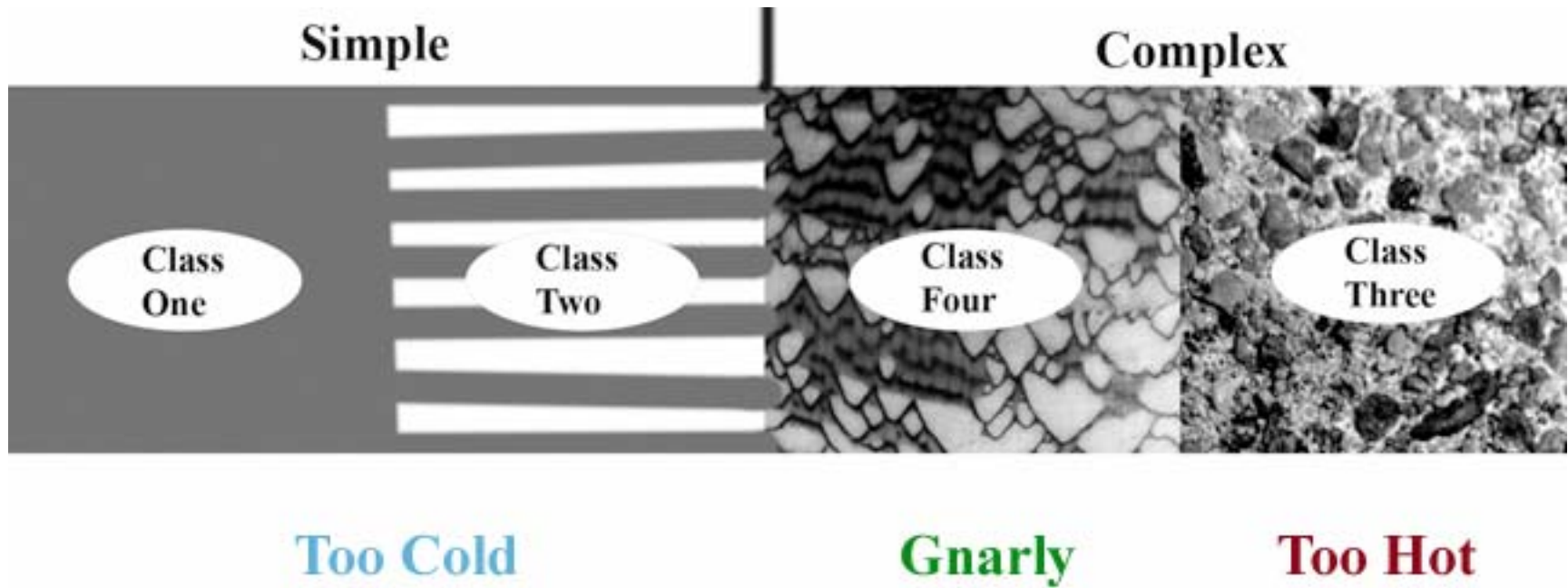
Cone Shells Show Naturally Occurring Gnarly Computations.
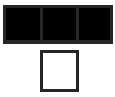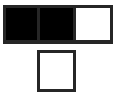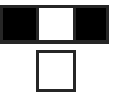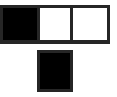