Gnarly Computation
by Rudy Rucker
Media Lab
MIT
Oct 31, 2005

www.rudyrucker.com
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)
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.
Ordo Sciendi, or,
The Stairway to Heaven
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 A New Kind of Science.
• **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
Limitative Consequences

• Formally uncomputable problems are absolutely unsolvable. Probably quantum computation isn’t going to help.

• (Wolfram PCE). Most naturally occurring processes are universal computations. Nature is rich.

• Most natural processes are unpredictable (irreducible), that is, they can’t be emulated much faster than they occur.

• Given any formal theory and any complex natural process, there are statements about the process which are formally undecidable by the theory.
Sunny Prospects

• Nature uses complex, gnarly solutions, and we can too.

• Stable patterns emerge even when we use computing systems that we can’t understand. Make CS more empirical.

• Use gnarly CA rules to grow new materials.

• Lots of basic science still to do on the taxonomy of computation.
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.

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

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


Book sample, software and more at [www.rudyrucker.com/lifebox](http://www.rudyrucker.com/lifebox)

Blog: [www.rudyrucker.com/blog](http://www.rudyrucker.com/blog)