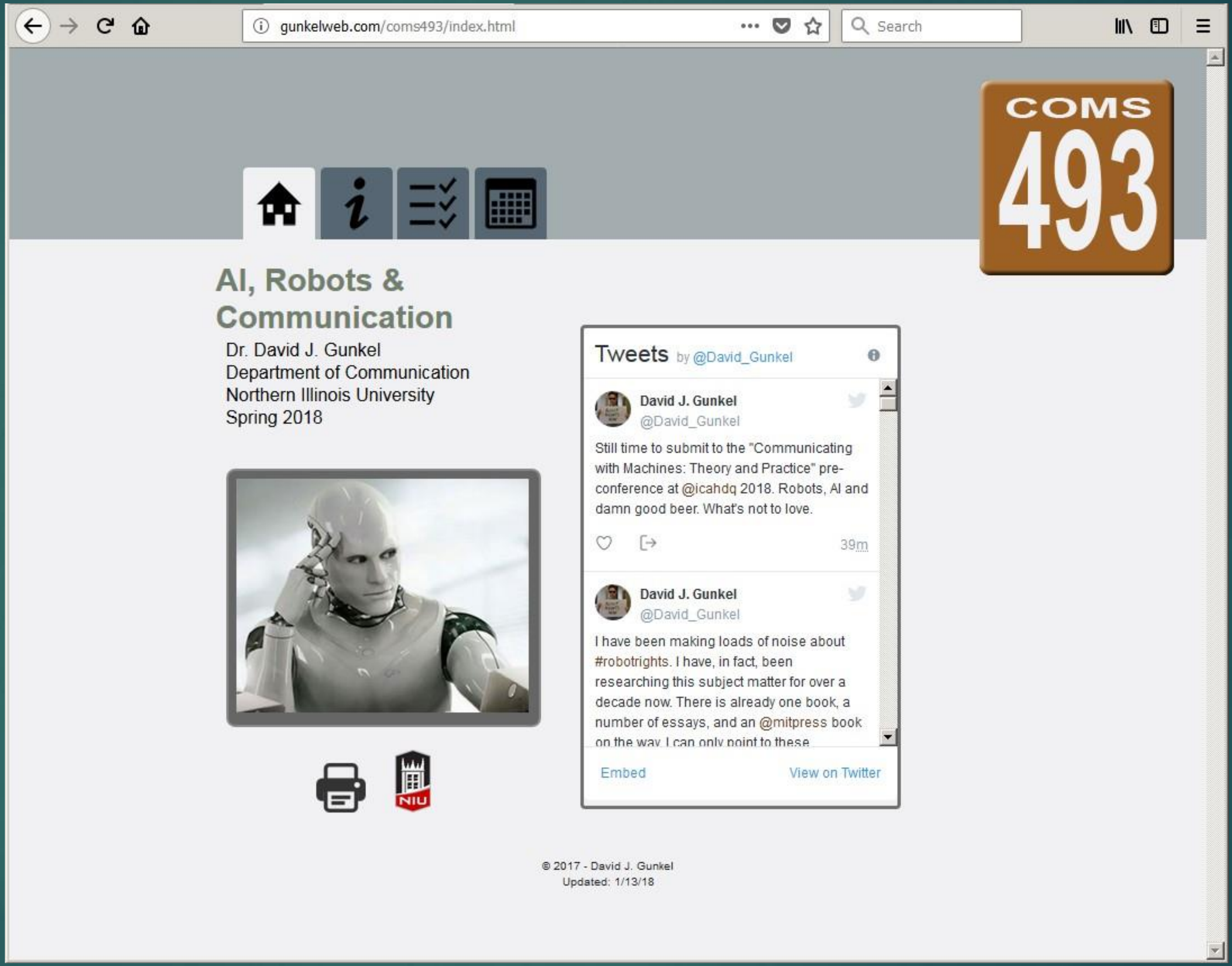
COMS 493

AI, ROBOTS & COMMUNICATION

Agenda – AI Introduction

- Review
- Presentation Sign-up
- History, Hype & Reality
- Preview

Review



http://gunkelweb.com/coms493

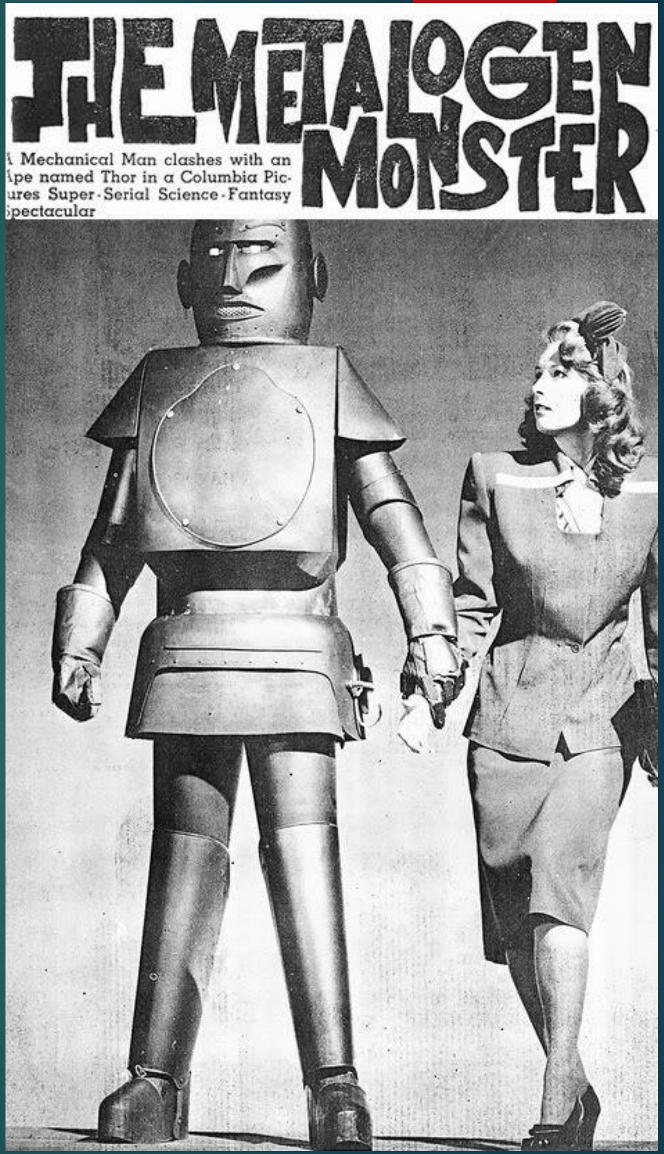
Presentations

COMS 493 - Presentation Schedule	Fall 2018
12 September - AI & Communication Turing - Computing Machinery & Intelligence Gunkel - Communication & AI PBS - The Chinese Room (video)	
19 September – Basic Concepts & Terminology Kaplan - AI: What Everyone Needs to Know - ch. 4 & 8 Steiner - Algorithms Are Taking Over (video) Garrett - A World Run on Algorithms? Howard - Machine Learning (video)	
26 September - Machine Translation Weaver Memo Gunkel - Machine Translation Poibeau - Machine Translation	
3 October - Natural Language Processing Weizenbaum - Contextual Understanding by Computers Gunkel – Natural Language Processing RadioLab - Talking to Machines	
17 October – Computational Creativity Gunkel - Computational Creativity Colton & Wiggins - Computational Creativity Amper (video) & Taryn Southern - Break Free Sunspring (video) NPR - Cooking with Watson (video)	
24 October – Social Robots Jibo - Promotional Video Breazeal - Personal Robots (video) Guzman - Making AI Safe de Graaf - Human-Robot Relationships	
31 October – Social Issues Kaplan - AI: What Everyone Needs to Know - ch. 6 & 7 Halpern - How Robots are Taking Over McAfee - Are Droids Taking Our Jobs? (video) PBS - Will Your Job Be Done by a Machine?	
7 November – Ethics, Law & Policy Crawford & Whittaker - AI Now Initiative (video) / (transcript) Knight - The Dark Secret at the Heart of AI Gunkel - Mind the Gap	
28 November - Machine Question & Robot Rights PBS Ideas - When Will We Worry about the Well Being of Robots? *The Machine Question*, ch. 1 & 2	

History, Hype & Reality

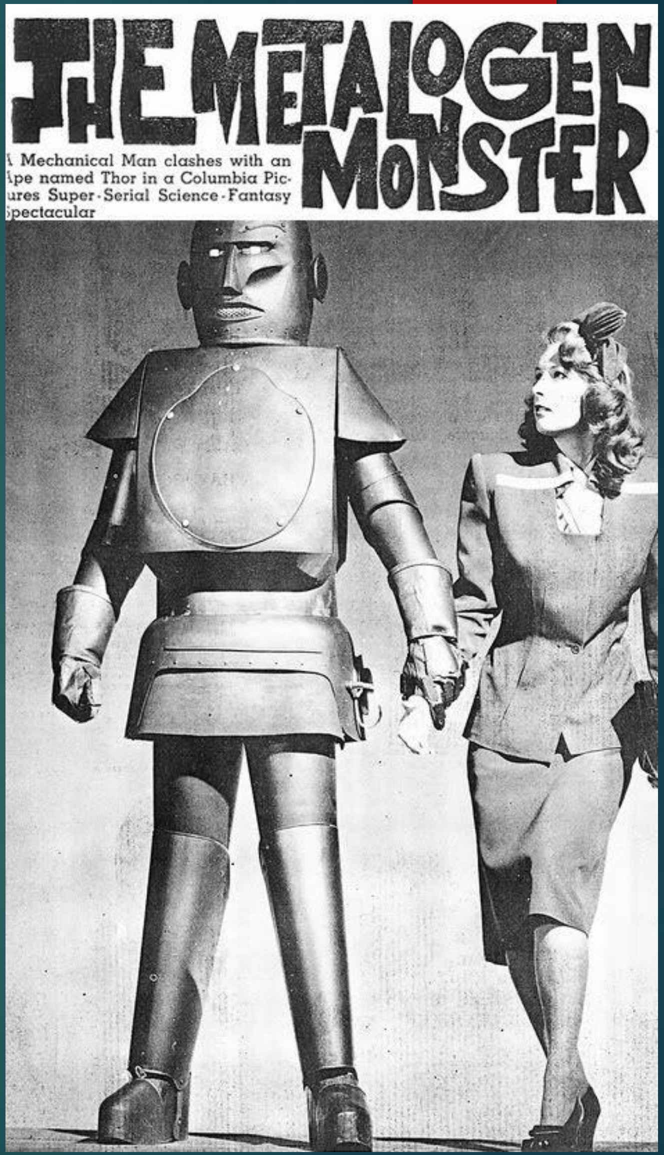
- **Objective:** Demystify Technology

  Sort science fiction from science fact by looking at the history of artificial intelligence and robotics, the hype that has surrounded the technology and its social consequences as portrayed in fiction, and the reality of AI/robots as they exists right now at the beginning of the 21st century.

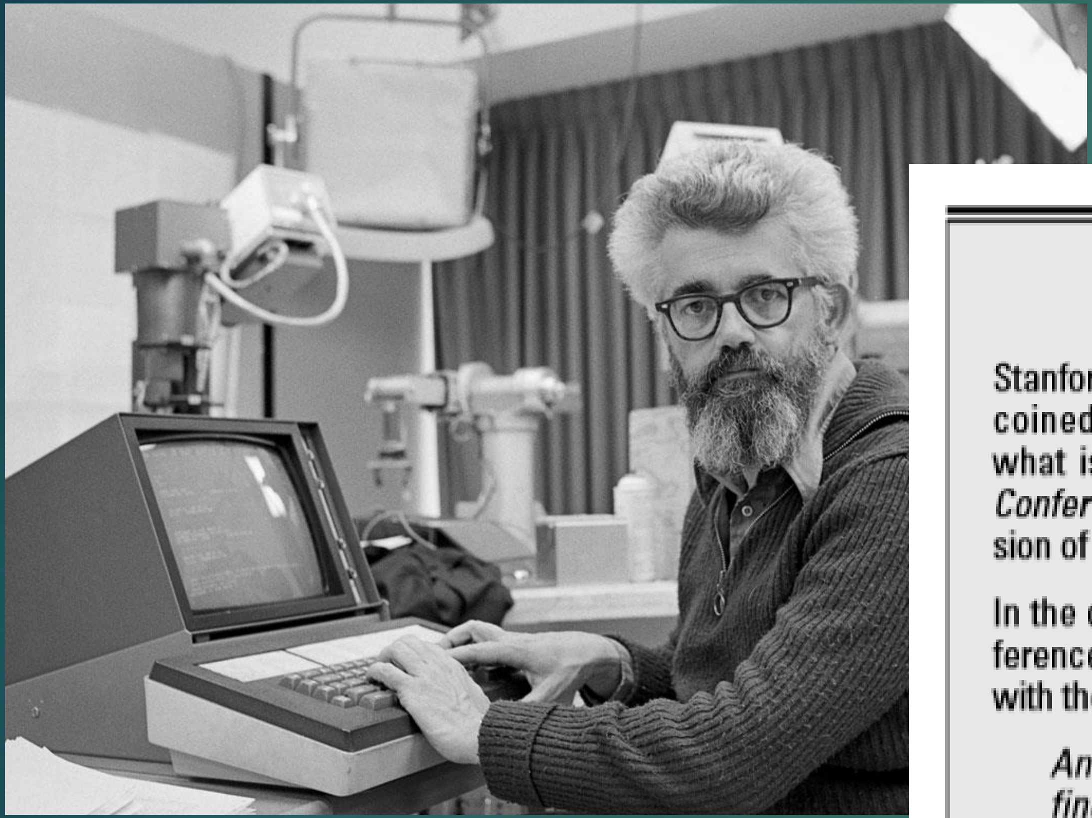


History, Hype & Reality

- Terminology
  - Artificial Intelligence
  - Robot
- Science Fiction
- History
- Research & Development
  - GOFAI vs. Machine Learning
  - Real World Applications



Artificial Intelligence



John McCarthy

The Dartmouth Conference

Stanford researcher John McCarthy coined the term in 1956 during what is now called *the Dartmouth Conference*, in which the core mission of AI was defined.

In the original proposal for the conference, McCarthy framed the effort with the following:

> *An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.*
>
> *— John McCarthy, Marvin Minsky, Nathan Rochester, and Claude Shannon, "A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence" (1955)*

Artificial Intelligence

A Proposal for the

DARTMOUTH SUMMER RESEARCH PROJECT ON ARTIFICIAL INTELLIGENCE

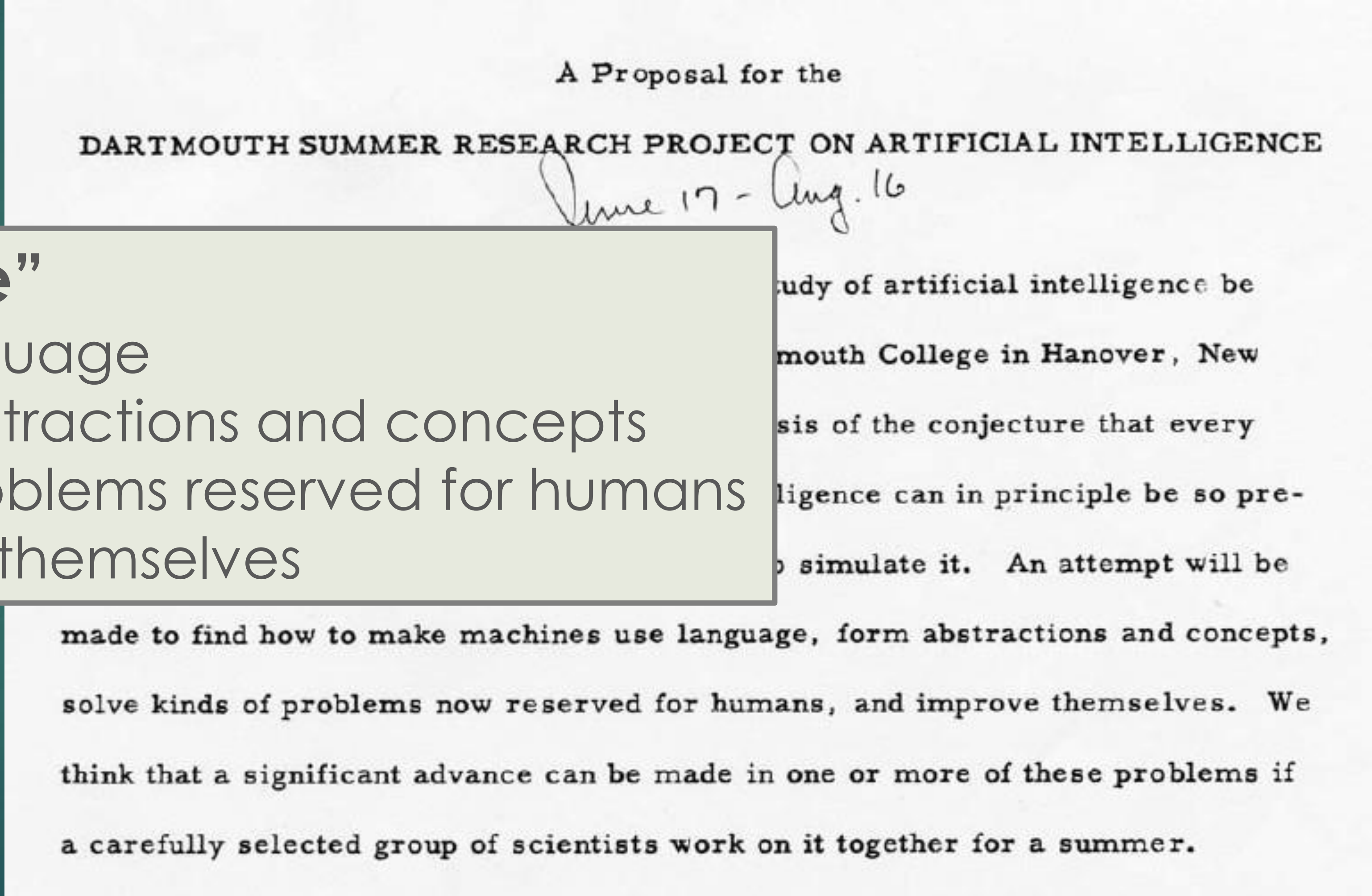
June 17 - Aug. 16

We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

Artificial Intelligence

- "Intelligence"
  - 1. Individually – Define "Intelligence"
  - 2. Collectively – Groups of 5, compare definitions and devise a single, common definition.
  - 3. Compare Outcomes

Artificial Intelligence



A Proposal for the

DARTMOUTH SUMMER RESEARCH PROJECT ON ARTIFICIAL INTELLIGENCE

June 17 - Aug. 16

udy of artificial intelligence be

mouth College in Hanover, New

sis of the conjecture that every

ligence can in principle be so pre-

simulate it. An attempt will be

made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

"Intelligence"

- Use Language
- Form abstractions and concepts
- Solve problems reserved for humans
- Improve themselves

Artificial Intelligence

Intelligence – Critical Features

1. *Communication* – "An intelligent entity can be communicated with. We can't talk to rocks or tell trees what we want."

