

# Why CSC180 is the the most important course you'll ever take\*

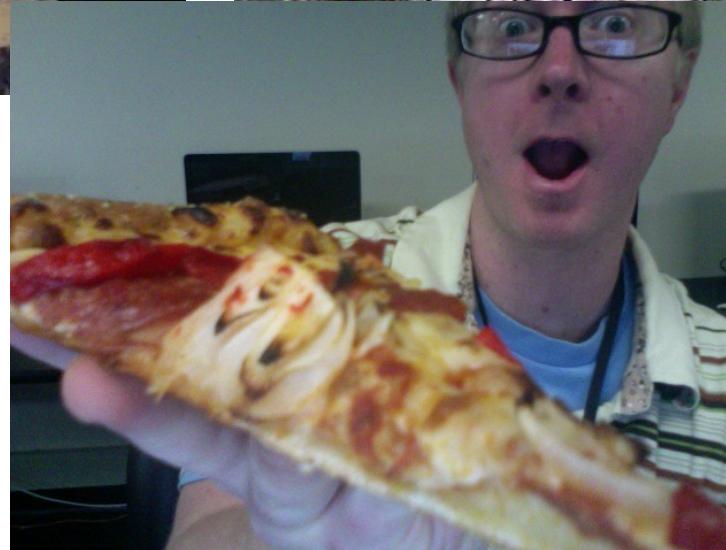
With slides taken from

The Future of Computer  
Science

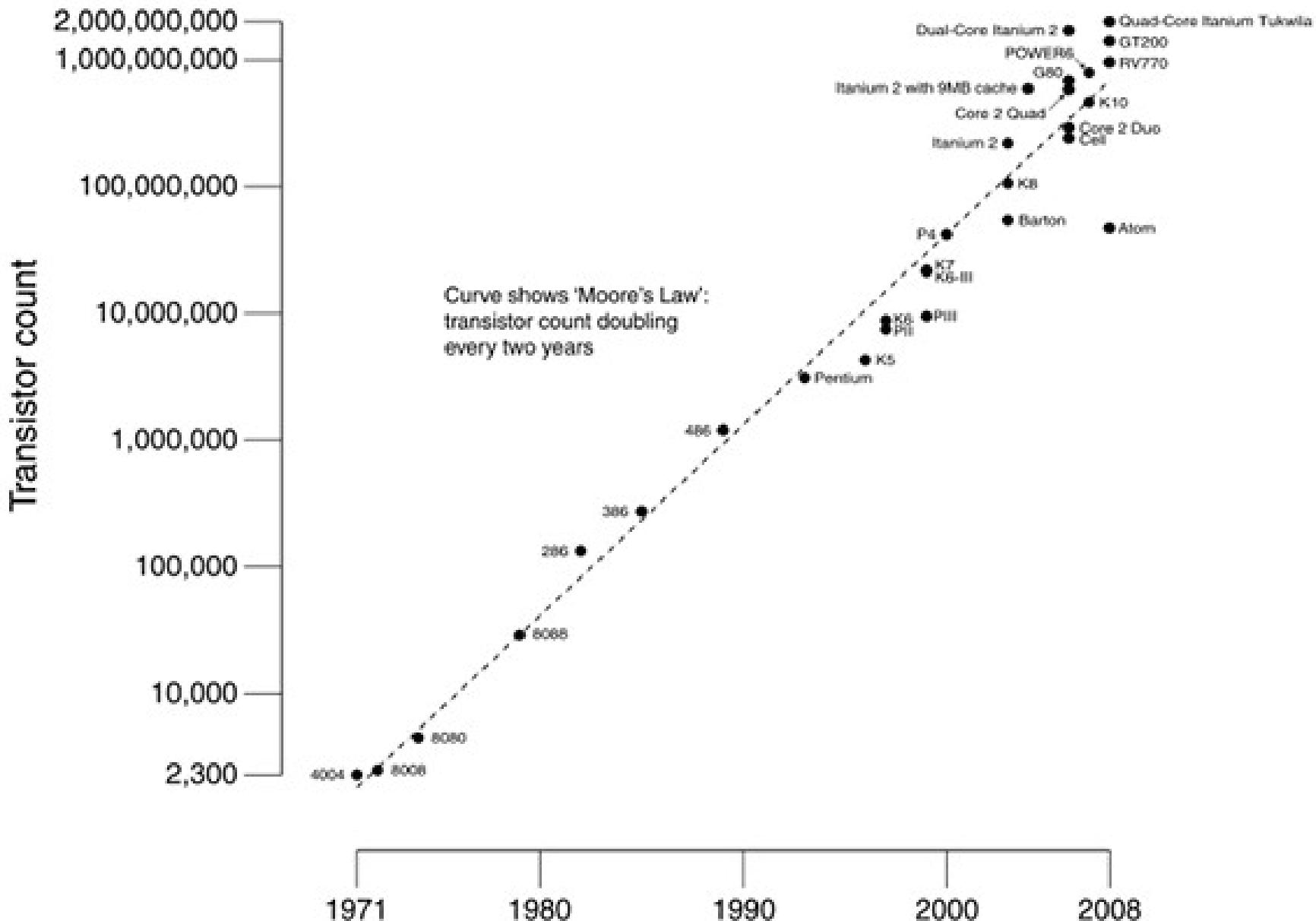
And Why Every Other Major Sucks By Comparison