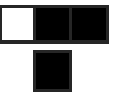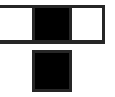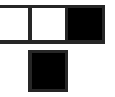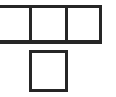
Science Needs
A Taxonomy of Computations
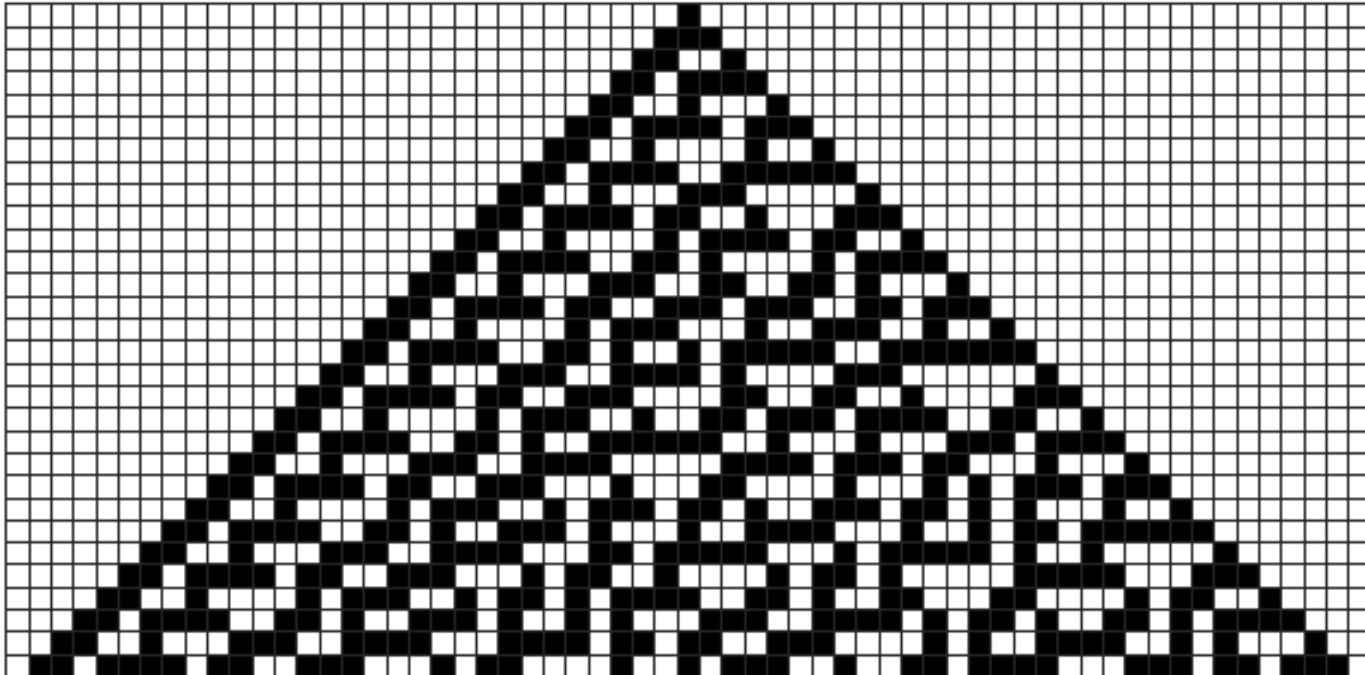
- What kinds of **computations** exist?

