

What problems can we solve with a computer?

# A Brief History Lesson

# Fin de siècle optimism

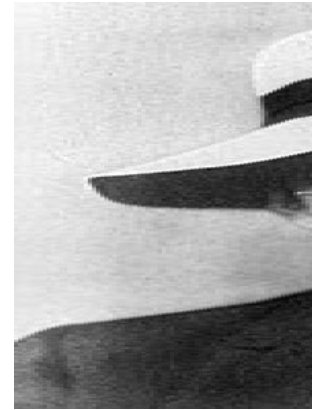
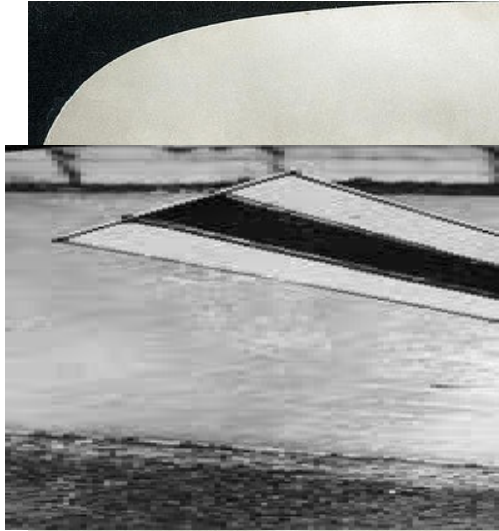


# Hilbert's Vision

1900 Int'l Congress of Mathematicians in Paris

- David Hilbert proposes **23 unsolved problems** as the agenda for the coming years of math theory
- A major part of Hilbert's program (#2 on the list of 23) was to formalize all of math into:
  - A finite set of axioms
  - A system for proving all mathematical statements true or false from those axioms
- Alonzo Church, Alan Turing, and others, set to work on ways that this theorem-proving could be systematically implemented, even automated
- *All truth will fall effortlessly into humanity's hands!*

Technology will solve all of mankind's problems! No more wars or sad, ever!



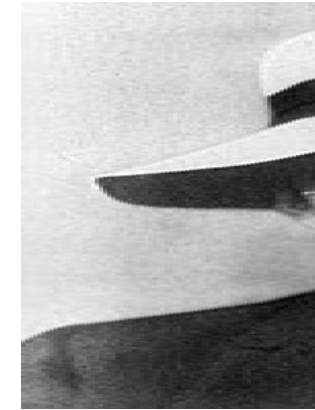
David Hilbert

“No one shall expel us from the Paradise that Cantor has created!”

“We must know! We will know!”

Technology will solve all of mankind's problems! No more wars or sad, ever!

(\* except we know WWI and WWII are right around the corner...)



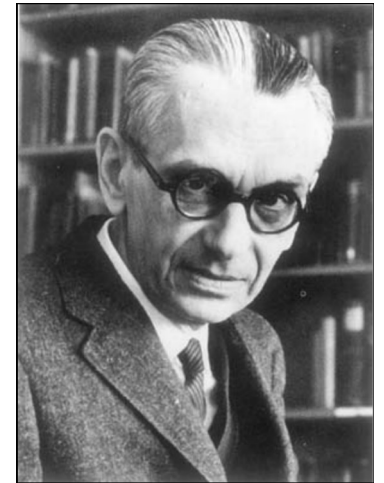
David Hilbert

“No one shall expel us from the Paradise that Cantor has created!”

“We must know! We will know!”

# Kurt Gödel (1906-1978)

- His *Incompleteness Theorems* proved that Hilbert's vision of exhaustive theorem-proving was impossible.
- There will always be true statements about numbers that can't be proved within a system of axioms.
- You can't use proofs to prove that proofs work. (\*loose interpretation)



# Alan Turing (1912-1954)

- His *Undecidability Theorem* proved that Hilbert's vision of computing devices solving all math problems was impossible.
- There will always be true statements about numbers that can't be computed by a device, even if it has infinite memory and can run as long as you want.



# Alan Turing, “Father of AI”

- Invented Turing Machines (CS103)
- Proved some problems are unsolvable (CS103)
- Invented the Turing Test as a measure of AI success
- Along with the largely female computer programming and codebreaking staff at Bletchley Park, played crucial role in Allied victory in WWII
- The CS equivalent of the Nobel Prize is named the Turing Award in his honor





# Alan Turing, gay pioneer



- Happily out gay man
- Participated in London's lively LGBTQ+ scene



# Wrongful Death

- In 1952, Turing was robbed, reported the robbery to police, who turned on *him* for homosexuality
- Convicted of the crime of “indecency”
- Following forced “cures,” he died by suicide in 1954
- Not officially pardoned by the government until 2013

