

Things Ain't What They Used To Be - On Paradox and the Nature of Time

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"Do I contradict myself? Very well then I contradict myself (I am large, I contain multitudes)."
-- Walt Whitman in *Song of Myself*

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Puzzle vs Paradox

par•a•dox (par'ədōks') n.

1. A seemingly contradictory statement that may nonetheless be true... one exhibiting inexplicable or contradictory aspects. (*a Puzzle*)
2. An assertion that is essentially self-contradictory, though based on a valid deduction from acceptable premises. (*a Paradox*)

-- American Heritage Electronic Dictionary, 3rd Edition

- A Paradox viewed from outside is a Puzzle.

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Classic Paradoxes

- Epimenides the Cretan (logic)
"All Cretans are liars." ("This statement is False.")
- Russell (set theory)
The set of all sets not containing themselves.
- the Barber (set theory or logic)
Barber shaves all men in town who don't shave themselves.
- Berry (number theory)
n = the smallest number not specifiable in less than N words.
- Gödel (logic/number/proof theory)
"This statement is unprovable."

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Oops! (Frege to Russell)

"Your discovery of the contradiction caused me the greatest surprise and, I would almost say, consternation, since it has shaken the basis on which I intended to build arithmetic. ... (N)ot only the foundations of my arithmetic, but also the sole possible foundations of arithmetic, seem to vanish. ..."

In any case, your discovery is very remarkable and will perhaps result in a great advance in logic, unwelcome as it may seem at first glance. "

-- Gottlob Frege, 1902.

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Magnanimity

"A scientist can hardly encounter anything more undesirable than to have the foundation collapse just as the work is finished. I was put in this position by a letter from Mr. Bertrand Russell when the work was almost through the press."

-- acknowledgement at the close of Vol. 2 of

The Fundamental Laws of Arithmetic by Gottlob Frege, 1903.

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Common & Historical Paradoxes

- Thermostat & furnace
"It's too cold." (= furnace on)
- Supply & demand
"It's a bargain." (= raise price)
- Chaos/dynamical systems
- Babbage: registers & "The engine eating its own tail."
- "Theology"; "Can God make a rock so heavy that he can't lift it?"
- Psychology: "Be spontaneous!"
- Physics: QM superposition, measurement, EPR?

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Modern Paradoxes (Oops #2)

- Gödel 1931 (logic/number/proof theory)
"This statement is unprovable."
- Turing 1936 (computability)
"This machine doesn't halt."

"Any paradox will do." -- Gödel to Gregory Chaitin

"If mathematicians cannot ever fully understand something as simple as number theory, then it is certainly too much to expect that science will ever expose any ultimate secret of the universe."
-- Rudy Rucker in *Infinity and the Mind*, 1982.

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Cantor Diagonalization

p1: b₁₁ b₁₂ b₁₃ b₁₄ b₁₅ ...
 p2: b₂₁ b₂₂ b₂₃ b₂₄ b₂₅ ...
 p3: b₃₁ b₃₂ b₃₃ b₃₄ b₃₅ ...
 p4: b₄₁ b₄₂ b₄₃ b₄₄ b₄₅ ...
 p5: b₅₁ b₅₂ b₅₃ b₅₄ b₅₅ ...
 : : :

 p_x: b₁₁ b₂₂ b₃₃ b₄₄ b₅₅ ...

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Paradox is Threatening

(Clip from "I, Mudd", *Star Trek*, 1967)

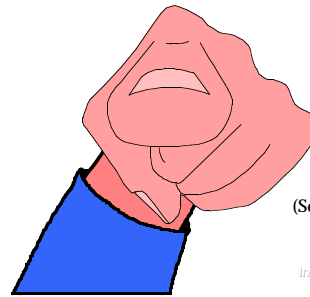
- Paradox defies "common sense"
"Common sense is the collection of prejudices acquired by age eighteen." -- Albert Einstein

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What Do All Paradoxes Have in Common?