- If everything is a computation, this study gives insight into what kinds of **phenomena** can exist.

- This is experimental computer science in an **observational** sense. Stephen Wolfram led the way with his <u>A New Kind of Science</u>.

Simple		Complex	
Class One	Class Two	Class Four	Class Three
Too Cold		Gnarly	Too Hot
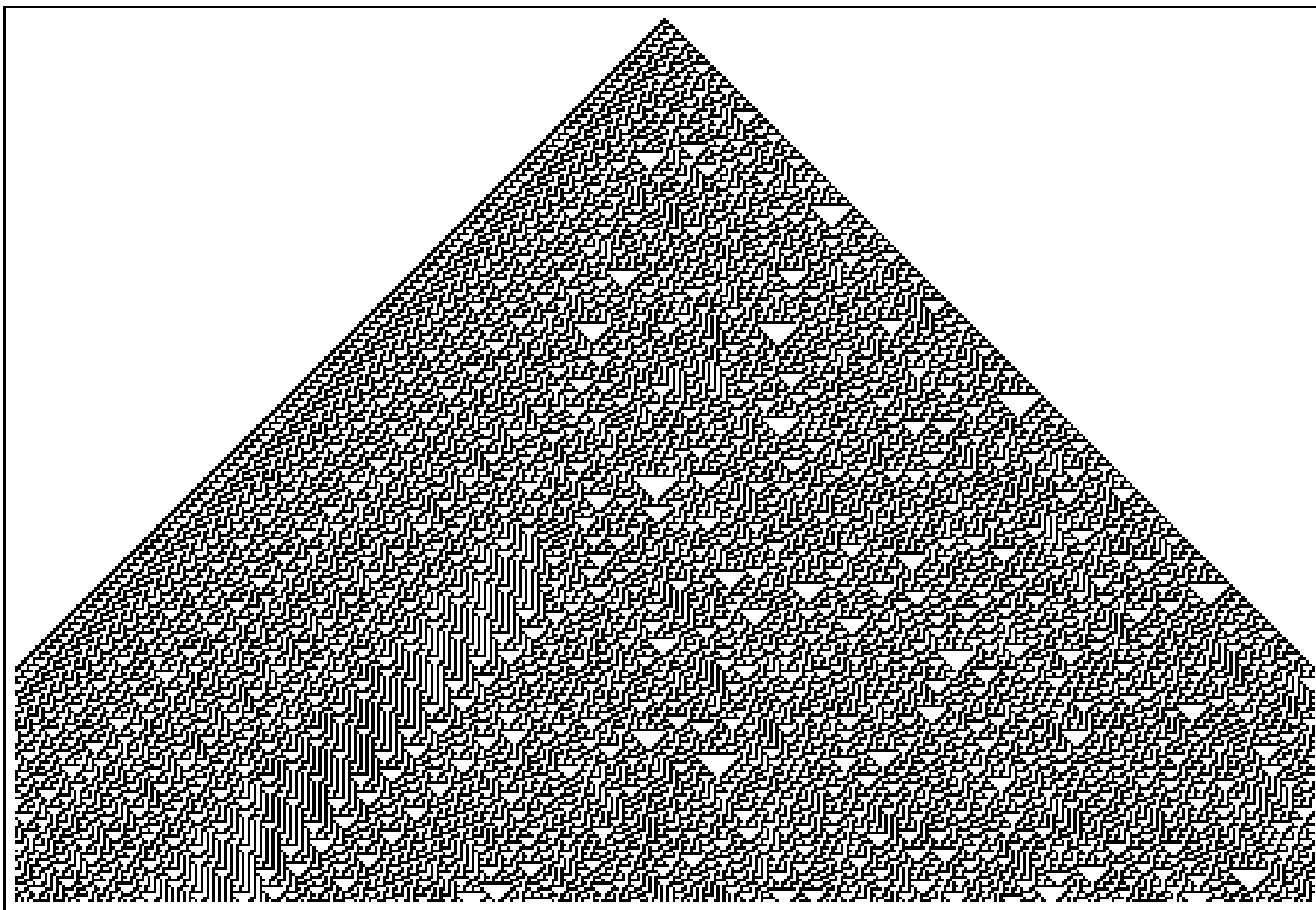
- **Simple (Too Cold):** Dies Out or Repeats. Wolfram classes 1 and 2.

- **Gnarly (Just Right):** Complex moving patterns. Natural processes. Wolfram class 4.

- **Looks Random (Too Hot):** "Seething Dog Barf" --- Bill Gosper. Wolfram class 3.

