

Artificial Intelligence (is no match for natural stupidity :)

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Thinking with Electricity

- The inventors of ENIAC, 1st computer, said it “thinks with electricity”
 - Do calculators “think”?
 - Does performing arithmetic, which is entirely algorithmic, require thinking?
 - Once, performing arithmetic, was thought to be divinely or magically conferred ability

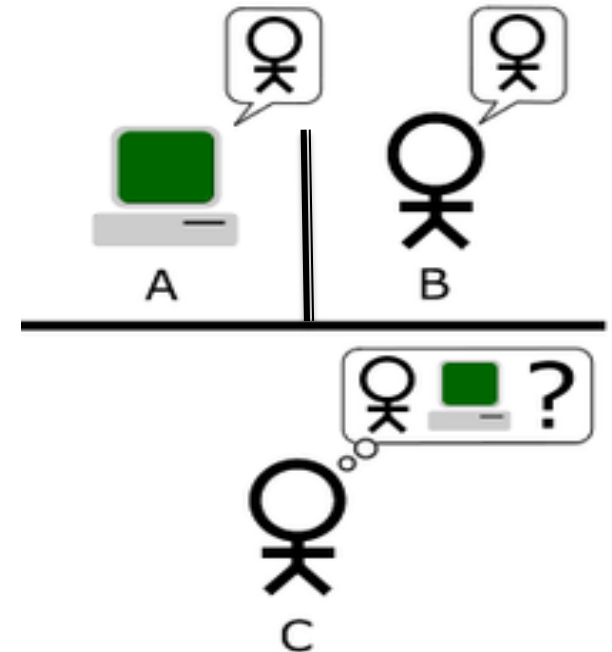
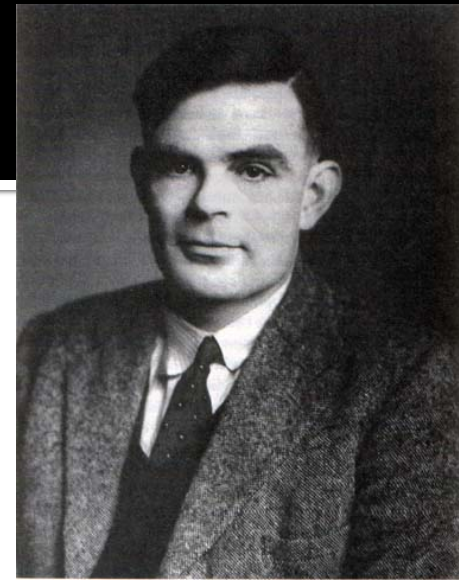
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The Problem: Many human activities look like thinking until they are understood (to be algorithmic)

Turing's Test

- A.M. Turing, computer pioneer, worried about intelligence in humans & machines; proposed a test (1950)
 - Aware that it is intelligence until it's understood, Turing devised an experiment:
A computer (A) and a person (B) are connected to an examiner, who can ask questions using text to determine which is which



Turing's Idea of Interrogation

Interrogator In the first line of your sonnet which reads 'Shall I compare thee to a summer's day', would not 'a spring day' do as well or better?

Computer It wouldn't scan.

Interrogator How about 'a winter's day'? That would scan all right.

Computer Yes, but nobody wants to be compared to a winter's day.

Interrogator Would you say Mr. Pickwick reminded you of Christmas?

Computer In a way.

Interrogator Yet Christmas is a winter's day, and I do not think Mr Pickwick would mind the comparison

Computer I don't think you're serious. By a winter's day one means a typical winter's day, rather than a special one like Christmas.

Captcha

- Completely Automated Public **Turing Test** To Tell Computers and Humans Apart
 - Developed at CMU by Luis Van Ahn and his team



Seeming To Be Intelligent

- Joel Weizenbaum's "Doctor" [a.k.a "Eliza"] was a program that *appeared* intelligent

User: I'm depressed.

Doctor: Why are you depressed?

User: My mother is not speaking to me.

Doctor: Tell me about your mother.