by Scott Aaronson, MIT EECS

# Stereotypes of CS Majors



# Moore's Law



# Insights From and to Other Disciplines

- Insights from *Distributional Semantics* lead to techniques like the one used in Project 3
  - “*Distributional hypothesis: linguistic items with similar distributions have similar meanings*” (Wikipedia)
- Programs inspired by how the brain works used to automatically learn how to detect cats in Youtube videos
- And to automatically learn to play videogames by trying different inputs and learning from mistakes

# NEWS

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## US Secret Service seeks Twitter sarcasm detector

⌚ 5 June 2014 | [Technology](#)



REUTERS

The Secret Service wants its own automated system of social media monitoring

The image shows the header of the Nature journal website. At the top, there is a dark red banner with the word 'nature' in white lowercase letters, followed by the subtitle 'International weekly journal of science'. Below the banner is a navigation bar with links for 'Home', 'News & Comment', 'Research', 'Careers & Jobs', 'Current Issue', 'Archive', 'Audio & Video', and a partially visible 'P' link. Below the navigation bar is a breadcrumb trail: 'Archive > Volume 518 > Issue 7540 > Letters > Article'. The main content area has a light gray background. At the top left of this area, the word 'NATURE | LETTER' is written in a small, dark font. To the right of this, there are two small icons: a share icon and a print icon. The main title of the article, 'Human-level control through deep reinforcement learning', is centered in a large, bold, dark font. Below the title, the authors' names are listed in a smaller dark font: Volodymyr Mnih, Koray Kavukcuoglu, David Silver, Andrei A. Rusu, Joel Veness, Marc G. Bellemare, Alex Graves, Martin Riedmiller, Andreas K. Fidjeland, Georg Ostrovski, Stig Petersen, Charles Beattie, Amir Sadik, Ioannis Antonoglou, Helen King, Dharshan Kumaran, Daan Wierstra, Shane Legg & Demis Hassabis. Below the authors' names, there are three blue links: 'Affiliations', 'Contributions', and 'Corresponding authors'. Further down, the journal information is provided: 'Nature 518, 529–533 (26 February 2015) | doi:10.1038/nature14236'. Below this, the submission and acceptance dates are given: 'Received 10 July 2014 | Accepted 16 January 2015 | Published online 25 February 2015'. At the bottom of the main content area, there is a row of five buttons with icons and text: 'PDF', 'Citation', 'Reprints', 'Rights & permissions', and 'Article metrics'.