2. *Internal Knowledge* – "We expect intelligent entities to have some knowledge about themselves"

3. *World Knowledge* – "Intelligence also involves being aware of the outside world and being able to find and utilize the information one has about the outside world"

4. *Goals and Plans* – "Goal driven behavior means knowing when one wants something and knowing a plan to get what one wants"

5. *Creativity* – "Every intelligent entity is assumed to have some degree of creativity"

Roger Schank "What is AI, Anyway?"

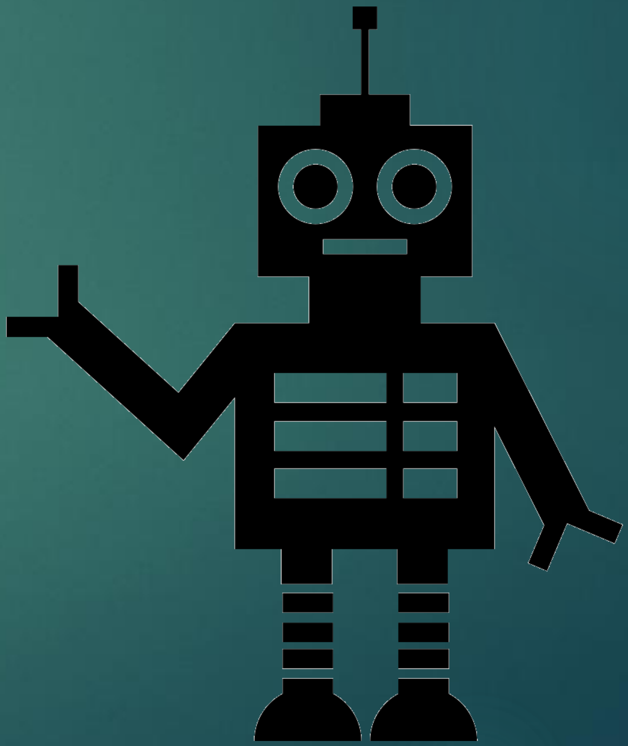
Artificial Intelligence

- “Artificial”?

Natural Intelligence

VS

Artificial Intelligence



Artificial Intelligence

- "Artificial"?

Robert Sokolowski

Natural and Artificial Intelligence

IN THIS ESSAY we will not attempt to decide whether artificial intelligence is the same as natural intelligence. Instead we will examine some of the issues and terms that must be clarified before that question can be resolved. We will discuss how the question about the relationship between natural and artificial intelligence can be formulated.

One of the first things that must be clarified is the ambiguous word *artificial*. This adjective can be used in two senses, and it is important to determine which one applies in the term *artificial intelligence*. The word *artificial* is used in one sense when it is applied, say, to flowers, and in another sense when it is applied to light. In both cases something is called artificial because it is fabricated. But in the first usage artificial means that the thing seems to be, but really is not, what it looks like. The artificial is the merely apparent; it just shows how something else looks. Artificial flowers are only paper, not flowers at all; anyone who takes them to be flowers is mistaken. But artificial light is light and it does illuminate. It is fabricated as a substitute for natural light, but once fabricated it is what it seems to be. In this sense the artificial is not the merely apparent, not simply an imitation of something else. The appearance of the thing reveals what it is, not how something else looks.

Artificial Intelligence

- "Artificial"?

Fake or Imitation
The thing seems to be, but really is not, what it looks like.

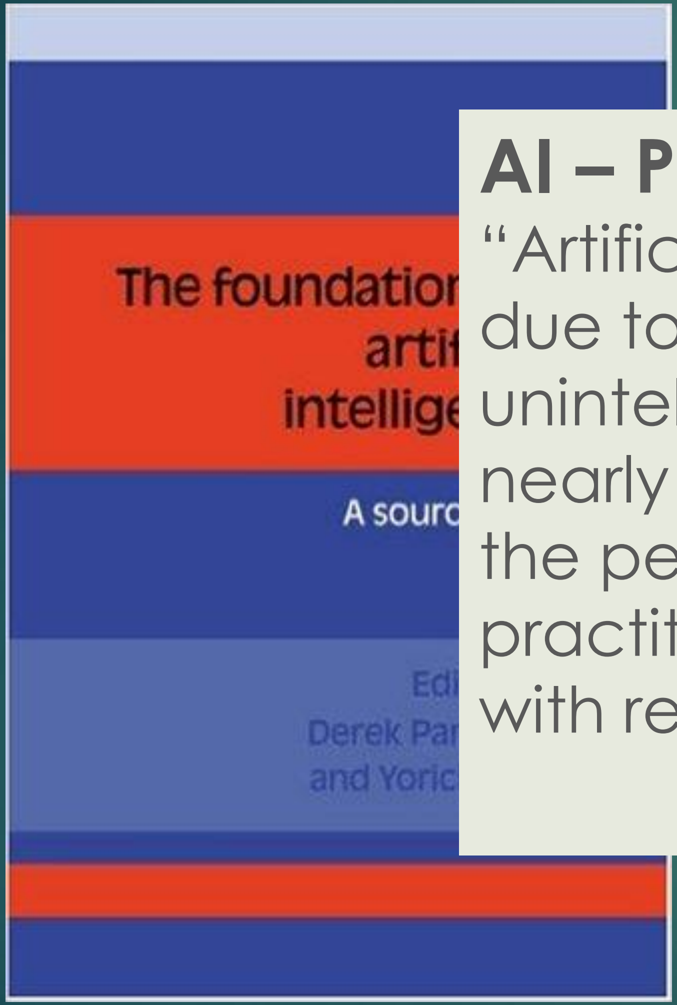
Substitute or Simulation
The thing is not just an imitation of something else but really is what it seems to be.

Artificial Intelligence

- Questions
  - Is Artificial Intelligence "fake" intelligence?
  - Is Artificial Intelligence "simulated" intelligence?
  - What would be the difference and how could you tell?

In which sense do we use the word *artificial* when we speak of artificial intelligence? Critics of artificial intelligence, those who disparage the idea and say it has been overblown and oversold, would claim that the term is used in the first sense, to mean the merely apparent. They would say that artificial intelligence is really nothing but complex mechanical structures and electrical processes that present an illusion (to the gullible) of some sort of thinking. Supporters of the idea of artificial intelligence, those who claim that the term names something genuine and not merely apparent, would say that the word *artificial* is used in the second of the senses we have distinguished. Obviously, they would say, thinking machines are artifacts; obviously they are run by human beings; but once made and set in motion, the machines do think. Their thinking may be different from that of human beings in some ways, just as the movement of a car is different from that of a rabbit and the flight of an airplane is different from that of a bird, but it is a kind of genuine thinking, just as there is genuine motion in the car and genuine flight in the plane.

Artificial Intelligence



AI – Problem with Definition

"Artificial intelligence is a subject that, due to the massive, often quite unintelligible, publicity that it gets, is nearly completely misunderstood by the people outside the field. Even AI's practitioners are somewhat confused with respect to what AI is really about."

Roger Schank "What is AI, Anyway?"

Artificial Intelligence

Problem might not be a problem

"Curiously, the lack of a precise, universally accepted definition of AI probably has helped the field to grow, blossom, and advance at an ever-accelerating pace. Practitioners, researchers, and developers of AI are instead guided by a rough sense of direction and an imperative to 'get on with it.'"

ARTIFICIAL INTELLIGENCE AND LIFE IN 2030

ONE HUNDRED YEAR STUDY ON ARTIFICIAL INTELLIGENCE | REPORT OF THE 2015 STUDY PANEL | SEPTEMBER 2016

PREFACE

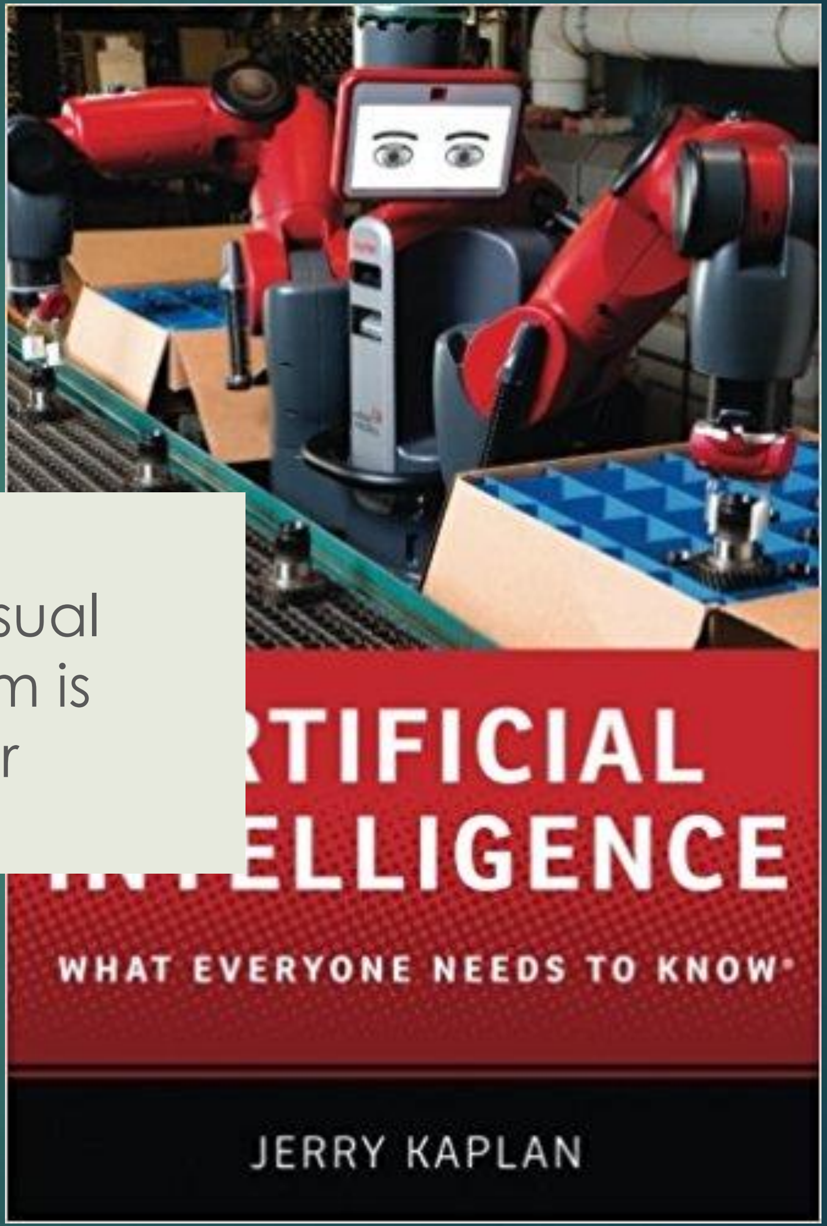
ollowing the immediately prior report,
ahead, and describes the technical and
se advances raise, including in such arenas as
ems compatible with human cognition. The
d Year Study's periodic expert review is to
reflections about AI and its influences as the
to develop syntheses and assessments that
rections in
lesign, as well as programs and policies to
enefit individuals and society.[1]
leled on an earlier effort informally known as
8-2009, the then president of the Association
gence (AAAI), Eric Horvitz, assembled a
itions and areas of the field, along with
, and law. Working in distributed subgroups,
developments, long-term possibilities,
came together in a three-day meeting at
ngs. A short written report on the intensive
rticipants' subsequent discussions with other
t and debate in the field and beyond.

The impact of the Asilomar meeting, and important advances in AI that included AI algorithms and technologies starting to enter daily life around the globe, spurred the idea of a long-term recurring study of AI and its influence on people and society. The One Hundred Year Study was subsequently endowed at a university to enable

The overarching purpose of the One Hundred Year Study's periodic expert review is to provide a collected and connected set of reflections about AI and its influences as the field advances.

1 "One Hundred Year Study on Artificial Intelligence (AI100)," Stanford University, accessed August 1, 2016, https://ai100.stanford.edu.

Artificial Intelligence



Another Problem - Moving Target
"But the field of AI suffers from an unusual deficiency—once a particular problem is considered solved, it often is no longer considered AI." – Kaplan p. 37

Artificial Intelligence

Moving Target
Example 1 = Chess

Garry Kasparov vs. Deep Blue (1997)

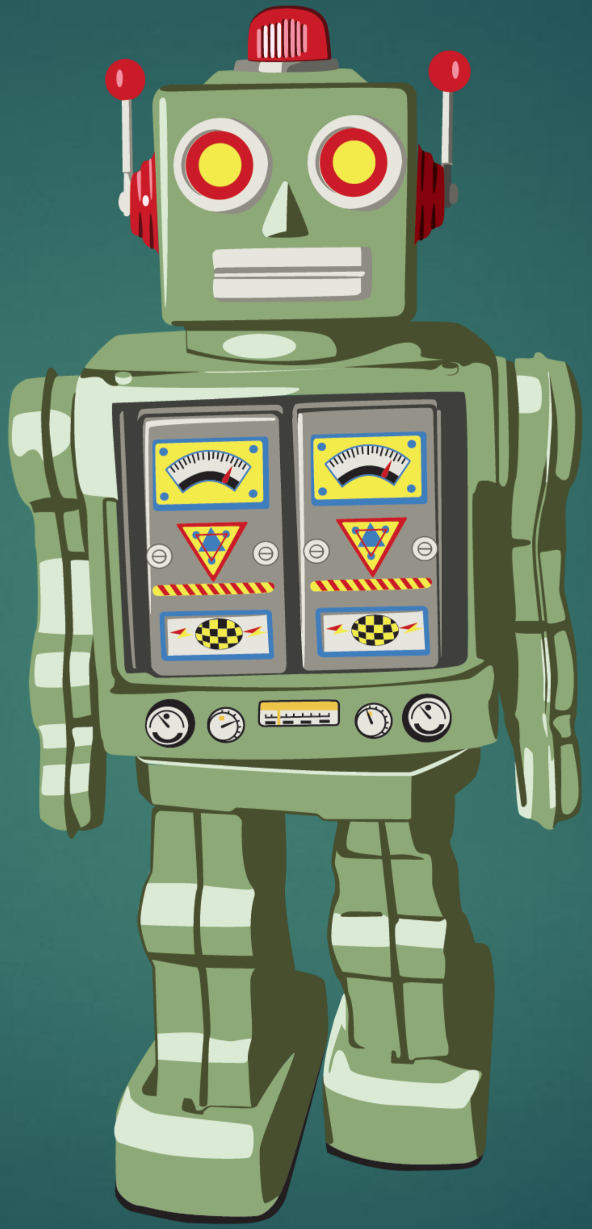
Artificial Intelligence

Moving Target
Example 2 = Jeopardy

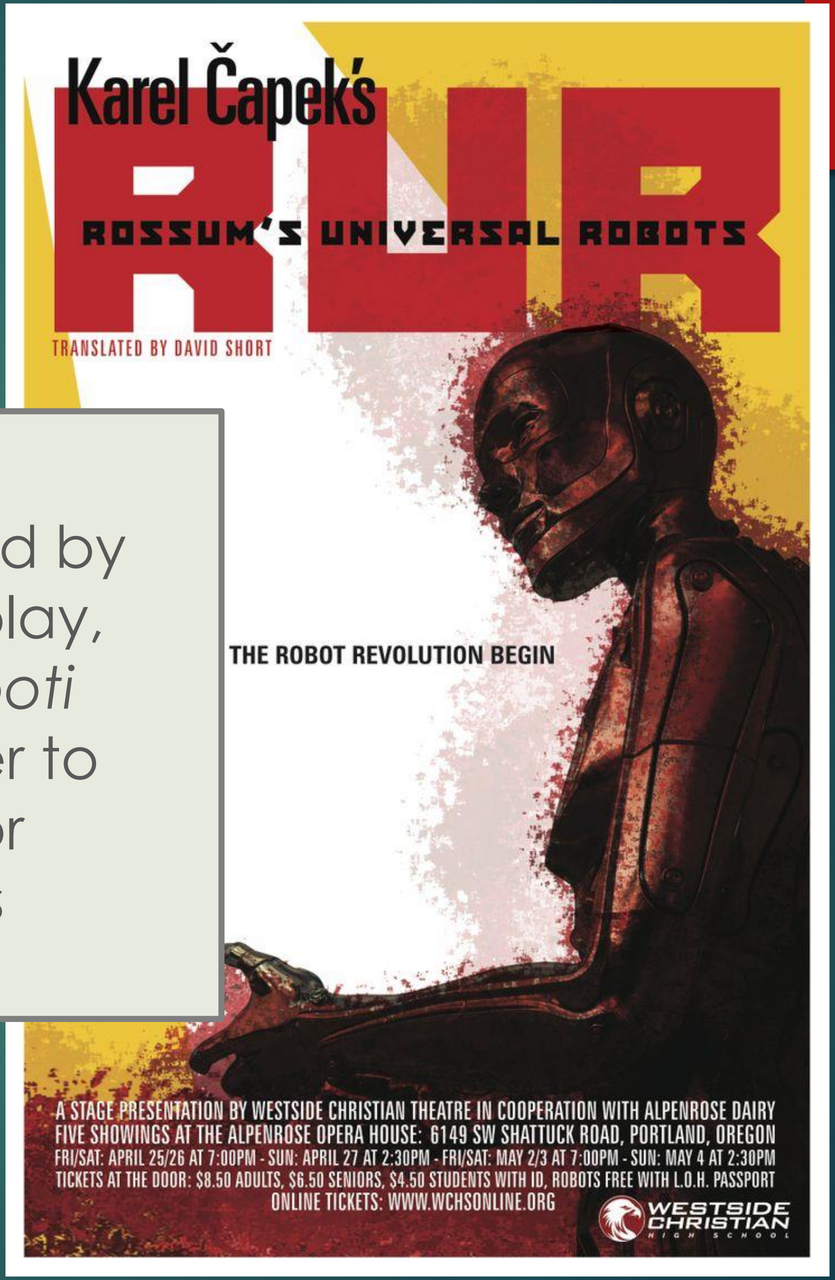
"I for one, welcome our
new computer overlords"
- Ken Jennings

IBM Watson beats Ken Jennings and Brad Rutter in February 2011.