User: She doesn't want me to major in CS.

Doctor: No?

User: No, she wants me to go into medicine.

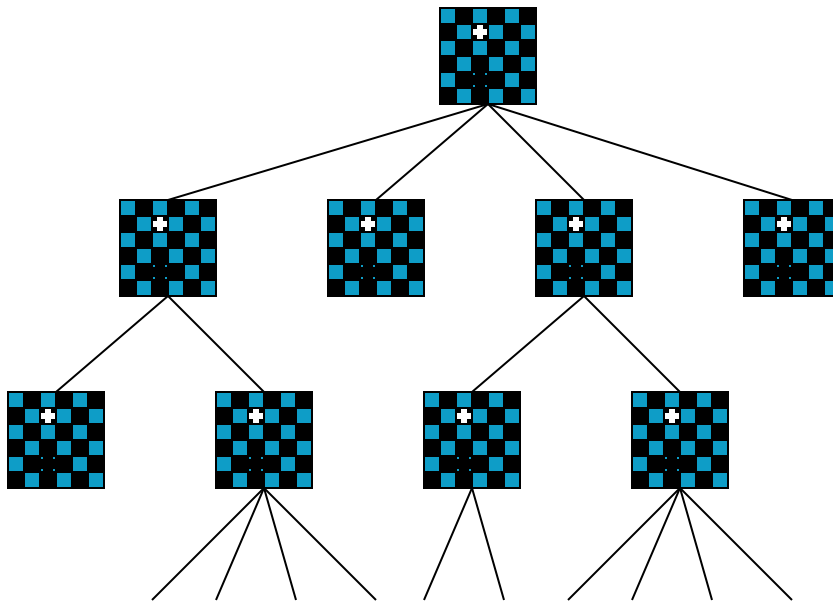
Doctor was basically scripted

Artificial Intelligence

- The study of making computers act intelligently
 - They already act intelligently ... e.g. they can correct your spelling mistakes
 - Is this intelligent behavior? Most AI researchers would say “no” ... algorithmic
 - Playing grandmaster level chess in a tournament became an AI goal (1952)
 - Minimizes real world knowledge
 - Clear goal, formal system

Playing Chess

- Chess is a game, so it uses a game tree
 - At each node is a ‘board’ -- easily digitized
 - Below it are all boards created in 1 move; below those, all boards needing another move



An objective function evaluates “goodness” of the position: go for highest ... opponent goes for lowest

Deep Blue vs Kasparov

- An IBM system, Deep Blue, played world champion Gary Kasparov
 - In 1996 Kasparov won, but Deep Blue played 1 game well!!! This was a first.
 - In May 11, 1997 Deep Blue won 3.5-2.5



Intelligent?

- Deep Blue is a 32 processor parallel computer with 256 “chess processors” that can consider 200,000,000 chess positions per second + openings
- Does Deep Blue’s performance show that a computer can be intelligent?
 - No -- it repeats its designers intelligence (weak rebuttal)
 - Yes – it’s better than anyone in the world at something people find interesting and fun
 - Maybe -- it shows intelligence in chess, but can it apply its intelligence elsewhere?

What do you think?

And Now Watson plays Jeopardy!



Day 1, Final Jeopardy

- Category: US Cities
- "Its largest airport is named for a World War II hero, its second largest for a World War II battle."
- What's the answer?

Day 1, Final Jeopardy

- Category: US Cities
- "Its largest airport is named for a World War II hero, its second largest for a World War II battle."
- What's the answer?
- Watson said, "Toronto?"