The theory of reinforcement learning provides a normative account<sup>1</sup>, deeply rooted in psychological<sup>2</sup> and neuroscientific<sup>3</sup> perspectives on animal behaviour, of how agents may optimize their control of an environment. To use reinforcement learning successfully in situations approaching real-world complexity, however, agents are confronted with a difficult task: they must derive efficient representations of the environment from high-dimensional sensory inputs, and use these to generalize past experience to new situations. Remarkably, humans and other animals seem to solve this problem through a harmonious combination of reinforcement learning and hierarchical sensory processing systems<sup>4, 5</sup>, the former evidenced by a wealth of neural data revealing notable parallels between the phasic signals emitted by dopaminergic neurons and temporal difference reinforcement learning algorithms<sup>3</sup>. While reinforcement learning agents have achieved

 ars technica

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gave us hope.

PHOTO BY THE PEREZ FAMILY

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## OPPOSABLE THUMBS / GAMING & ENTERTAINMENT

### This AI “solves” *Super Mario Bros.* and other classic NES games

Program even takes advantage of bugs and glitches.

by Ian Steadman, wired.co.uk - Apr 14, 2013 3:00pm EDT

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MARIO 000000 0x00 WORLD 1-1 TIME

**SUPER MARIO BROS.**

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1 PLAYER GAME  
2 PLAYER GAME

TOP - 000000

Nintendo

Computer program that learns to play classic NES games

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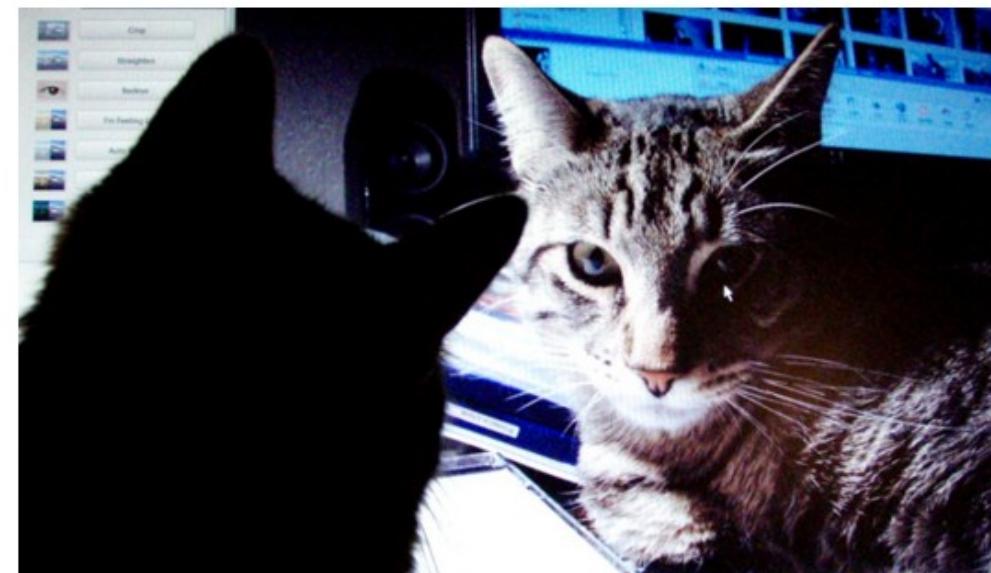


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WIRED.UK SCIENCE 06.26.12 11:15 AM