CA Rule 30 is Pseudorandom
## (Too Hot, Seethes, Class 3)
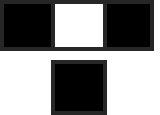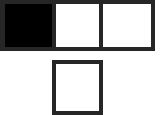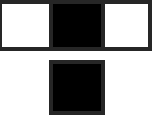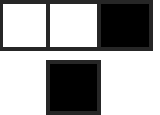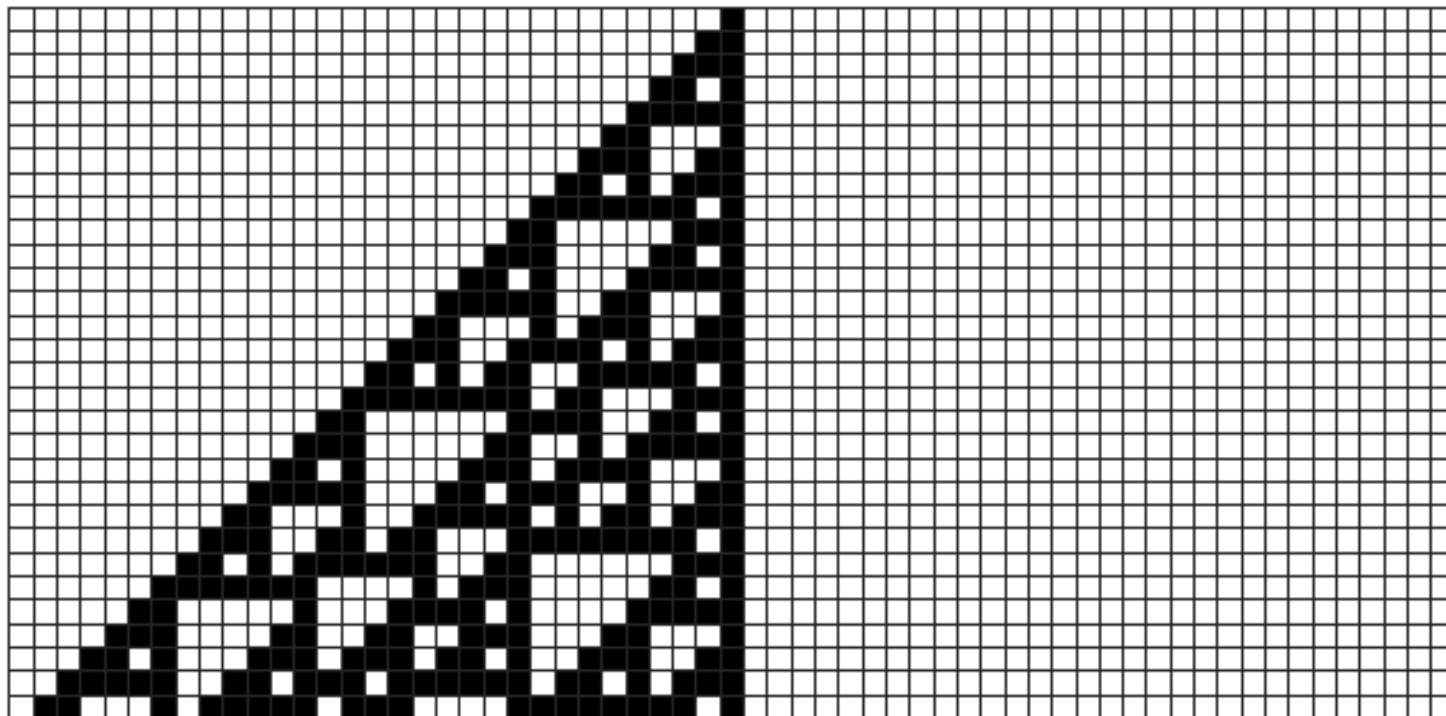
# Rule 30 Seethes
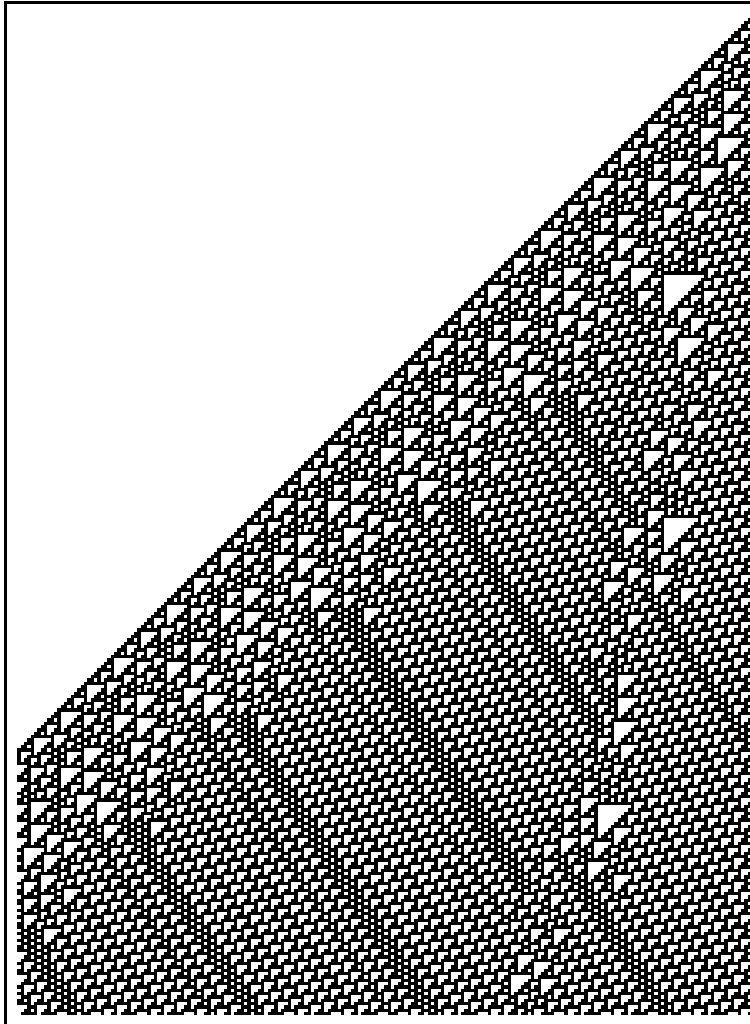