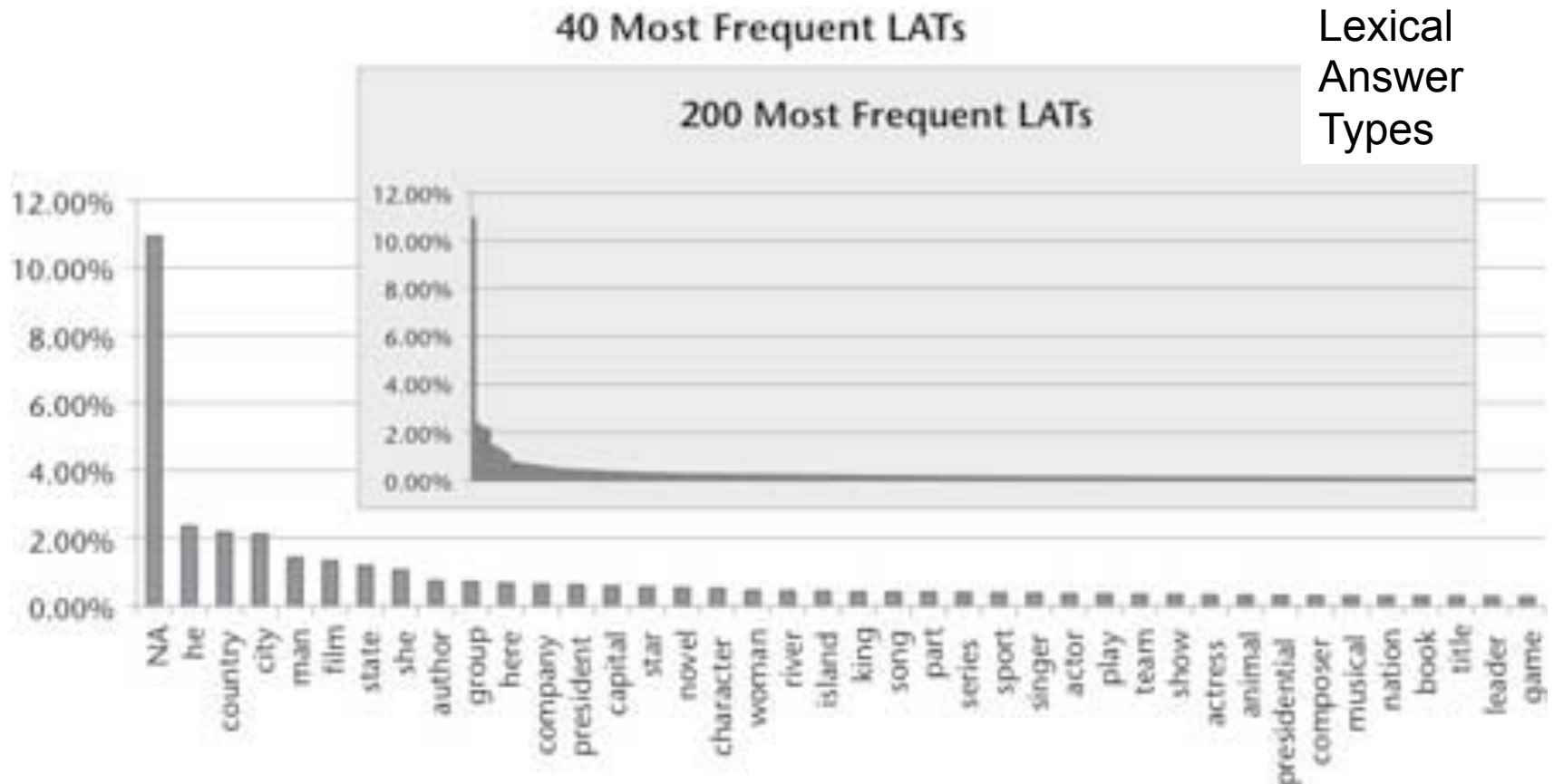
Despite the wrong answer, Watson is waaay more awesome than Deep Blue was. Why?

Watson: More Sophisticated

- Compared to Deep Blue, Watson is much more sophisticated in design, organization
 - runs on ~2,500 parallel CPUs, each capable of up to 33 billion operations a second; size of small RV
 - crawled and organized 200 million pages of data
 - “expert” analyzers — more than 100 different techniques running concurrently to analyze natural language, appraise sources, propose hypotheses, merge results and rank top guesses.

A Problem: What *Type* of Answer?