# GOOGLE'S ARTIFICIAL BRAIN LEARNS TO FIND CAT VIDEOS



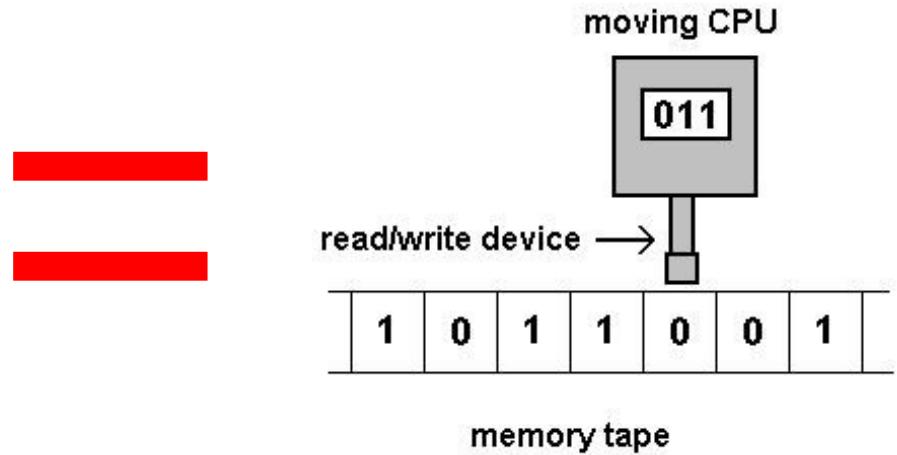
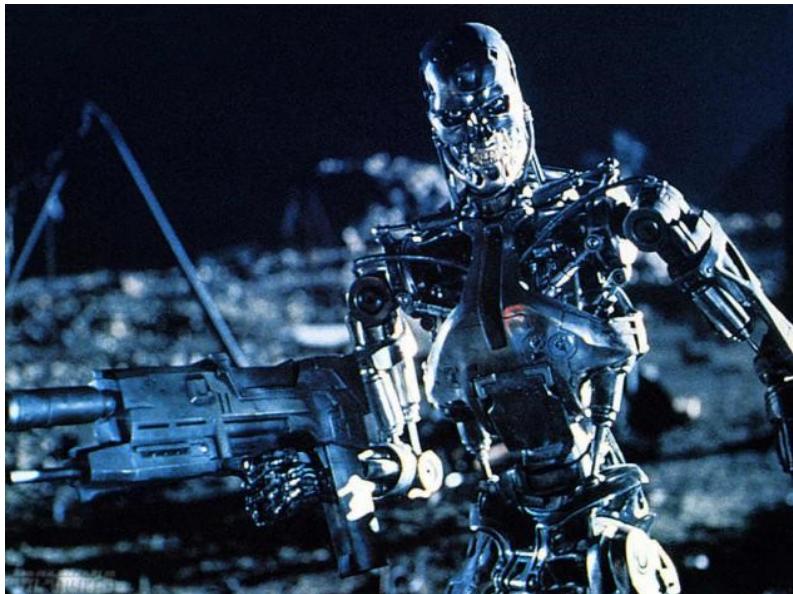
**So what's next?**

# Robot Uprising



Uploading our brains to computers;  
replacement of “real life” by the Matrix





So what else is there?