Rule 110 Has Gliders
(Gnarly, Class 4)
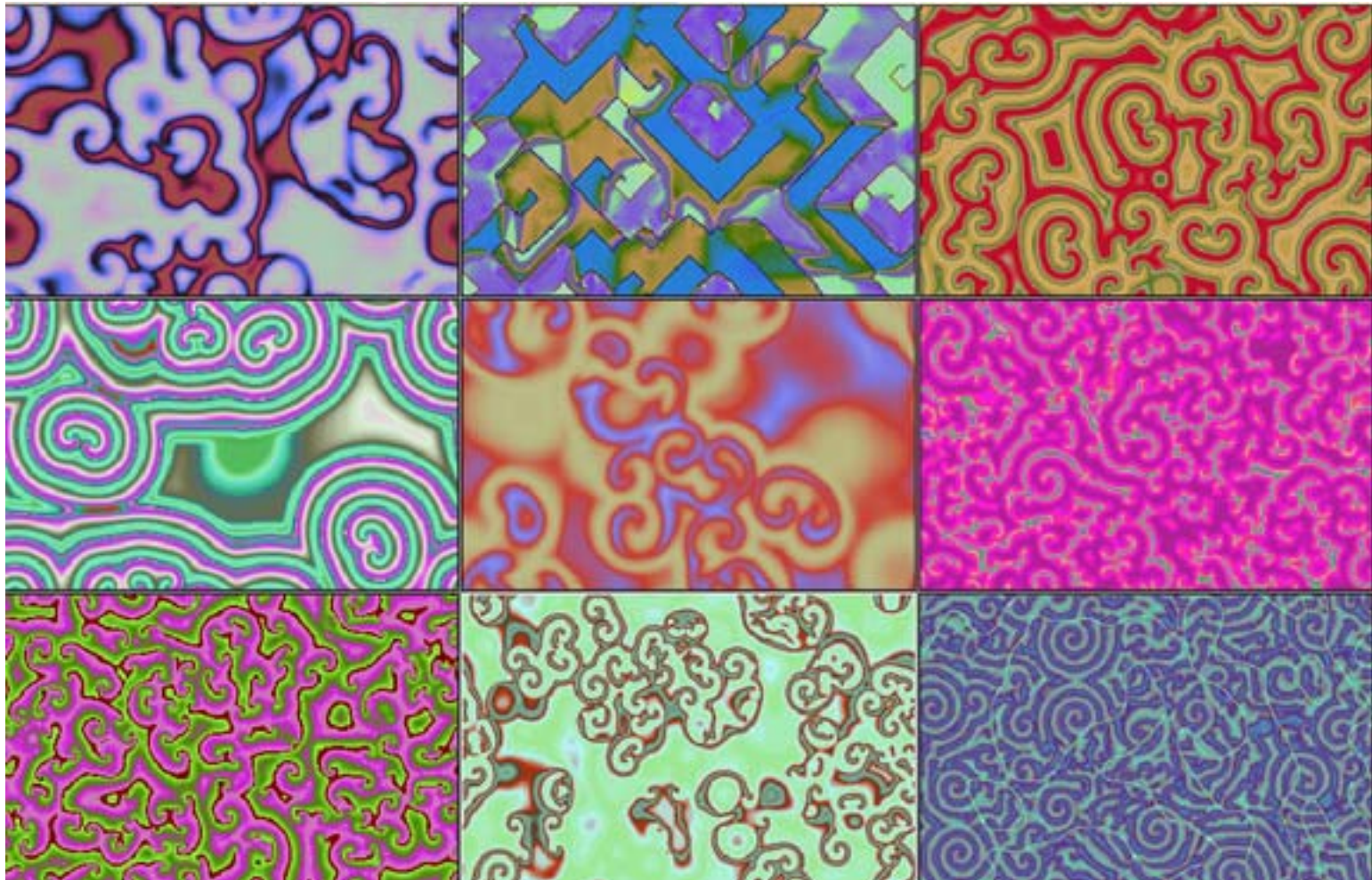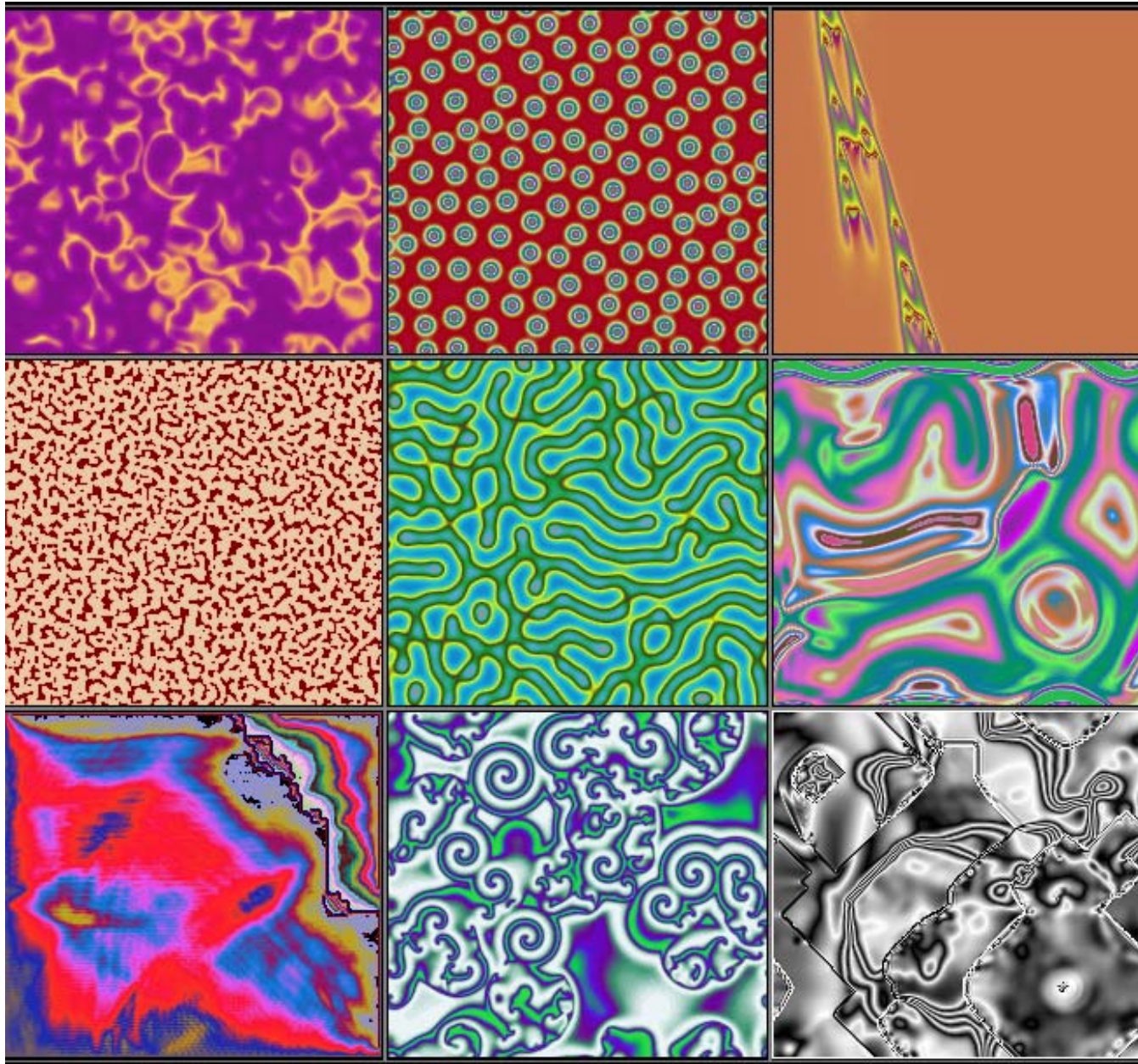
Gnarly Rule 110 Is Provably Computation Universal!