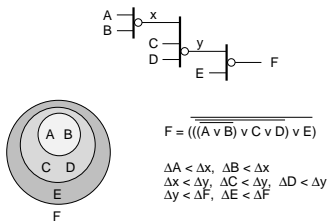
(Self-Reference)

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Combinational Logic is Timeless

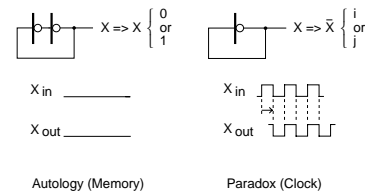


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Self-Reference - the Origin of Time

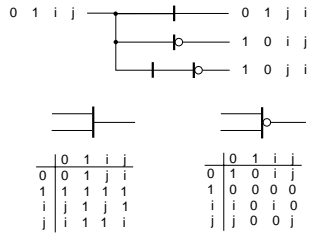


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4-Valued Logic Holds Paradox



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i : Logic $:: \sqrt{-1}$: Reals

Logic

$$x = \sim x$$

$$x = i$$

Real Numbers

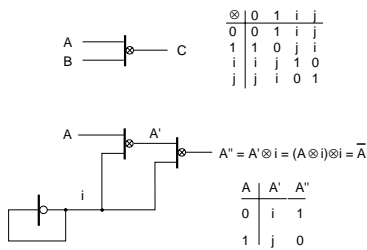
$$x = -1/x \quad (x^2 = -1)$$

$$x = \sqrt{-1}$$

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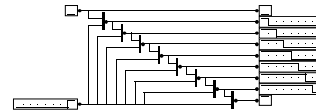
Square Root of NOT



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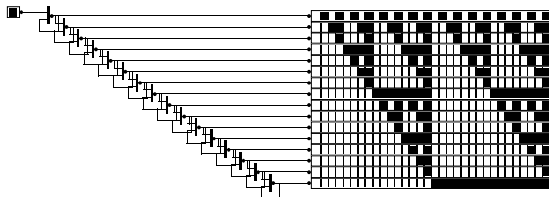
Eighth Root of NOT



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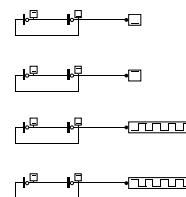
Sierpinski



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Memory & Superposition



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Timeless vs Timely Thinking

- no Self-Reference => Dependency => Sequence
- Self-Reference => Self-Sequence => discrete Time or, equivalently, Meta-Values
- Dual representation - unfold in Space or in Time
- 'Time' is highly addictive!

"Time is nature's way of keeping everything from happening at once."

Better: "Time is our way of allowing a thing to exist differently."

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Constructive Physics

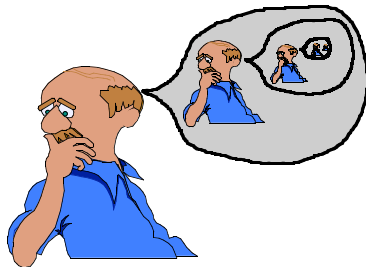
- Alternative to Reductionist approach
- Not from First principles, but from NO principles
- No assumptions of Space, Time, etc.
- Nowhere else to hide!

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Consciousness?



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Can Machines Think?

"The question ... I believe to be too meaningless to deserve discussion. Nevertheless, I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted." -- Alan Turing, 1950.

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Turing Anticipates Objections to AI

1. The Theological Objection (a Soul)
2. The "Heads in the Sand" Objection (Fear)
3. The Mathematical Objection (from Gödel)
4. Argument from Consciousness
5. Arguments from Various Disabilities
6. Lady Lovelace's Objection (Originality)
7. Argument from Continuity in the Nervous System
8. Argument from Informality of Behavior
9. Argument from Extra-Sensory Perception

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Summary

- Paradox is everywhere, and is our friend.
- Paradox is due to Self-Reference.
- Self-Reference creates clocks and memories and is the origin of our idea of Time.
- Self-Reference necessarily generates Meta-Values, but a larger system can hold them.
- Claim: "Consciousness " is nothing more than complex Self-Reference.
- Speculation: The Universe can be Constructed.
- Speculation: Superposition in QM is essentially the imaginary state of a memory element.
- Speculation: Quantum Computers can exhibit ESP.

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