# Quantum Computers

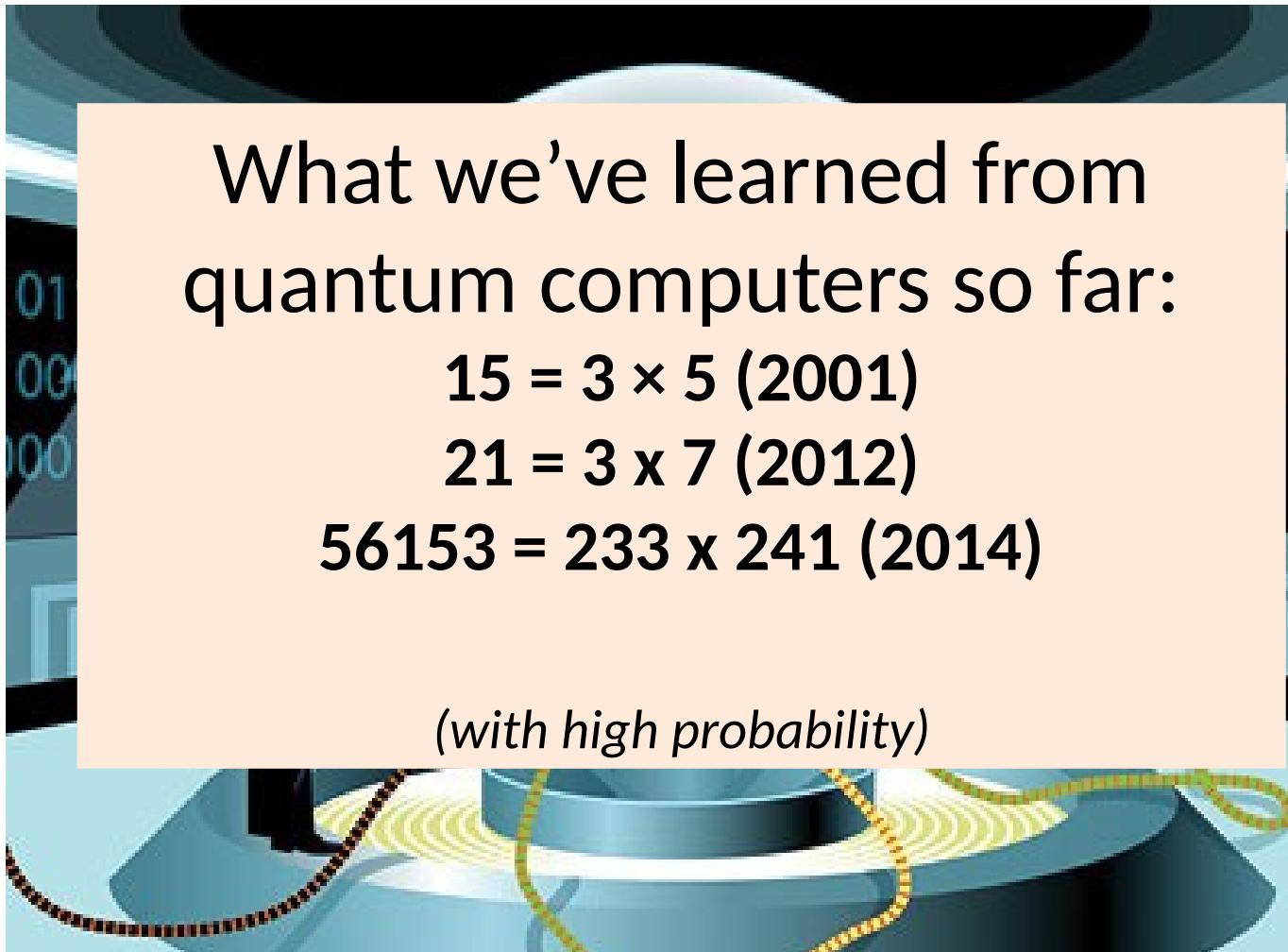
What we've learned from quantum computers so far:

$15 = 3 \times 5$  (2001)

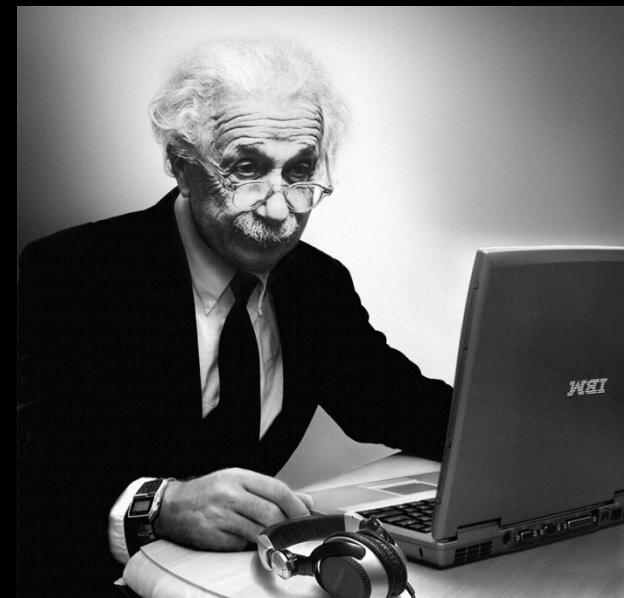
$21 = 3 \times 7$  (2012)