- Figuring out what is needed as an answer is tough: Who's on first? <baseball player>

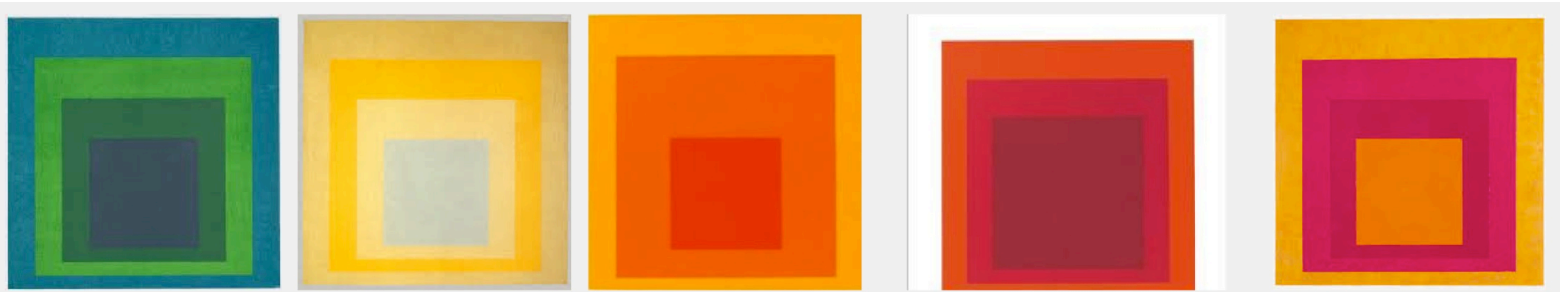


Compare Watson, Deep Blue

- Chess seems harder, but it's not
 - Chess has fixed rules, little real world data needed
 - Jeopardy, more free form using only real data
- Other differences
 - In chess the “problem” is known beforehand, but in Jeopardy, someone else sets up the problem
 - In chess, decisions are based on a formula, but in Jeopardy many forms of evaluation are needed (a problem solved by probabilities)
 - In chess there is very little pre-planning, but in Jeopardy, organizing the data is the key

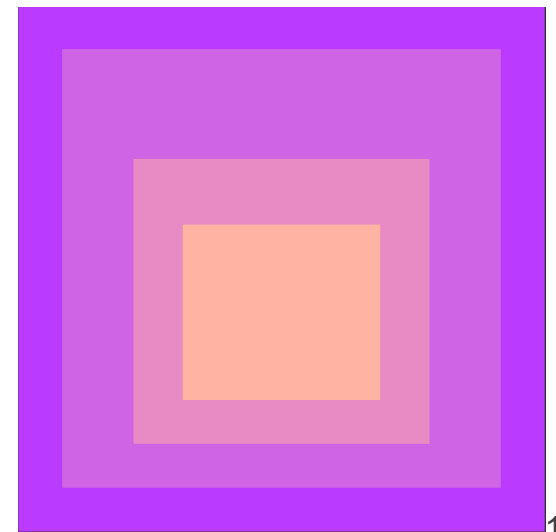
Creativity Shows Intelligence

- Can a computer be creative?
- Josef Albers, a famous 20th C artist
- Google search returns