Robot



Robot



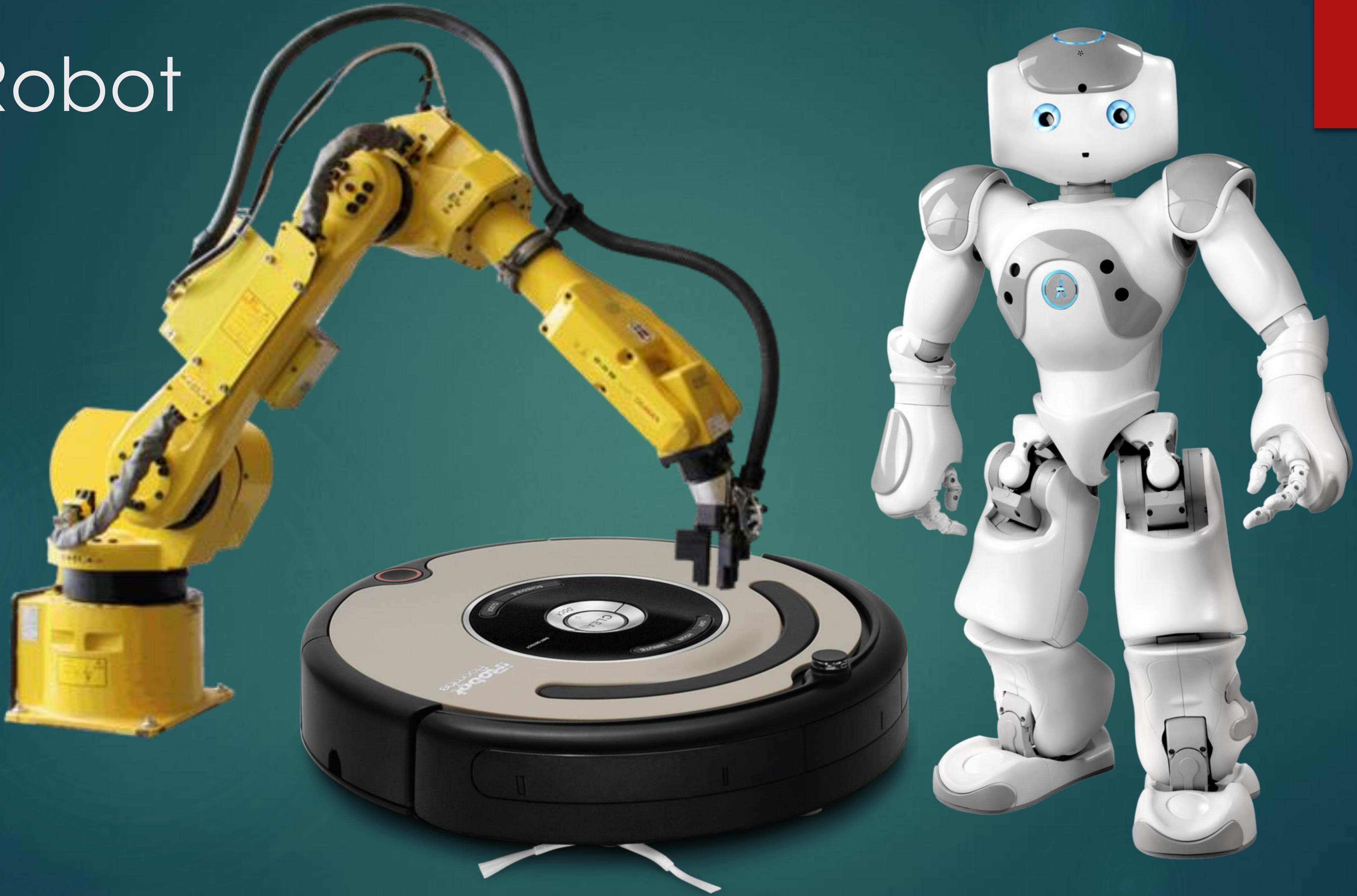
Robot

The word **robot** came into the world by way of Karel Čapek's 1920 stage play, R.U.R. or *Rossumovi Univerzální Roboti* (Rossum's Universal Robots) in order to name a class of artificial servants or laborers. In Czech "robota" means servant or slave.

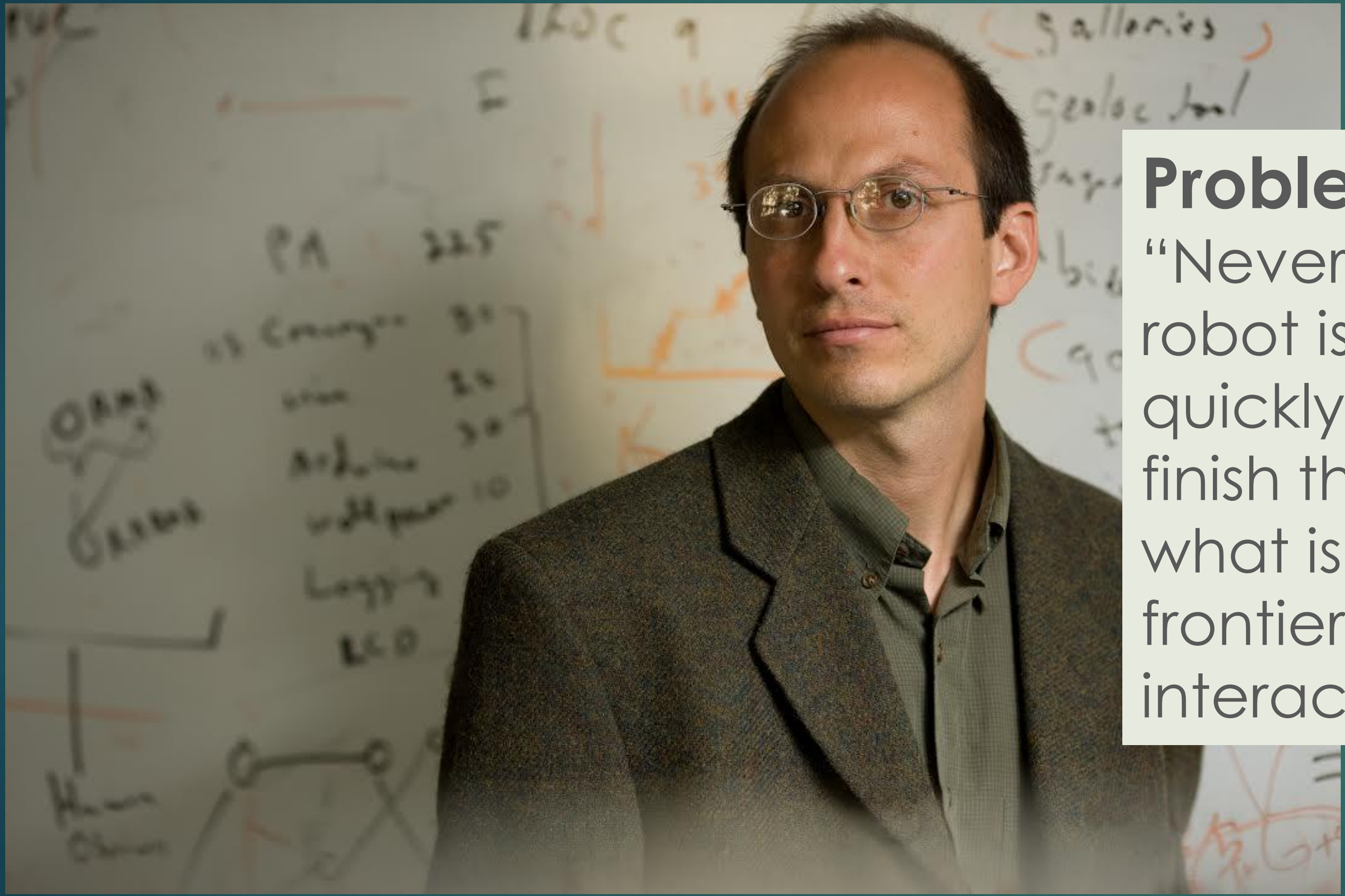
Robot

The author of the play *R.U.R.* did not, in fact, invent that word; he merely ushered it into existence. It was like this: the idea for the play came to said author in a single, unguarded moment. And while it was still warm he rushed immediately to his brother Josef, the painter, who was standing before an easel and painting away at a canvas till it rustled. “Listen, Josef,” the author began, “I think I have an idea for a play.” “What kind,” the painter mumbled (he really did mumble, because at the moment he was holding a brush in his mouth). The author told him as briefly as he could. “Then write it,” the painter remarked, without taking the brush from his mouth or halting work on the canvas. The indifference was quite insulting. “But,” the author said, “I don't know what to call these artificial workers. I could call them *Labori*, but that strikes me as a bit bookish.” “Then call them Robots,” the painter muttered, brush in mouth, and went on painting. And that’s how it was. Thus the word Robot was born; let this acknowledge its true creator. (Čapek 1935; also quoted in Jones 2016, 53)

Robot



Robot



Illah Nourbakhsh – Professor of Robotics CMU

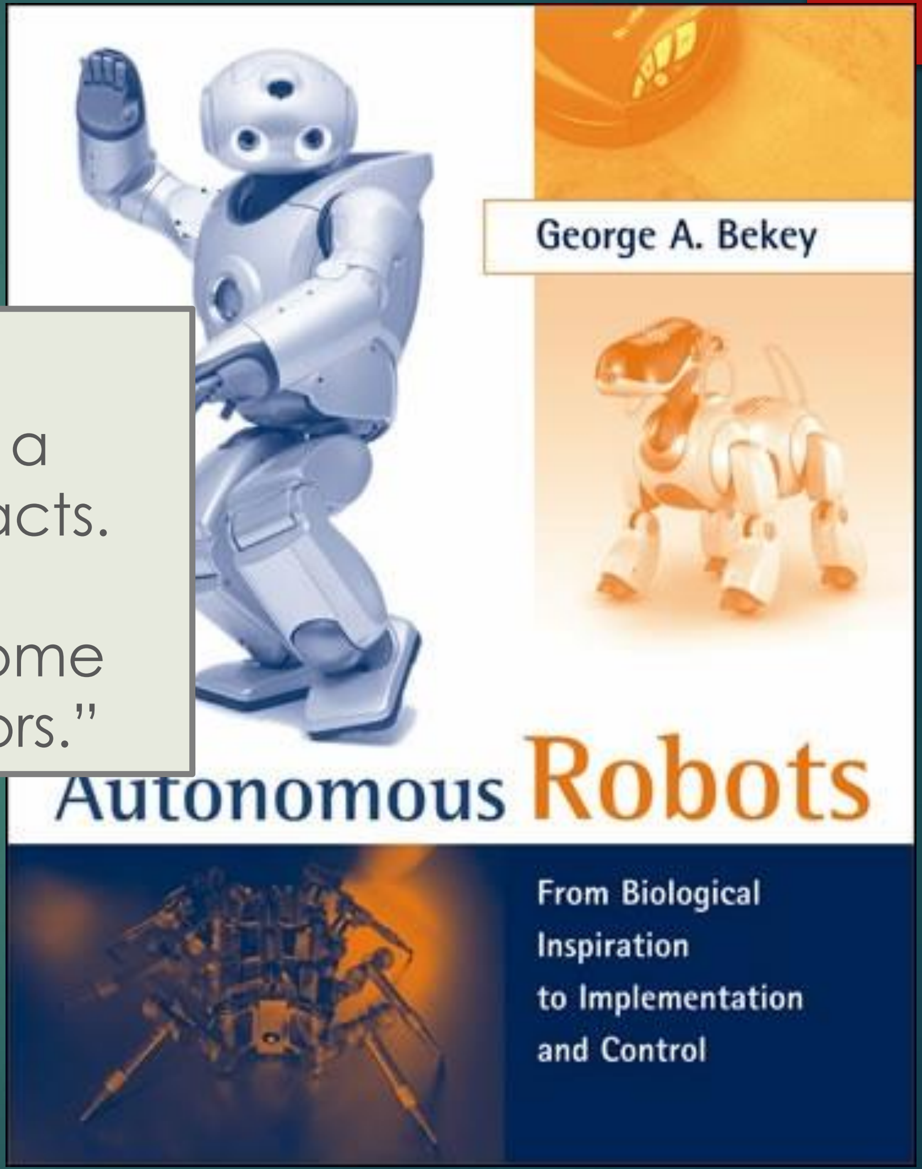
Problem with Definition

"Never ask a roboticist what a robot is. The answer changes too quickly. By the time researchers finish their most recent debate on what is and what isn't a robot, the frontier moves on as whole new interaction technologies are born."

Robot

Sense-Act-Think Paradigm

"In this book we define a robot as a machine that senses, thinks, and acts. Thus, a robot must have sensors, processing ability that emulates some aspects of cognition, and actuators."



Robot

1. Sense
Speech Recognition

Figure 2-2: A waveform generated when an intelligent assistant captures voice.

Robot

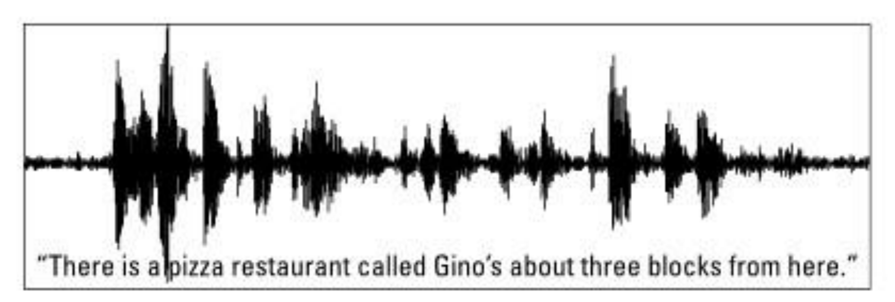
2. Think
Make Inferences

Move from the captured sound to words to ideas to user needs. In this case, the system identifies the word "pizza" from the input. Infers that the user wants to get a pizza. It therefore accesses GPS info, looks up restaurants that serve pizza, and ranks them according to some criteria like location, rating, or price.

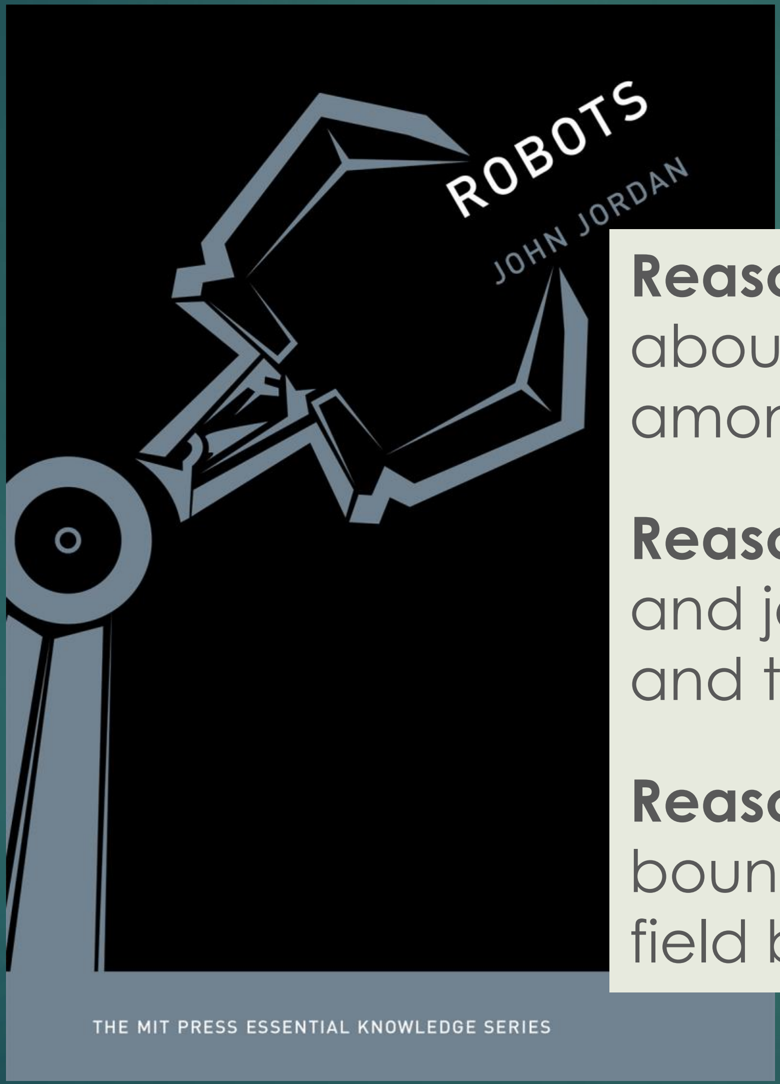
Robot

3. Act
Communicate Results

This involves organizing the results into a reasonable set of ideas to be communicated, mapping the ideas onto a sentence or two (natural language generation), and then turning those words into sounds (speech synthesis).