**$56153 = 233 \times 241$  (2014)**

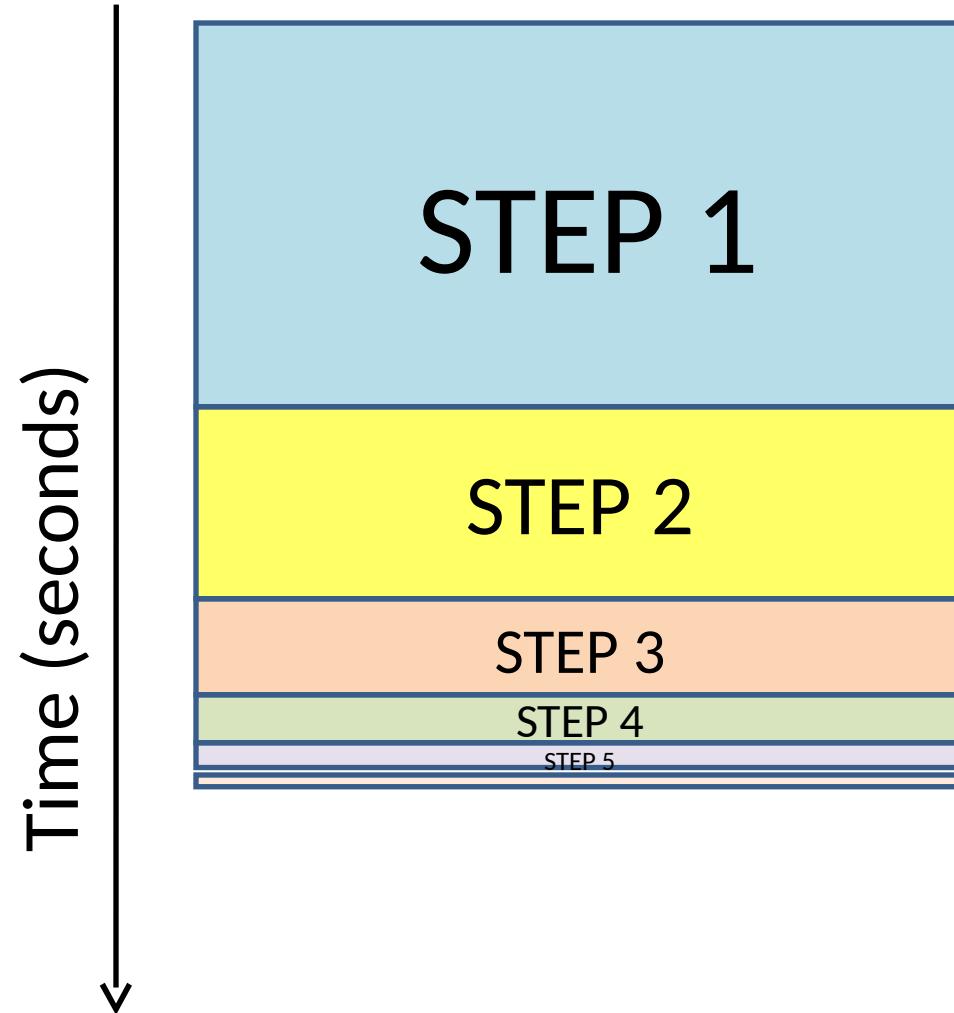
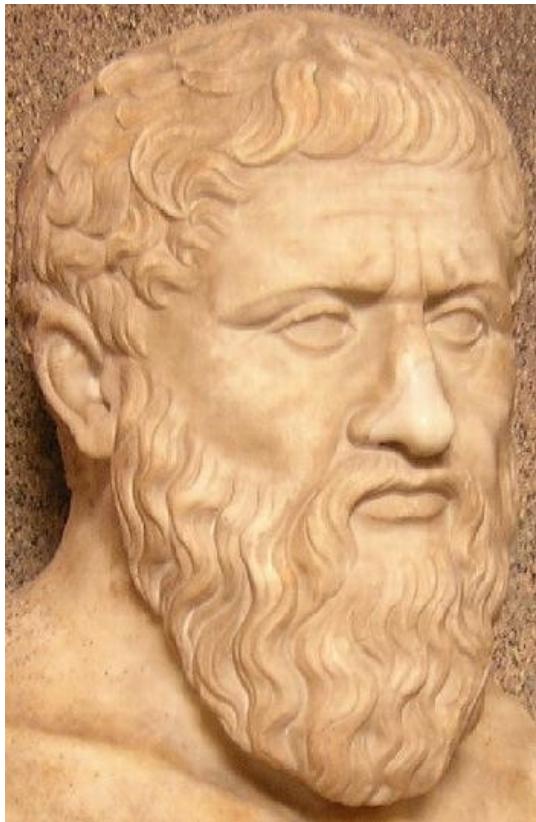
*(with high probability)*