Gnarly 2D CAs:
CAPOW Zhabotinsky Scrolls

CAPOW: Continuous Valued CAs

Theoretical Consequences

- (Wolfram's Principle of Computational Equivalence). Most naturally occurring processes are universal computations. **Nature is rich**.

- (Principle of Unpredictability)
  Most natural processes are unpredictable, that is,
  They can't be emulated faster than they occur.

- (Godel's Incompleteness Theorem for Nature)
  Given any scientific theory of the world T,
  And given any complex natural process P,
  **There are statements about process P
      which theory T is unable to prove or disprove.**

Takeaway for Designers

- Nature uses **unpredictable, gnarly computations**, they "look right."

- **Stable patterns emerge** in all sorts of computations, and you needn't worry why.

- If a complicated algorithm can achieve a given effect, a **very simple algorithm** can do it too. Focus on appearance, not hidden reasoning.

- Lots of **exploration** still to do. Mechanized searches of computation space are fruitful.

How to Be Happy

► *CS*. **Turn off the machine**.
  Nature computes better than a beige, buzzing box.

► *Physics*. **See the gnarl**.
  The world is full of rich, chaotic computation.

► *Biology*. **Feel your body**.
  Your body is the most complex device you'll ever operate.

► *Psychology*. **Release your thoughts**.
  Avoid repetition. Don't overvalue logic. Accept change.

► *Sociology*. **Open your heart**.
  Others are complex universal computations like you.

► *Philosophy*. **Be amazed**.
  The universe is a miracle, forever transcending science.

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Book sample, software and more at
www.rudyrucker.com/lifebox

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