Robot

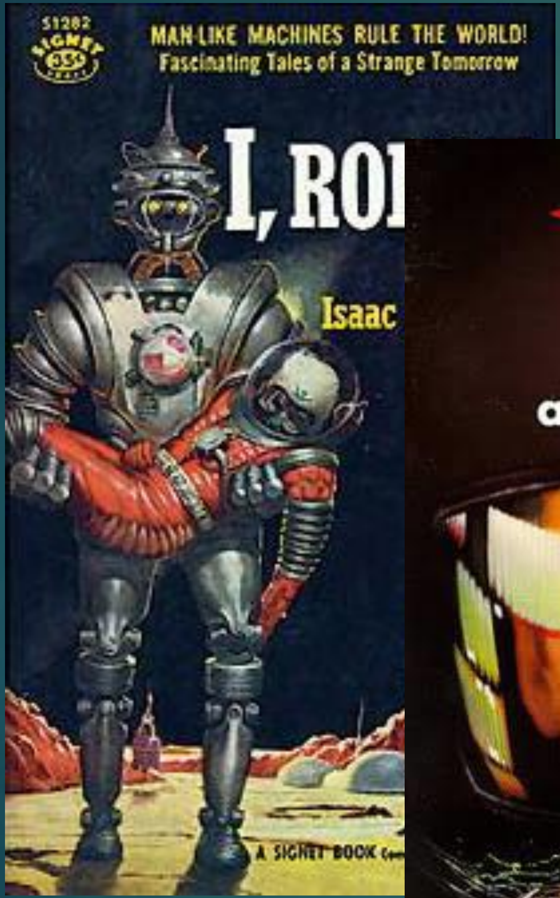


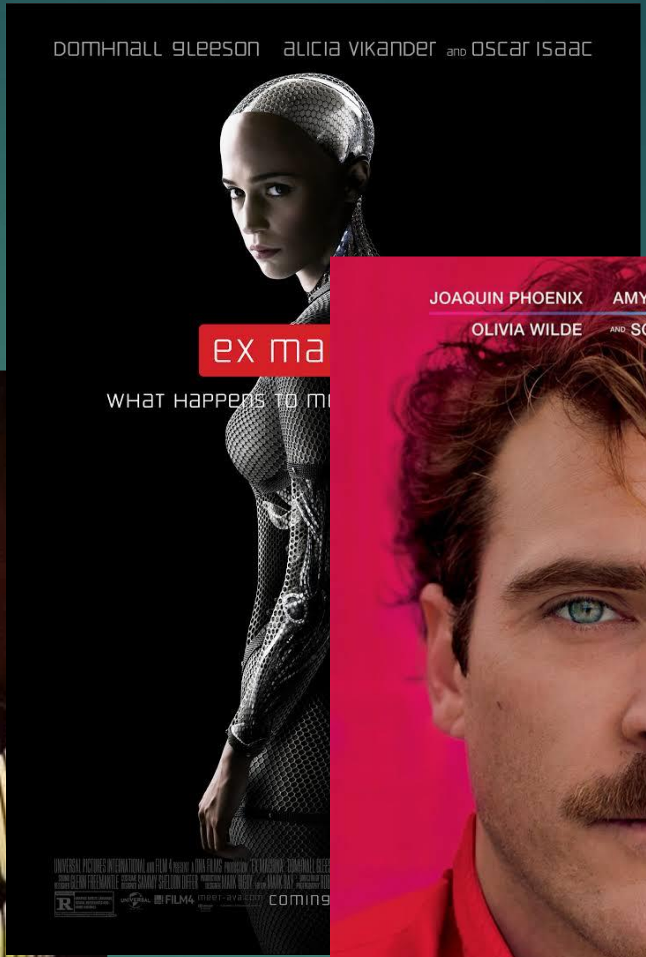
Reason 1: why robots are hard to talk about: <u>the definition is unsettled</u>, even among those most expert in the field.

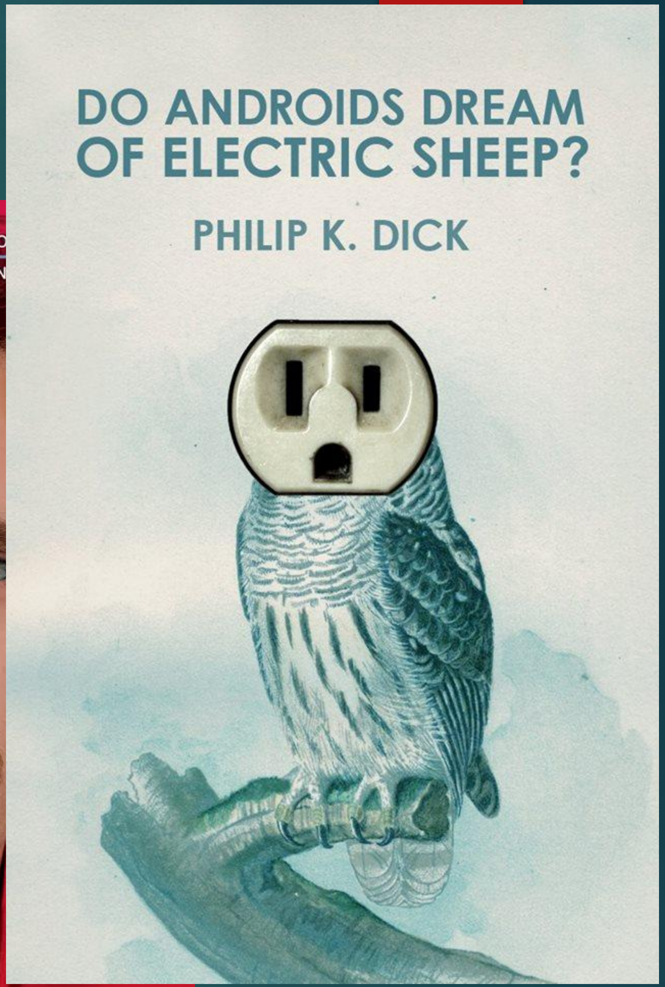
Reason 2: <u>definitions evolve</u> unevenly and jerkily, over time as social context and technical capabilities change.

Reason 3: <u>science fiction</u> set the boundaries of the conceptual playing field before the engineers did.