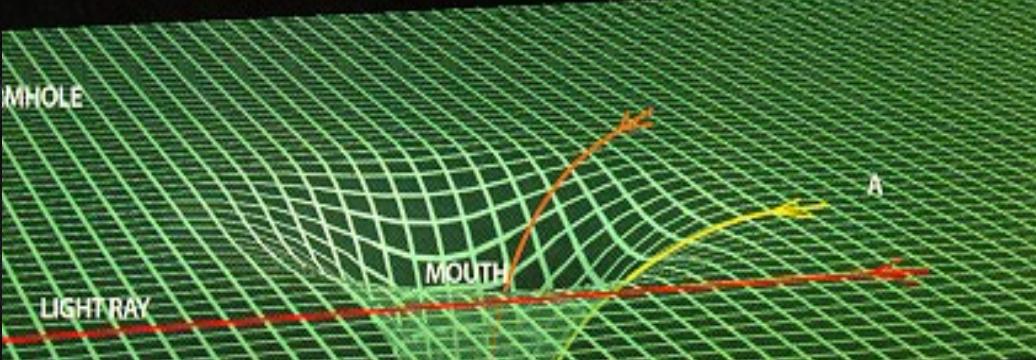
# Relativity Computer



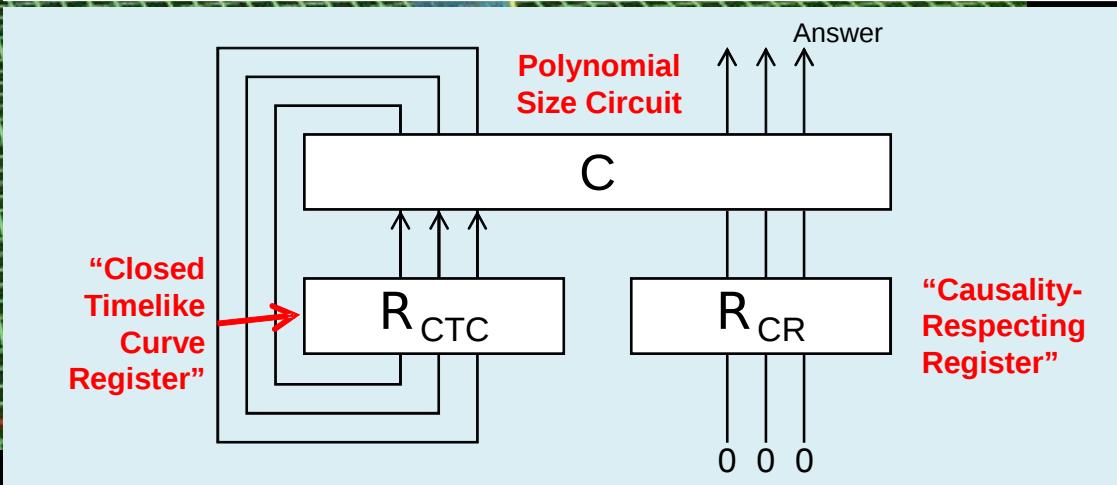
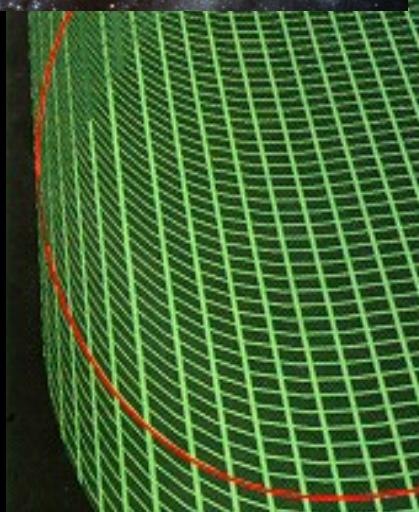
# Zeno's Computer



# Time Travel Computer



S. Aaronson and J. Watrous. **Closed Timelike Curves Make Quantum and Classical Computing Equivalent**, *Proceedings of the Royal Society A* 465:631-647, 2009. arXiv:0808.2669.



# Computer Science Is Interdisciplinary