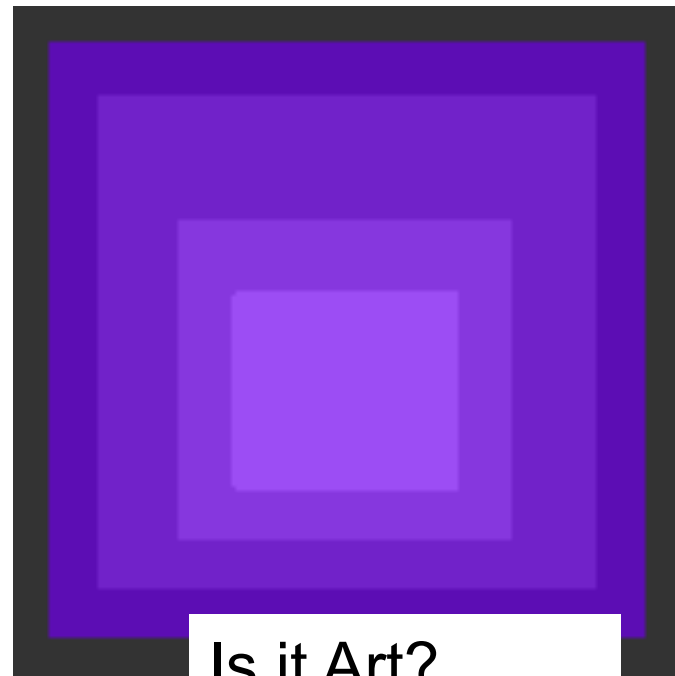
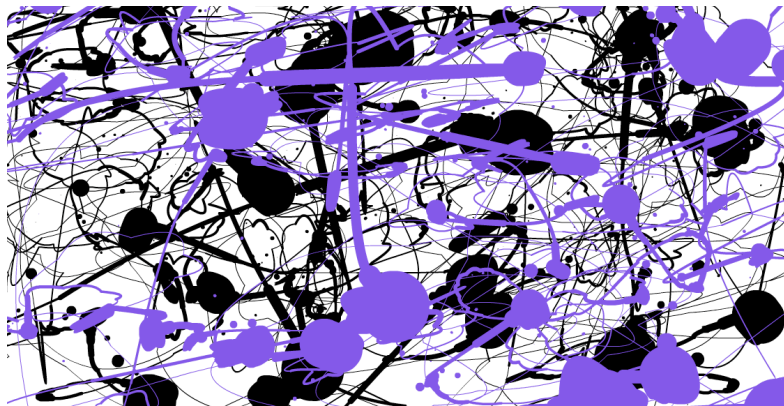
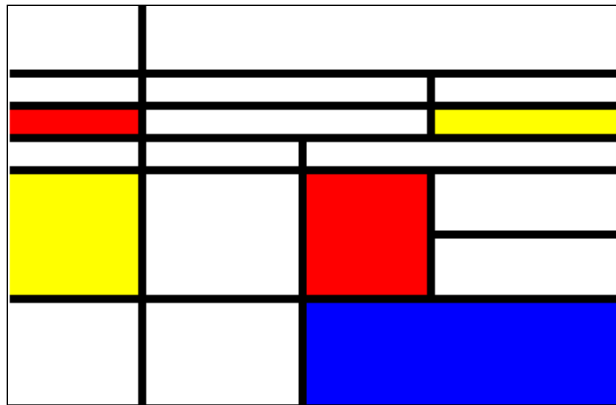
as examples of his work

- `hommageColor.pde` produces:



Being Creative

- Computers do things deemed creative in past
 - Create designs in the style of Piet Mondrian, Jackson Pollack or Josef Albers ...



Is it Art?
Is it Creative?

Definition of Creativity

- Creativity is a continuum; at ends: “flash out of the blue” and “incremental revision”
 - “Flash,” i.e. inspiration, is rare; is it just luck?
 - “Revision”, i.e. hard work, is common and to a large degree algorithmic

Advertising agencies are famous for creativity, but in a recent study, 89% of all *award-winning* ads were an application of one of six templates -- design algorithm

Composing Music

- An experiment at the U. of Oregon ...
compose music in the style of Bach
- Three participants: Bach, U of O Professor (Larson), EPI program
- Student pianists played a composition by each person; then the audience members gave their opinions as to who wrote each piece

Composing Music

- And the winner is ...

| | Audience Guess | True Composer |
|---------------|---------------------------|--------------------------|
| Composition 1 | EMI | Larson |
| Composition 2 | Larson | Bach |
| Composition 3 | Bach | EMI |

Summary

- Watson looks to be a major advance in AI and a big step towards answering Turing's Test

THE CAPACITY OF
A COMPUTER TO
PERFORM OPERATIONS
ANALOGOUS TO
LEARNING AND
DECISION MAKING
IN HUMANS

What is AI?