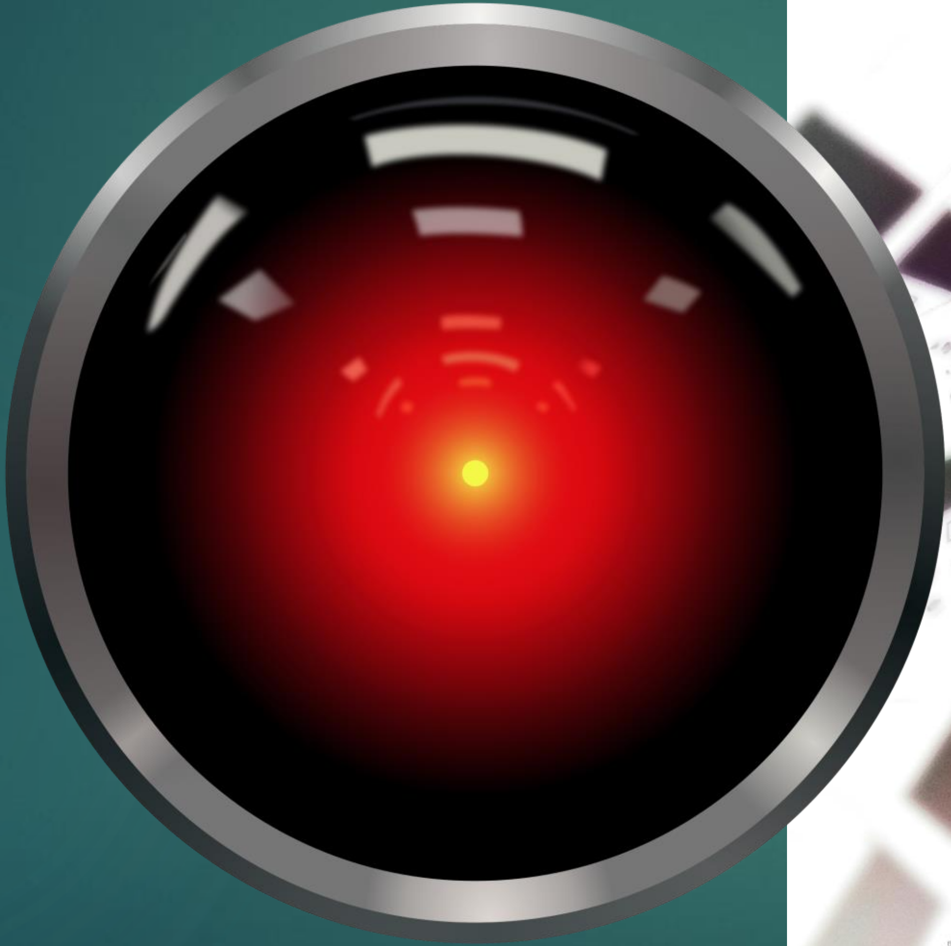
Science Fiction

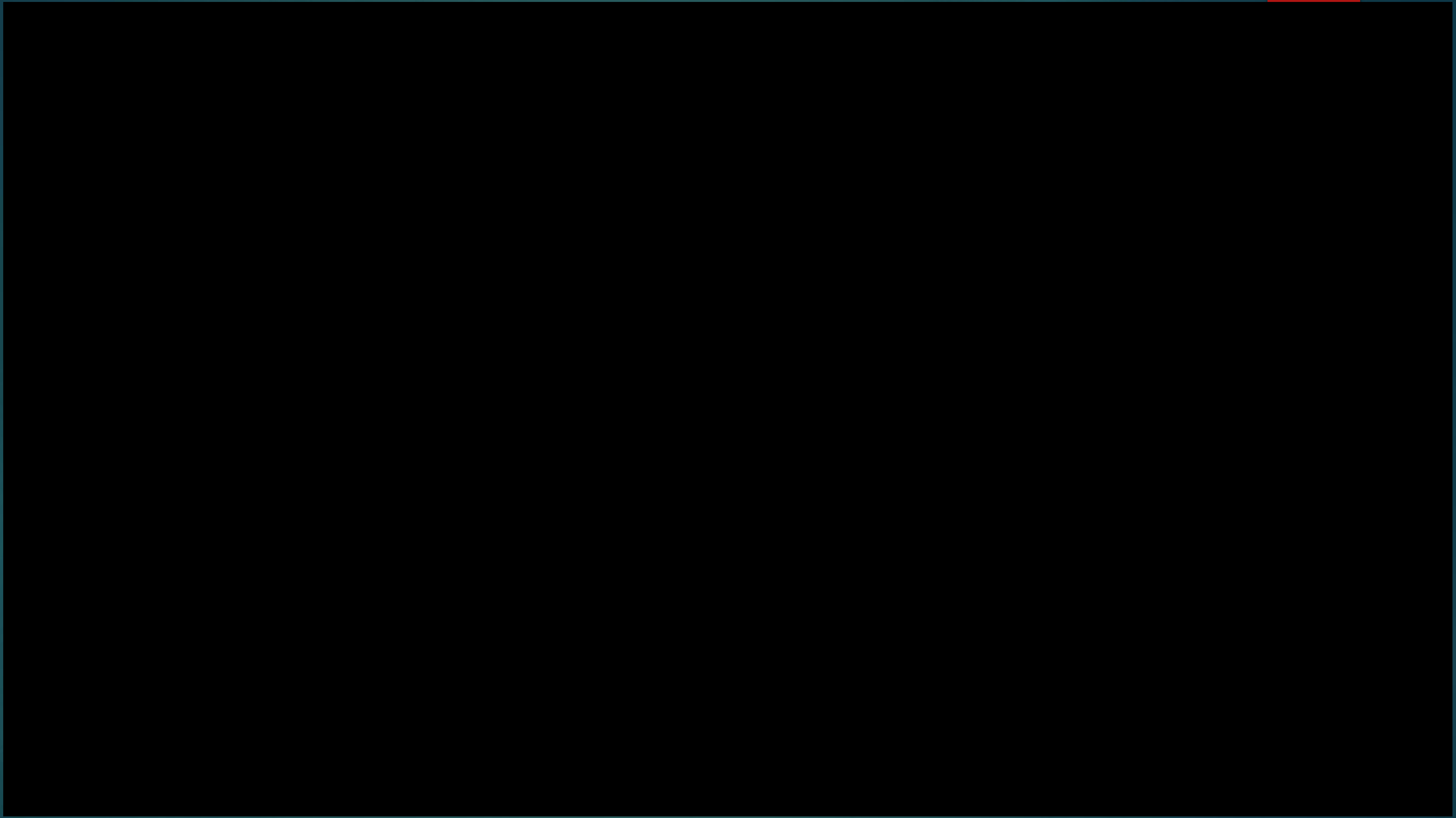






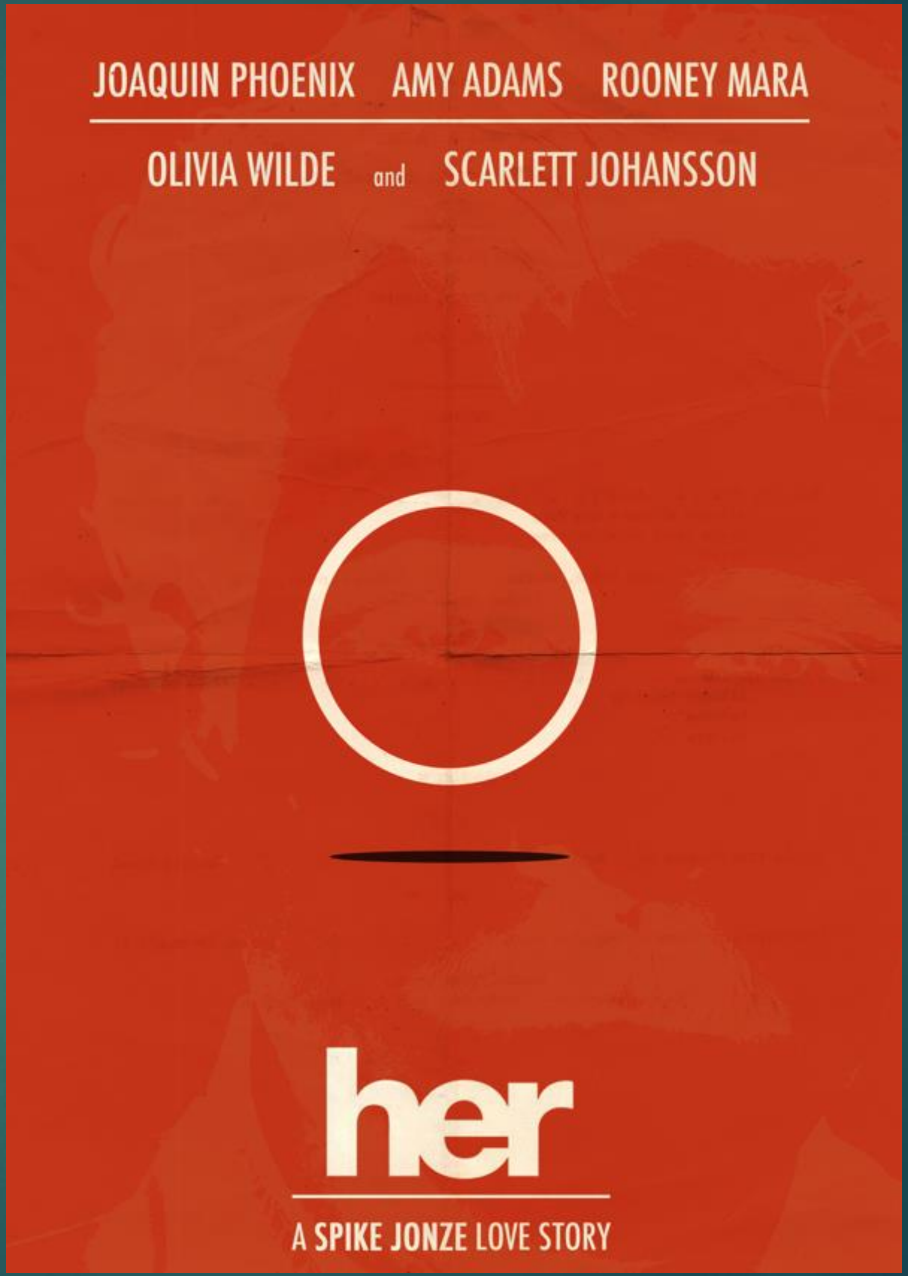
Science Fiction

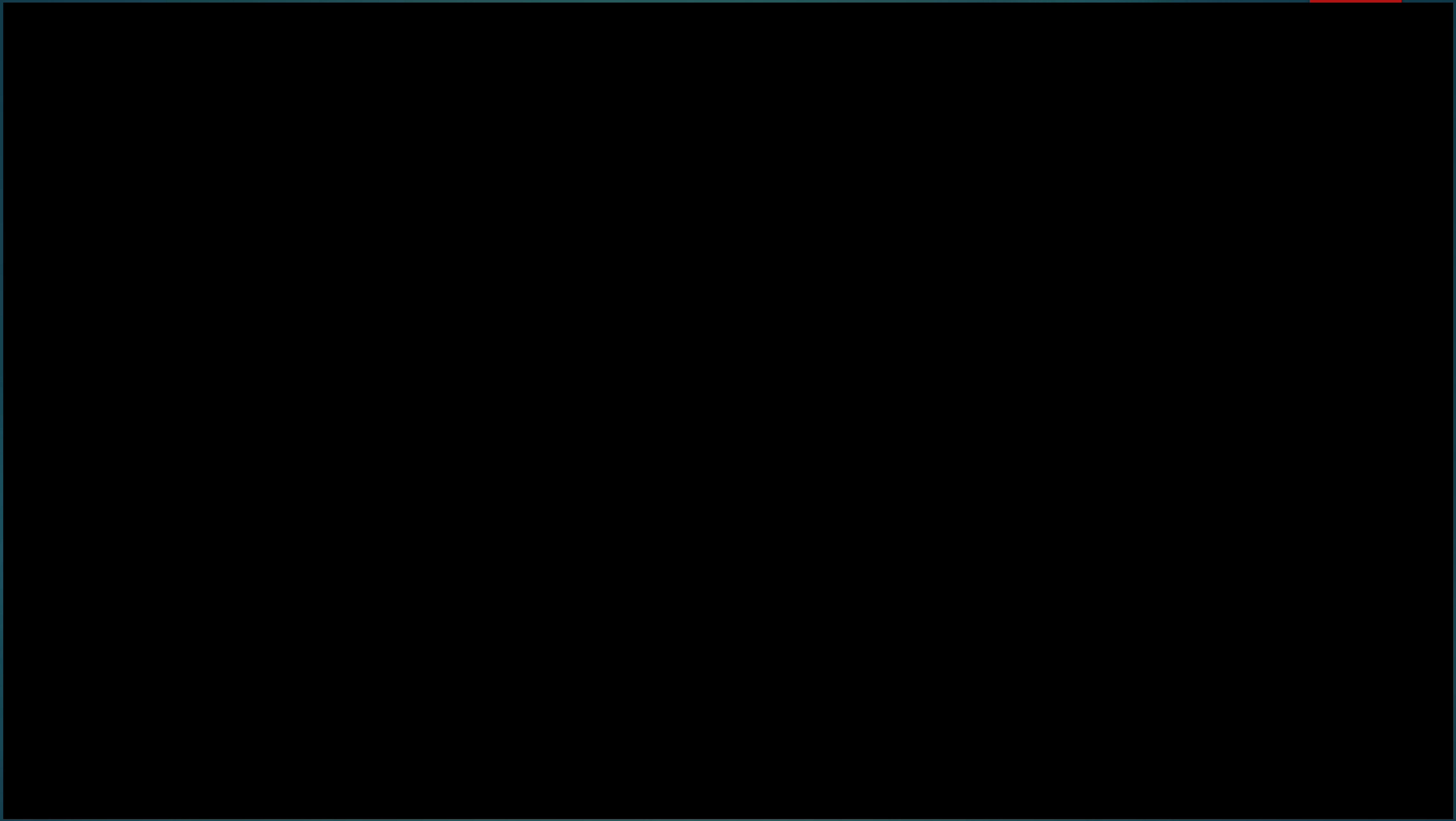




http://www.tcm.com/mediaroom/video/474156/2001-A-Space-Odyssey-Movie-Clip-HAL-9000.html

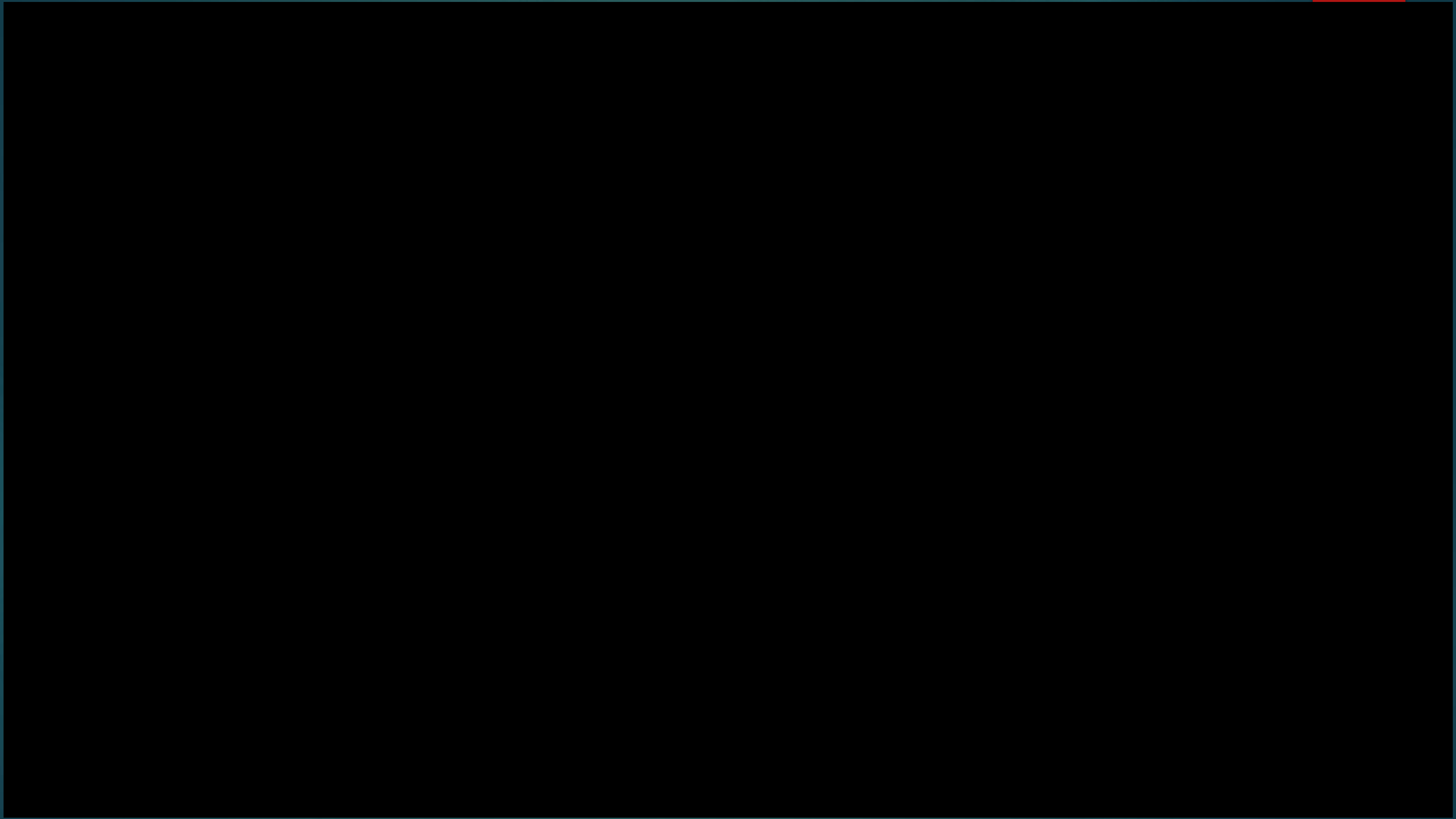
Science Fiction





https://www.youtube.com/watch?v=ne6p6MfLBxc

Science Fiction



https://www.youtube.com/watch?v=BV8qFeZxZPE

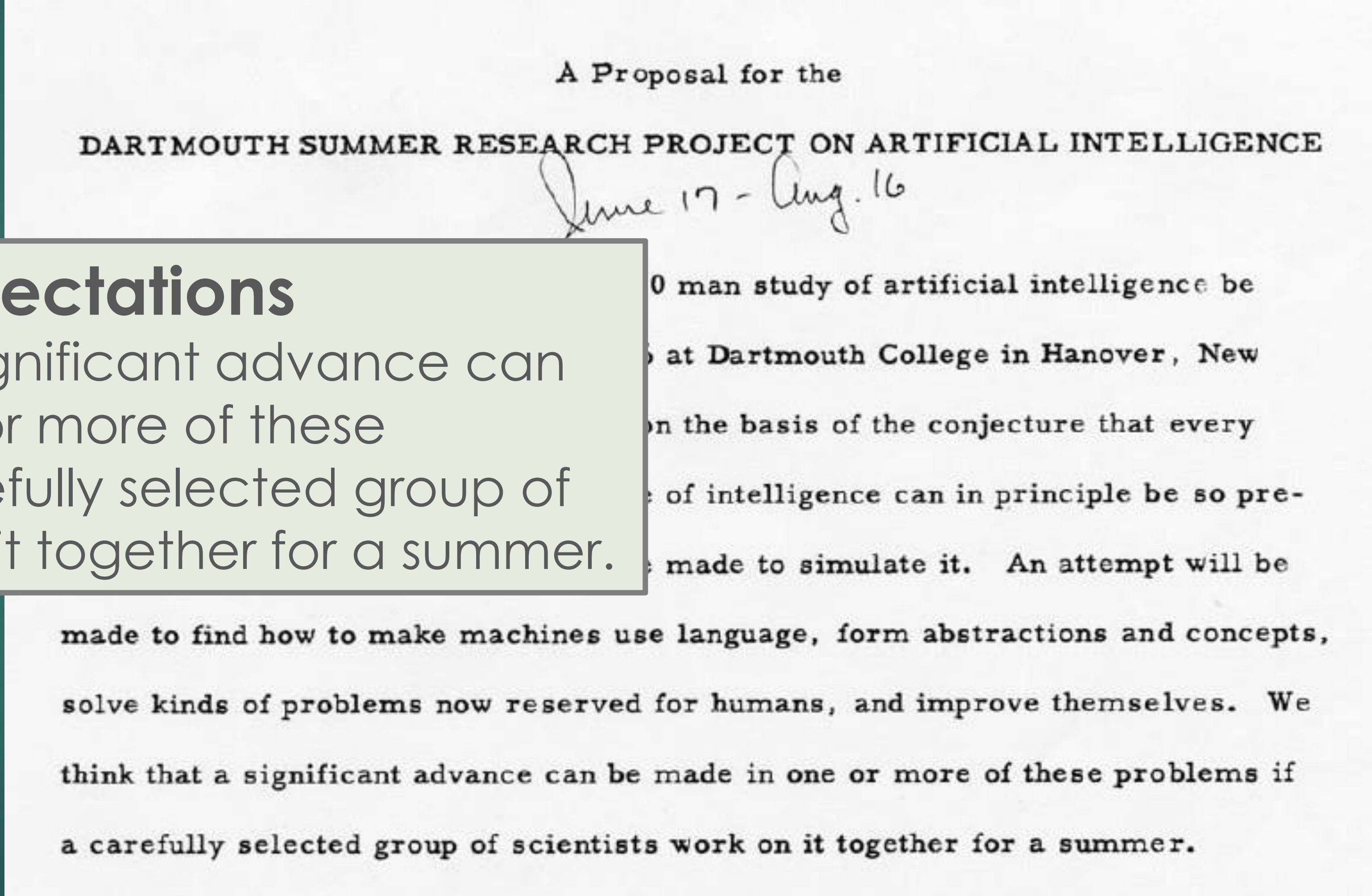
Science Fiction

- Questions
  - Why all these AI/Robot films and TV shows? Why now?
  - What are these AI/robot narratives about?
  - What expectations about AI and robots are produced or supported by these fictional representations?
  - What are the advantages and disadvantages of the "conceptual playing field" set up by science fiction?

History

Optimism/Expectations

We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.



A Proposal for the

DARTMOUTH SUMMER RESEARCH PROJECT ON ARTIFICIAL INTELLIGENCE

June 17 - Aug. 16

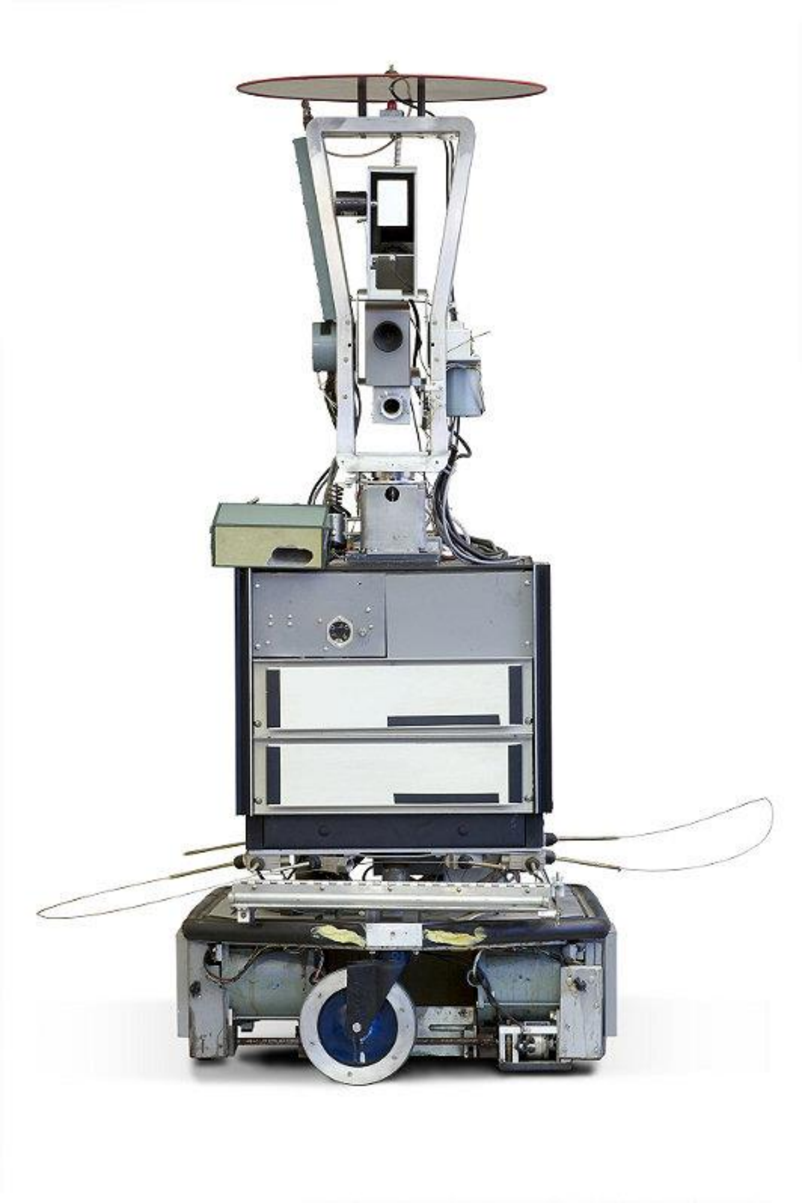
0 man study of artificial intelligence be
at Dartmouth College in Hanover, New
on the basis of the conjecture that every
of intelligence can in principle be so pre-
made to simulate it. An attempt will be
made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

History

Early Successes and Proof of Concept

SRI's Shakey

Shakey, developed at the Stanford Research Institute (SRI) from 1966 to 1972, was the first mobile robot to reason about its actions. Shakey's playground was a series of rooms with blocks and ramps. Although not a practical tool, it led to advances in AI techniques, including visual analysis, route finding, and object manipulation.



History

Early Successes and Proof of Concept

Meet Shaky, the first electronic person

The fascinating and fearsome reality of a machine with a mind of its own

Computer scientist Charles Rosen communes with Shaky, the intelligent machine he helped create.

58B

by Brad Darrach

It looked at first glance like a Good Humor wagon sadly in need of a spring paint job. But instead of a tinkly little bell on top of its box-shaped body there was this big metallic whangdoodle that came rearing up, full of lenses and cables, like a junk-sculpture gargoyle.

"Meet Shaky," said the young scientist who was showing me through the Stanford Research Institute. "The first electronic person."

I looked for a twinkle in the scientist's eye. There wasn't any. Sober as an equation, he sat down at an input terminal and typed out a terse instruction which was fed into Shaky's "brain," a computer set up in a nearby room: PUSH THE BLOCK OFF THE PLATFORM.

Something inside Shaky began to hum. A large glass prism shaped like a thick slice of pie and set in the middle of what passed for his face spun faster and faster till it dissolved into a glare. Then his superstructure made a slow 360° turn and his face leaned forward and seemed to be staring at the floor. As the hum rose to a whir, Shaky rolled slowly out of the room, rotated his superstructure again and turned left down the corridor at about four miles an hour, still staring at the floor.

"Guides himself by watching the baseboards," the scientist explained as we hurried to keep up. At every open door Shaky stopped, turned his head, inspected the room, turned away and rolled on to the next open door. In the fourth room he saw what he was looking for: a platform one foot high and eight feet long with a large wooden block sitting on it. He went in, then stopped short in the middle of the room and stared for about five seconds at the platform. I stared at it too.

"He'll never make it," I found myself thinking. "His wheels are too small." All at once I got gooseflesh. "*Shaky*," I realized, "*is thinking the same thing I am thinking!*"

Shaky was also thinking faster. He rotated his head slowly till his eye came to rest on a wide shallow ramp that was lying on the floor on the other side of the room. Whirring briskly, he crossed to the ramp, semicircled it and then pushed it straight across the floor till the high end of the ramp hit the platform. Rolling back a few feet, he cased the situation again and discovered that only one corner of the ramp was touching the platform. Rolling quickly to the far side of the ramp, he nudged it till the gap closed. Then he swung around, charged up the slope, located the block and gently pushed it off the platform.

Compared to the glamorous electronic elves who trundle across television screens, Shaky may not seem like much. No death-ray eyes, no secret transistorized lust for nubile lab technicians. But in fact he is a historic achievement. The task I saw him perform would tax the talents of a lively 4-year-old child, and the men who over the last two years have headed up the Shaky project—Charles Rosen, Nils Nilsson and Bert Raphael—say he is capable of far more sophisticated routines. Armed with the right devices and

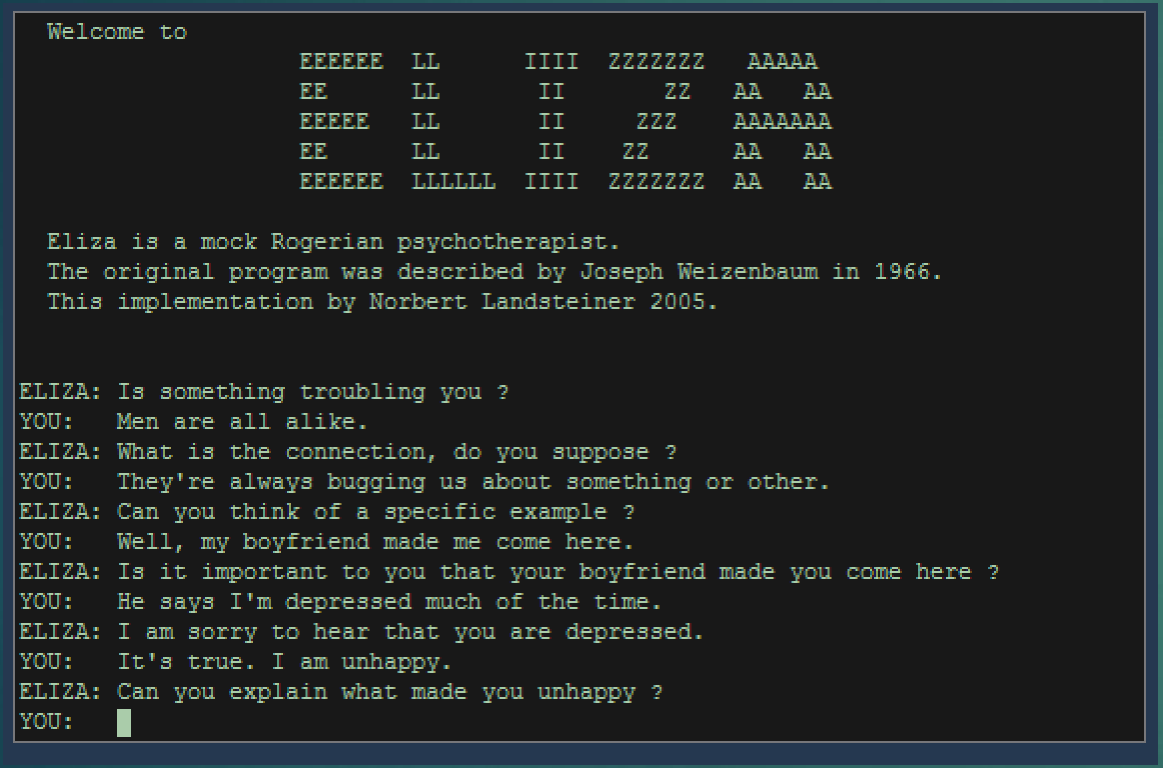
CONTINUED

58C

Life - 1970

History

Early Successes and Proof of Concept



Joseph Weizenbaum - ELIZA

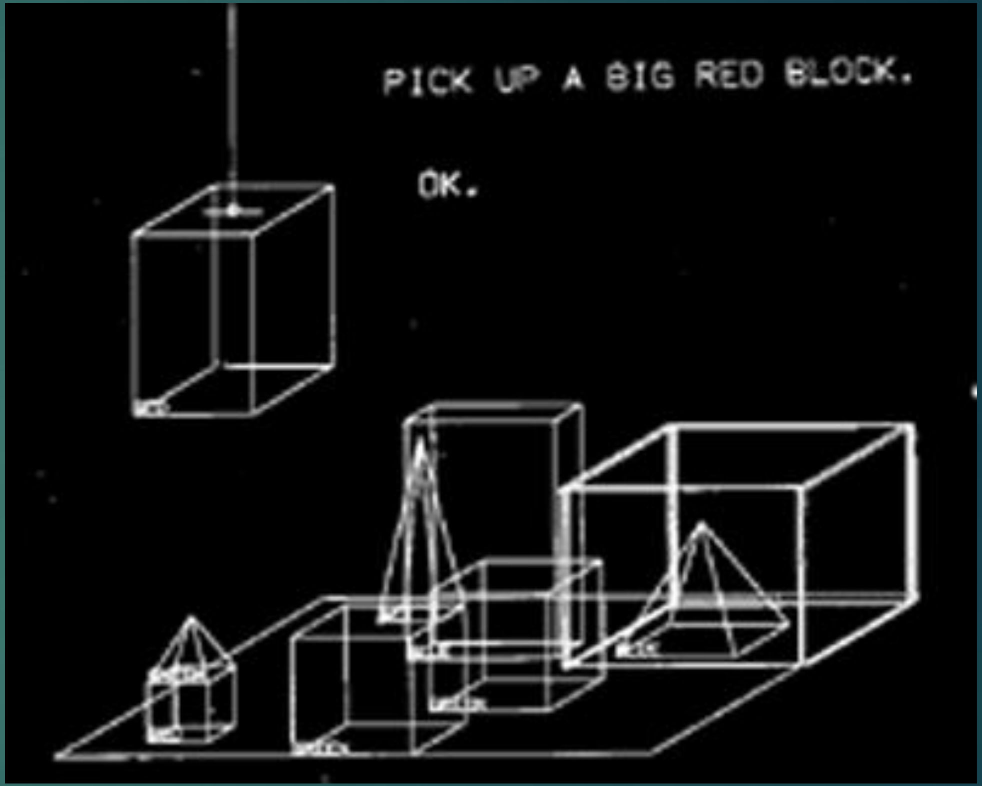
Proto-chatbot created in 1966. Eliza could participate in text-based chat conversations in natural language with human users. Users of the application—even those that knew they were simply chatting up a chatbot—insisted that ELIZA really understood them and often requested to be able to talk to the application in private.

History

Early Successes and Proof of Concept

Terry Winograd's SHRDLU

SHRDLU was an early natural language understanding (NLU) computer program, developed by Terry Winograd at MIT in 1968–1970. In it, the user carries on a conversation with the computer, moving objects, naming collections and querying the state of a simplified "blocks world", essentially a virtual box filled with different blocks.



https://www.youtube.com/watch?v=QAJz4YKUwqw

History

Early Successes and Proof of Concept

Auther Samuel (1959)
Machine learning using the game of checkers. Created a program that can learn (self-improvement) to play a better game of checkers than can be played by the person who wrote the program.

History

Optimism

Downturn
"AI Winters"

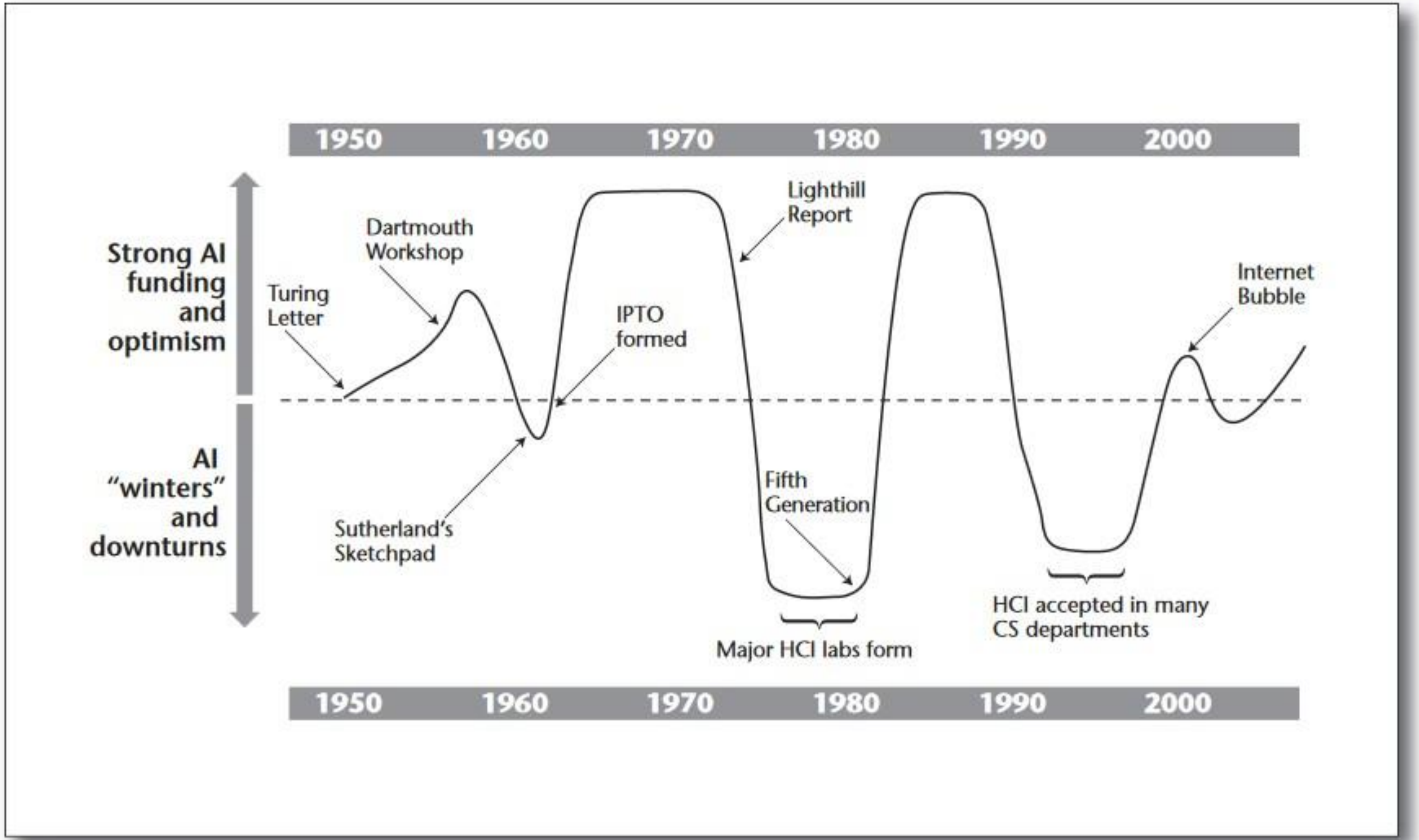


Figure 1. The Changing Seasons of AI and HCI.

Funding climate and public perception with three HCI high points.

History

Sophia

- Hanson Robotics – Hong Kong
- Promoted as "the world's most advanced and perhaps most famous artificial intelligence (AI) humanoid robot."

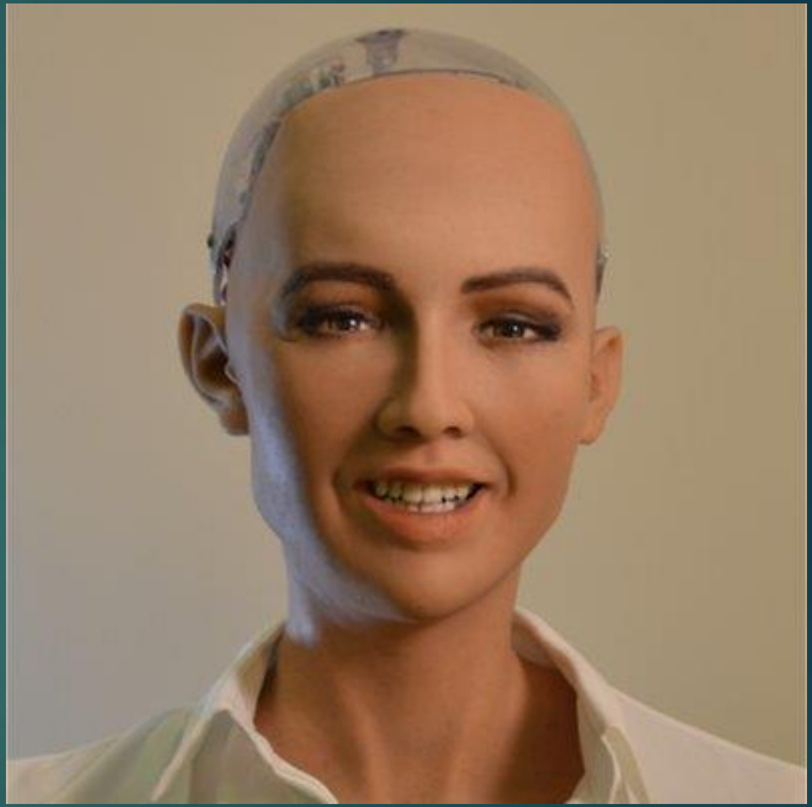
Accomplishments

- Featured on the cover of popular magazines
- Addressed the UN and world leaders
- Invited to talk at AI meetings & conferences
- Granted honorary citizenship by Saudi Arabia
- Appeared on *The Tonight Show* w/Jimmy Fallon

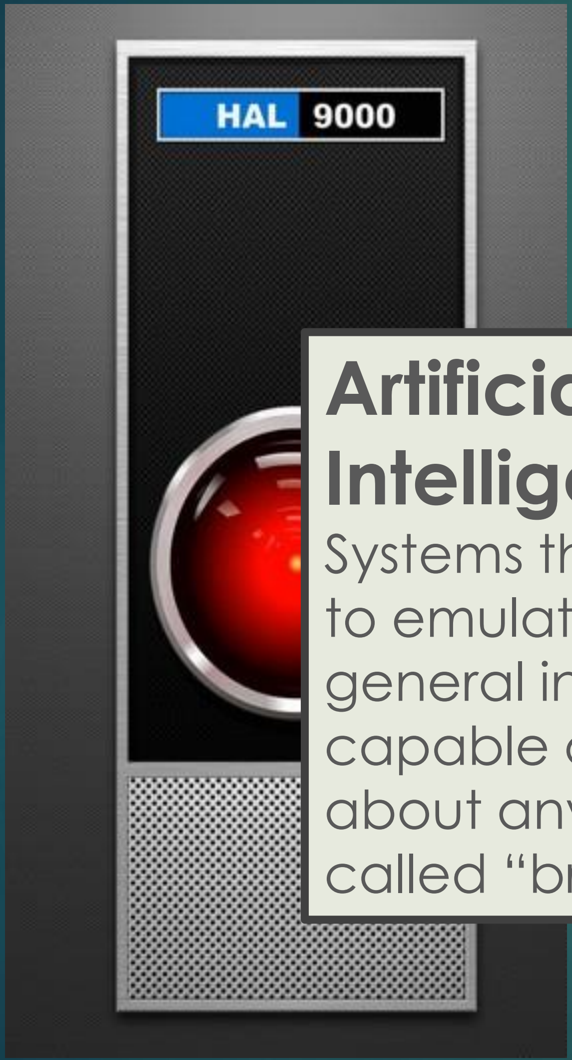
History

Significance of Sophia

- **Next Big Thing** – Start of the next phase in aggressive AI development and funding.
- **More Hype** – Beginning of an AI winter as the promises of the robot are not met with actual R&D accomplishments.



History



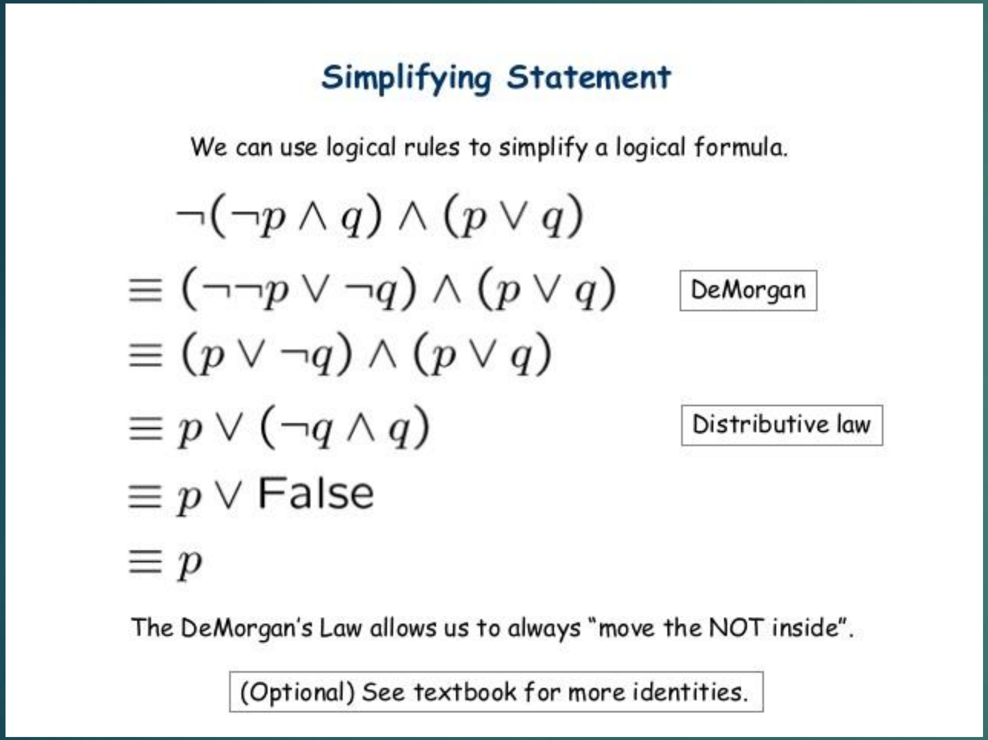
Artificial General Intelligence (AGI)

Systems that are designed to emulate human-like general intelligence capable of reasoning about any subject. Also called “broad AI.”

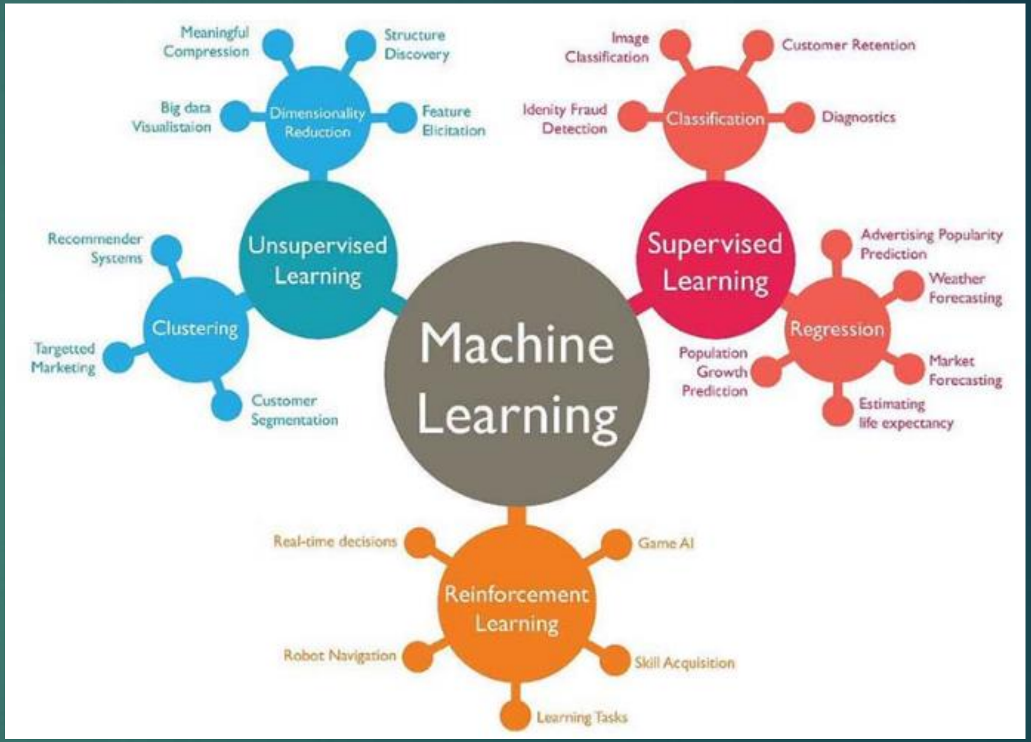
Narrow AI

Systems that are designed to accomplish a specific tasks. Instead of “reasoning” about the world in general, these systems have discrete capabilities to perform specific practical tasks

Approaches and Methods



Symbolic Reasoning



Machine Learning

Approaches and Methods

Symbolic Reasoning

Physical Symbol System (PSS)

“A physical symbol system has the necessary and sufficient means for general intelligent action” (Newell and Simon, 1976)

Intelligence = symbol manipulation (words or symbolic logic). We think by manipulating symbols and machines can be programmed to do the same.

“Computational Theory of Mind”

Computer Science as Empirical Inquiry: Symbols and Search

Allen Newell and Herbert A. Simon

Computer science is the study of the phenomena surrounding computers. The founders of this society understood this very well when they called themselves the Association for Computing Machinery. The machine—not just the hardware, but the programmed, living machine—is the organism we study.

This is the tenth Turing Lecture. The nine persons who preceded us on this platform have presented nine different views of computer science. For our organism, the machine, can be studied at many levels and from many sides. We are deeply honored to appear here today and to present yet another view, the one that has permeated the scientific work for which we have been

Key Words and Phrases: symbols, search, science, computer science, empirical, Turing, artificial intelligence, intelligence, list processing, cognition, heuristics, problem solving.

CR Categories: 1.0, 2.1, 3.3, 3.6, 5.7.

The authors' research over the years has been supported in part by the Advanced Research Projects Agency of the Department of Defense (monitored by the Air Force Office of Scientific Research) and in part by the National Institutes of Mental Health.

Authors' address: Carnegie-Mellon University, Pittsburgh.

Approaches and Methods

Symbolic Reasoning

PSS Description/Characterization

A physical symbol system is a machine that, as it moves through time, produces an evolving collection of symbol structures. Symbol structures can, and commonly do, sever as internal representations (e.g., "mental images") of the environment to which the symbol system is seeking to adapt. They allow it to model that environment with greater or less veridicality and in greater or less detail, and consequently to reason about it…Symbols may also designate processes that the symbol system can interpret and execute. Hence the program that governs the behaviour of a symbol system can be stored, along with other symbol structures, in the system's own memory, and executed when activated.

Herbert Simon, *The Sciences of the Artificial*, 3rd Edition

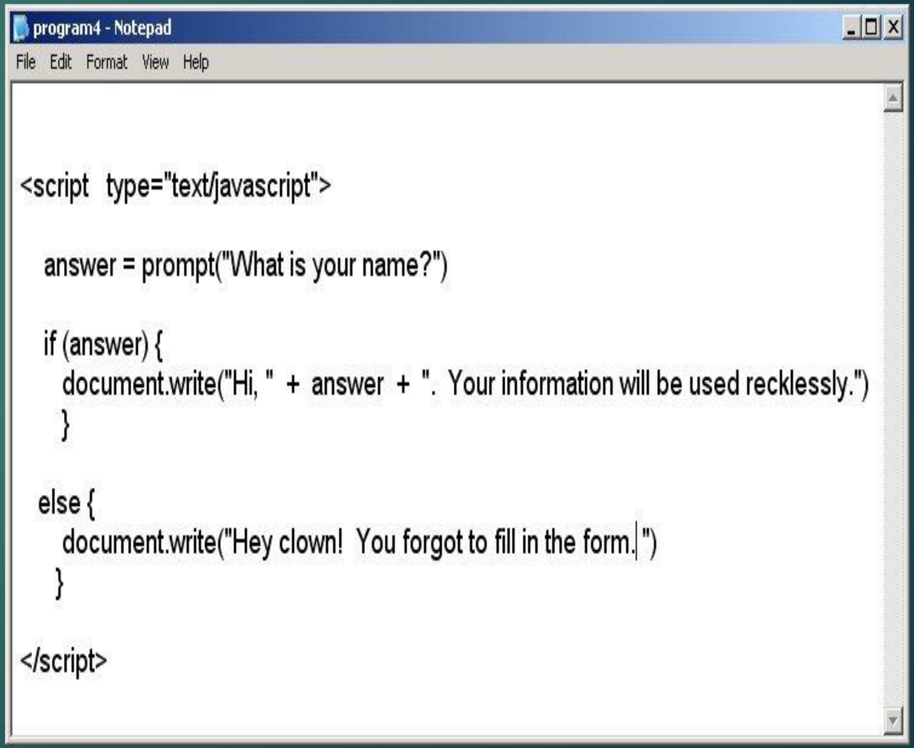
Approaches and Methods

Symbolic Reasoning

Translation = Step-by-step procedures encoded in some kind of symbol system, like language.

Driving Directions

From Interstate 71
Go South on I71 to exit 47
Turn East (left turn) 6.5 Miles
Turn North (Left Turn) onto Weaver Rd.
Go 3.5 miles on Weaver Rd.
Park entrance is on the right (brick arch)



```
program4 - Notepad
File  Edit  Format  View  Help

<script  type="text/javascript">

  answer = prompt("What is your name?")

  if (answer) {
    document.write("Hi, " + answer + ". Your information will be used recklessly.")
   }

  else {
    document.write("Hey clown!  You forgot to fill in the form.")
   }

</script>
```

Approaches and Methods

Machine Learning

Learning, presumably, comes mainly from experience, practice, or training, not solely from reasoning.

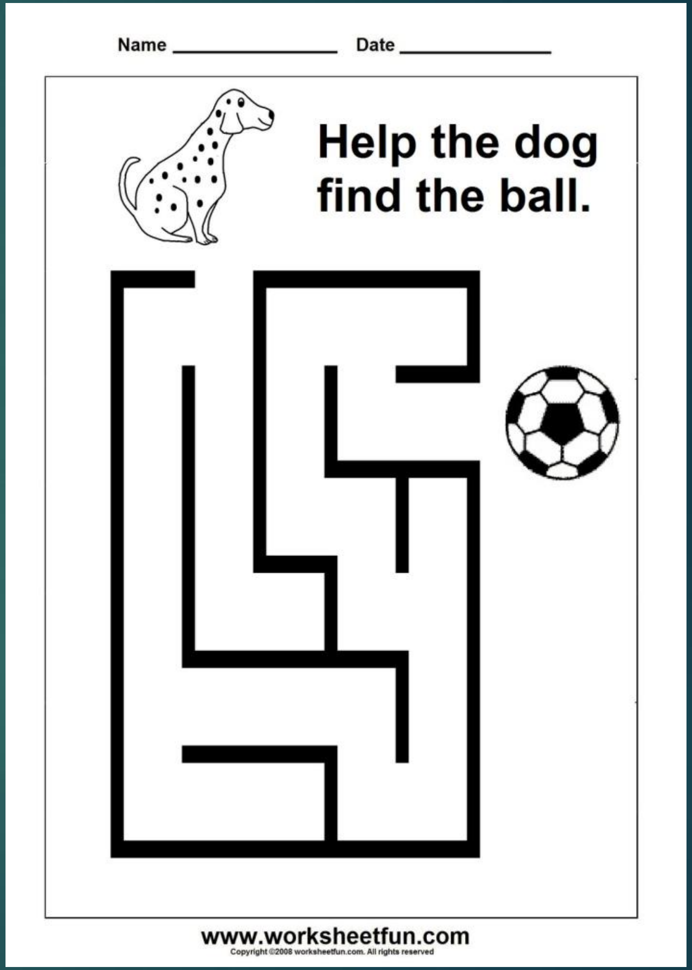
Machine Learning = computer programs that extract patters of behavior from data. Unlike symbolic reasoning that needs to encode all possible behaviors in advance and up front, machine learning algorithms develop behaviors by discovering (for themselves) various patterns in data.

Kaplan p. 27

Arthur Samuel

Approaches and Methods

- Exercise/Demonstration
  - Maze Navigation
  - Symbolic Reasoning approach – formulate step-by-step instructions for movement through space
  - Learning – discover best method through space by trial and error (i.e. learning from data)

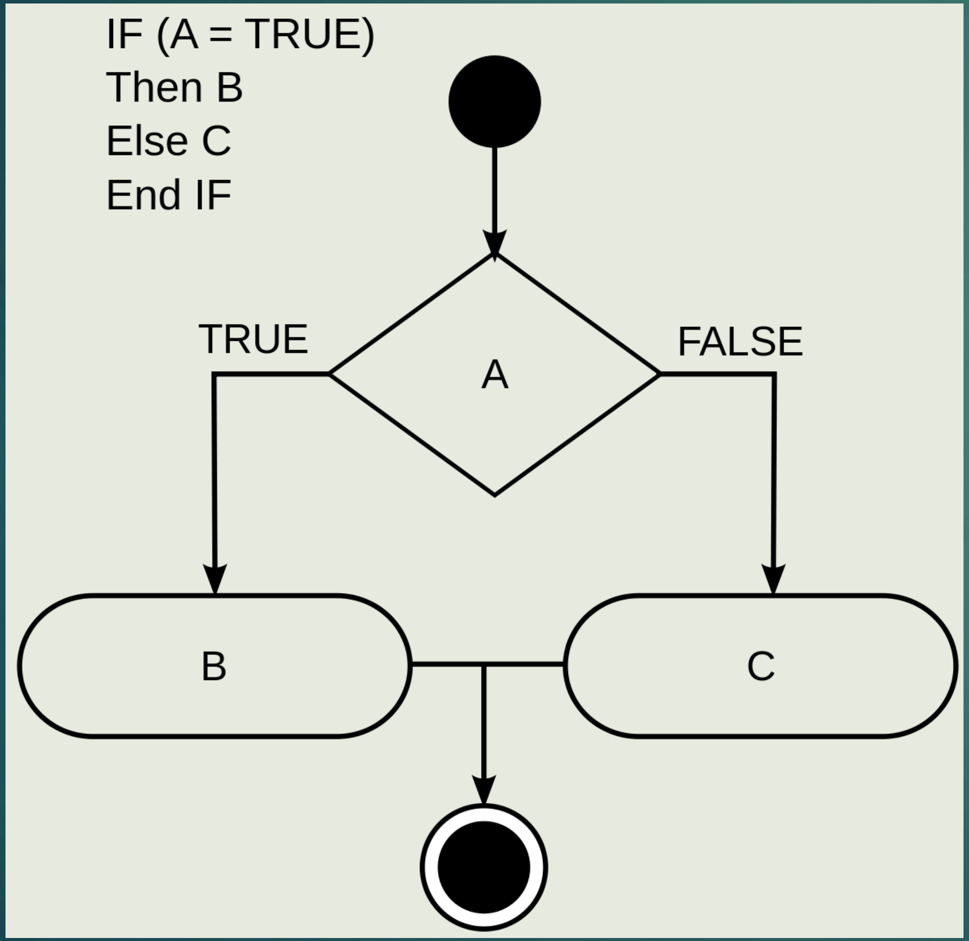


Approaches and Methods

- Symbolic Reasoning
  - **Advantage:** Step-by-step (serial) instructions that, if executed correctly, will provide consistent results
  - **Challenge:** Programmer needs to know everything in advance (e.g. the configuration of the maze, the exact movements of the test subject, the desired outcome, etc.) and be able to code these items in explicit instructions (symbols)
- Machine Learning
  - **Advantage:** Programmers do not need to know anything. They just need to set up the initial situation and observe what happens.
  - **Challenge:** Less control and oversight. Do not know what will happen or why until it actually happens.

Approaches and Methods

Symbolic Reasoning



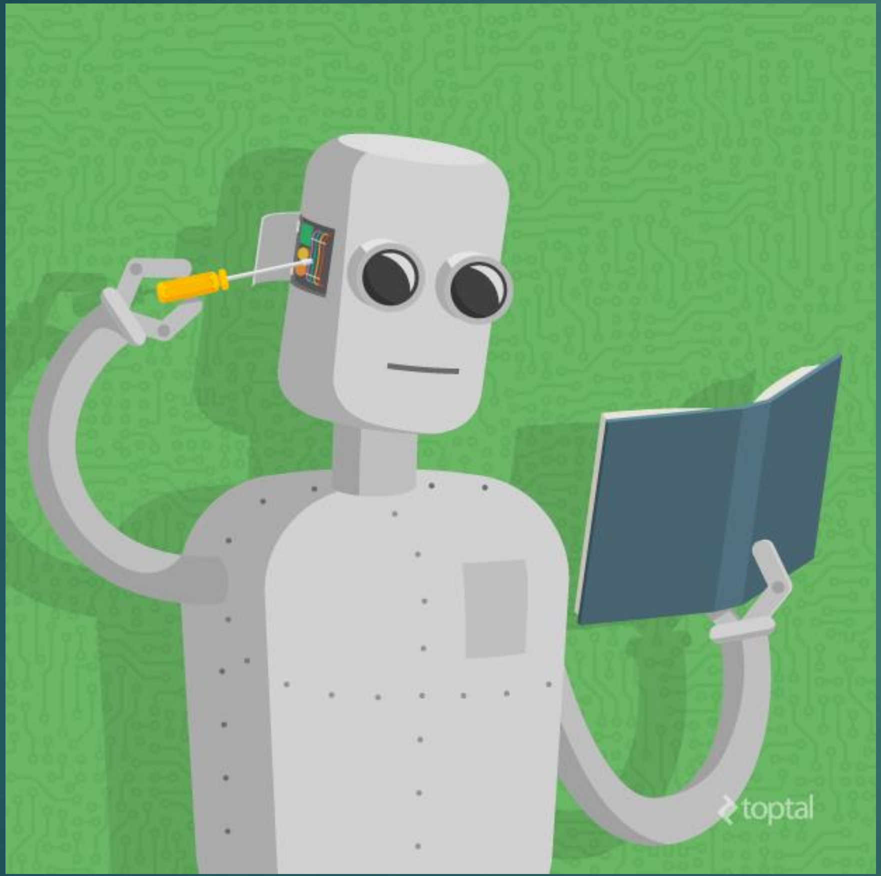
ACTIONS - FRAME

```
function checkMail(mail:String):void
{
    if(mail == "junk")
    {
        trace("throw it away!");
    }
    else if(mail == "possible junk")
    {
        trace("set it aside");
    }
    else
    {
        trace("keep it!");
    }
}

checkMail("possible junk");
```

Approaches and Methods

Machine Learning



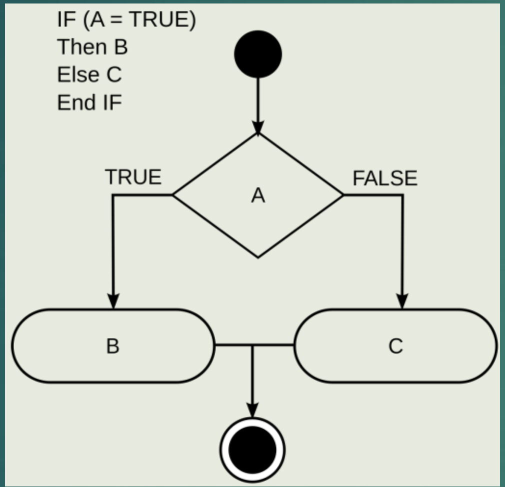
Different Types/Varieties

- Decision Tree
- Neural Networks
- Deep Learning
- Bayesian Network
- Reinforcement Learning
- Genetic Algorithms

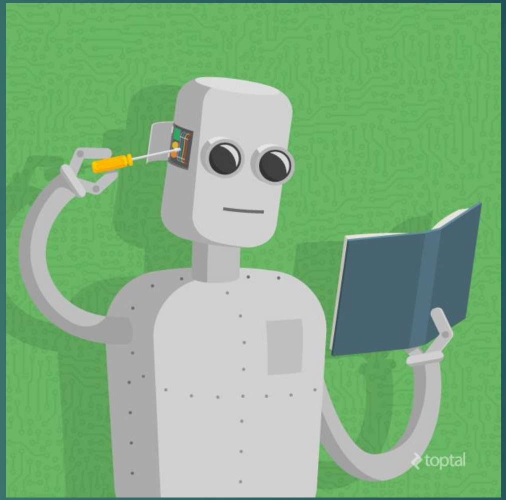
Explainer Video – Genetic Algorithms
https://www.youtube.com/watch?v=R9OHn5ZF4Uo

Approaches and Methods

GOFAI

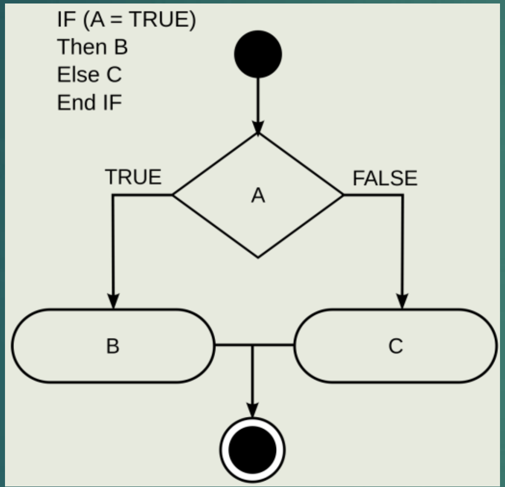


VS.

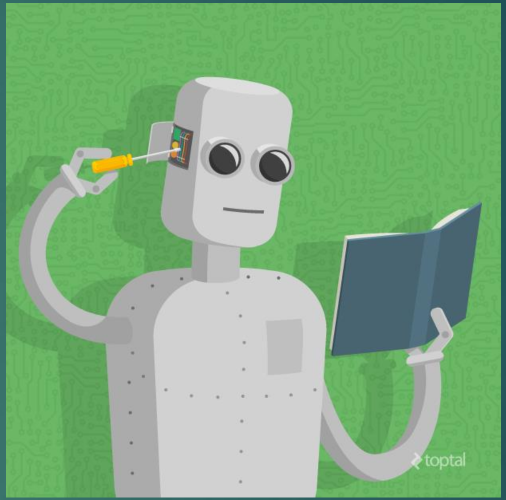


Even though the two approaches are introduced at about the same time (late 1950s), initial work in AI focused almost exclusively on symbolic reasoning approaches. All the energy and funding went to this way of doing thing. Machine Learning remains a minor thread until about 1980, when it began to gain traction again.

Approaches and Methods



both/and



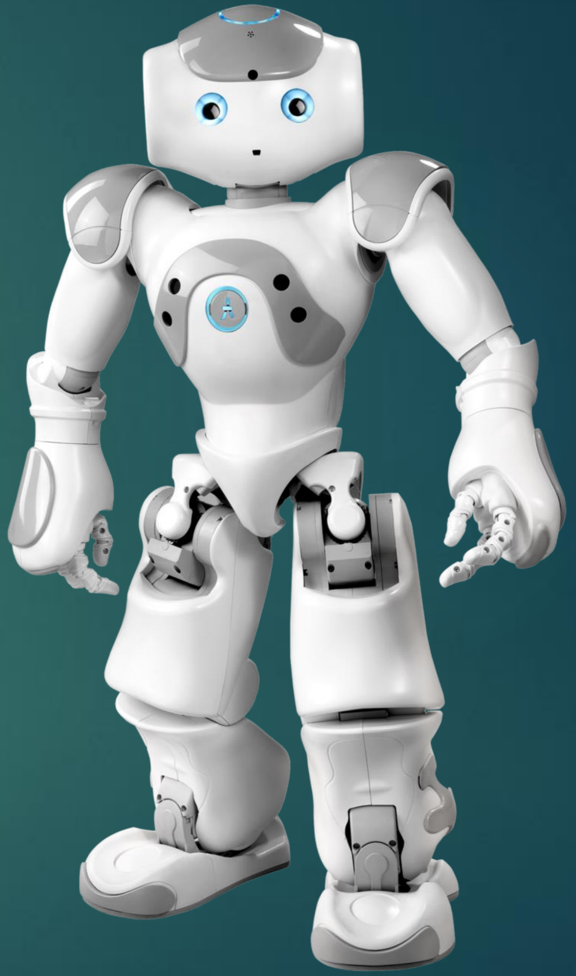
Symbolic Reasoning is more appropriate for problems that require abstract reasoning—problems where programmers can abstract a desired behavior or outcome into distinct steps that can be encoded and followed by a computer.

Machine Learning is better for situations that require sensory perception or extracting patterns of behavior from noisy data. It works when there is a lot of data about something but programmers do not necessarily know how to describe the behavior in an abstract form.

Examples/Applications

1. Robotics

Autonomous Vehicles



Social Robots

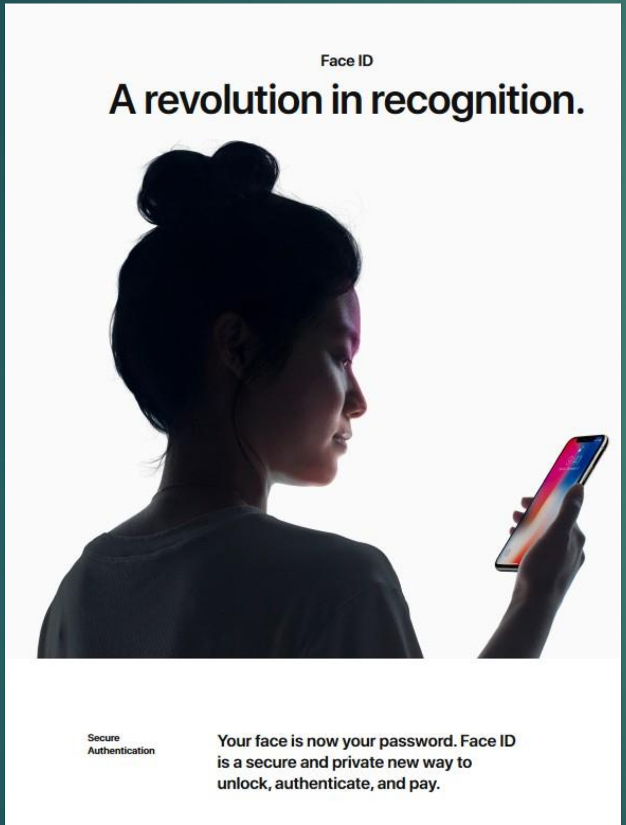
Examples/Applications

2. Computer vision

Facial Recognition

Examples/Applications

2. Computer vision

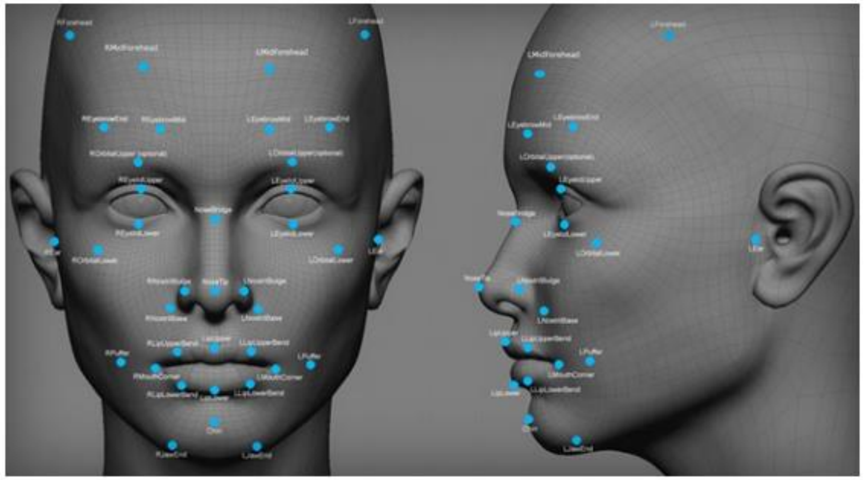


Apple – Face ID

Facebook's facial recognition software is now as accurate as the human brain, but what now?

By Sebastian Anthony on March 19, 2014 at 1:38 pm | 36 Comments

5.1K shares



Facebook's facial recognition research project, DeepFace (yes really), is now very nearly as accurate as the human brain. DeepFace can look at two photos, and irrespective of lighting or angle, can say with 97.25% accuracy whether the photos contain the same face. Humans can perform the same task with 97.53% accuracy. DeepFace is currently just a research project, but in the future it will likely be used to help with facial recognition on the Facebook website. It would also be irresponsible if we didn't mention the true power of facial recognition, which Facebook is surely investigating: Tracking your face across the entirety of the web, and in real life, as you move from shop to shop, producing some very lucrative behavioral tracking data indeed.

http://www.extremetech.com

Examples/Applications

3. Speech Recognition and NLP

Examples/Applications

3. Speech Recognition and NLP

Business

AI models beat humans at reading comprehension, but they've still got a ways to go

Researchers at the Allen Institute for Artificial Intelligence in Seattle. (Stuart Isett for The Washington Post)

By **Drew Harwell** January 16

When computer models designed by tech giants Alibaba and Microsoft this month surpassed humans for the first time in a reading-comprehension test, both companies celebrated the success as a historic milestone.

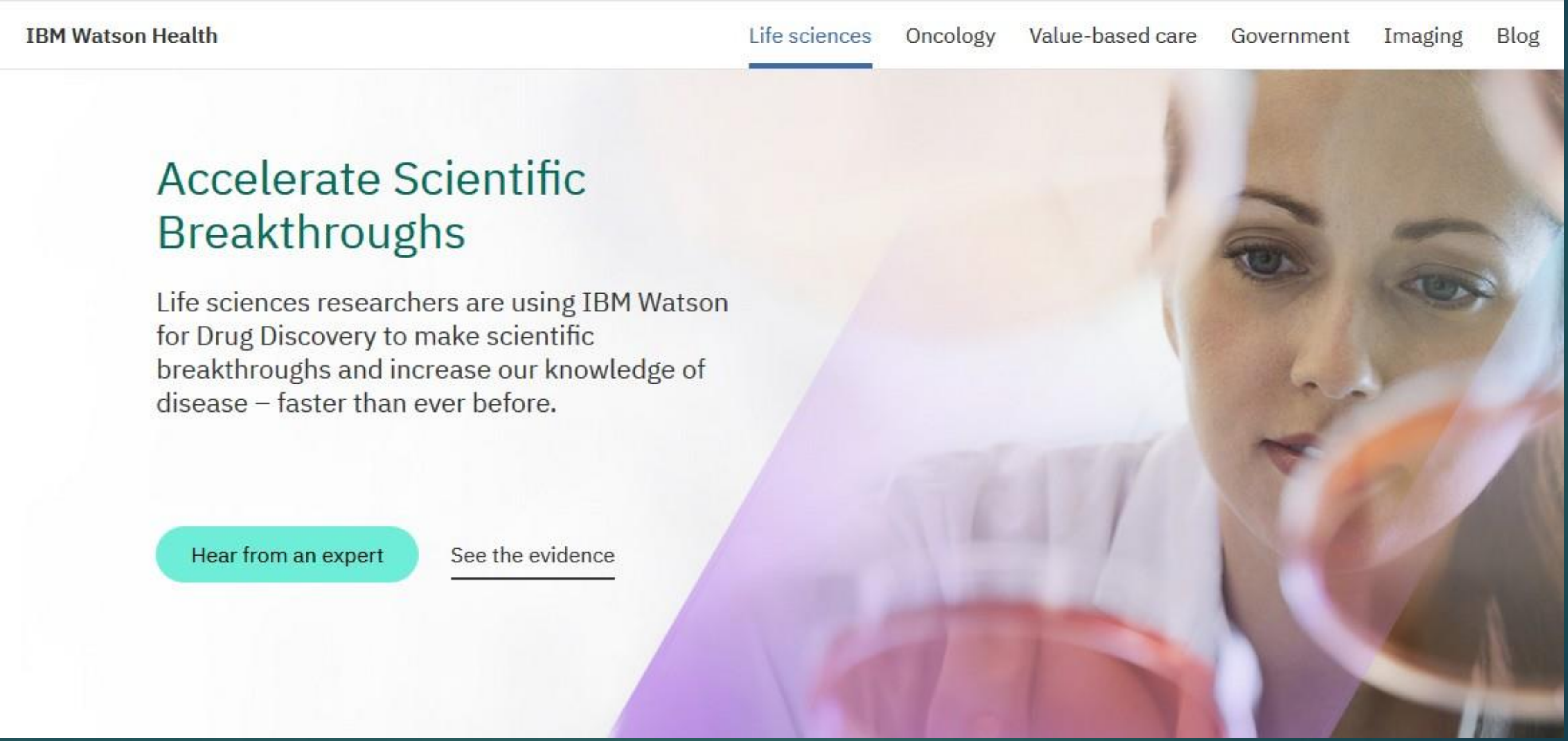
Examples/Applications

3. Computational Creativity

Narrative Science – Quill
"Quill transforms data into automated, human-sounding Intelligent narratives that empower your people with insights to improve every aspect of your business."

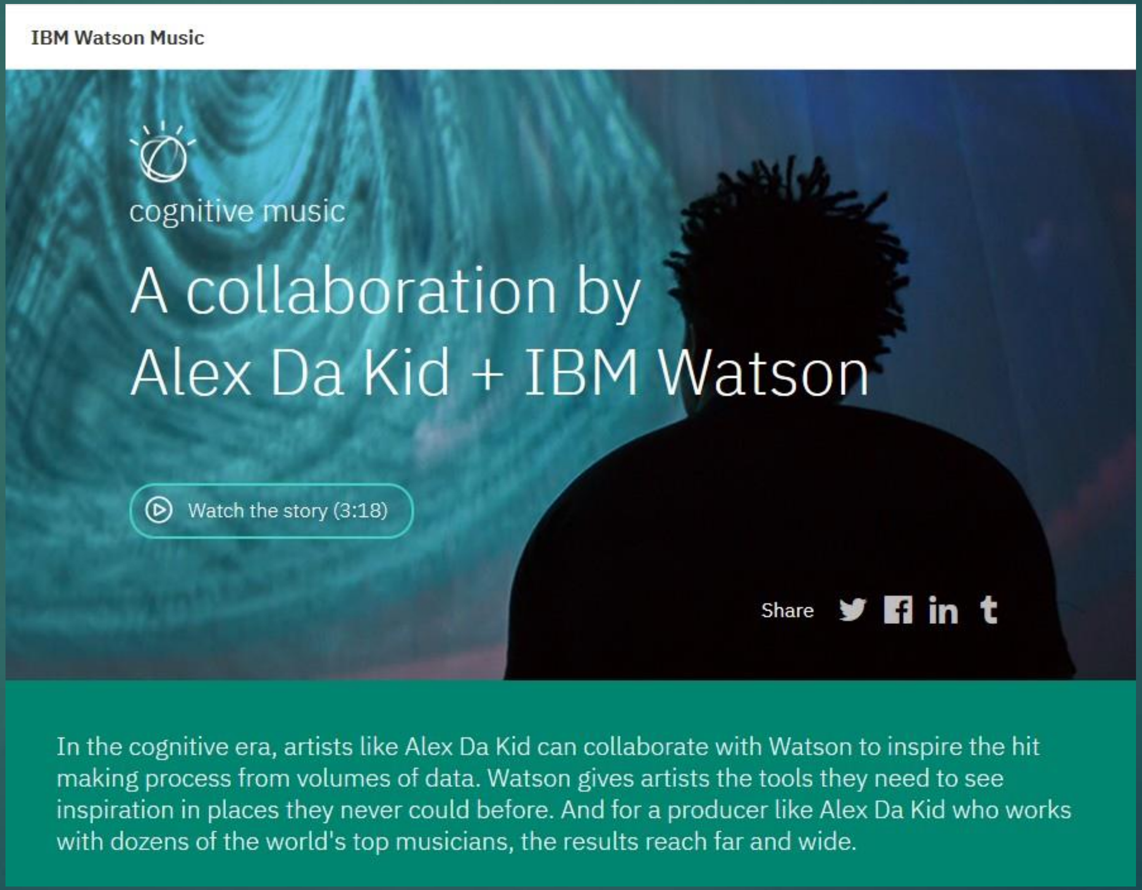
Examples/Applications

3. Computational Creativity



Examples/Applications

3. Computational Creativity



https://www.ibm.com/watson/music/

Preview

- AI & Communication
- Texts
  - Turing - Computing Machinery & Intelligence
  - Gunkel - Communication & Artificial Intelligence
  - PBS - The Chinese Room (video)