



COMS 493

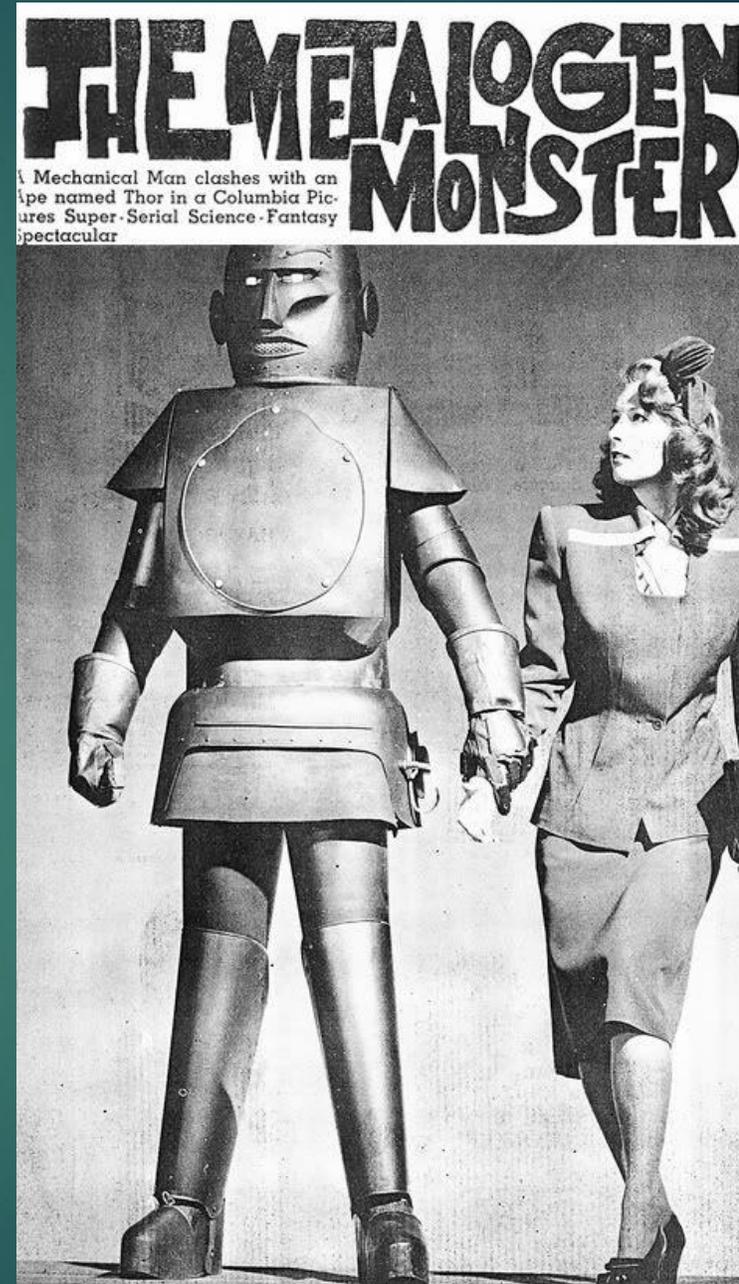
AI, ROBOTS & COMMUNICATION

Agenda

- ▶ Review
- ▶ AI & Communication
- ▶ Preview

Review

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

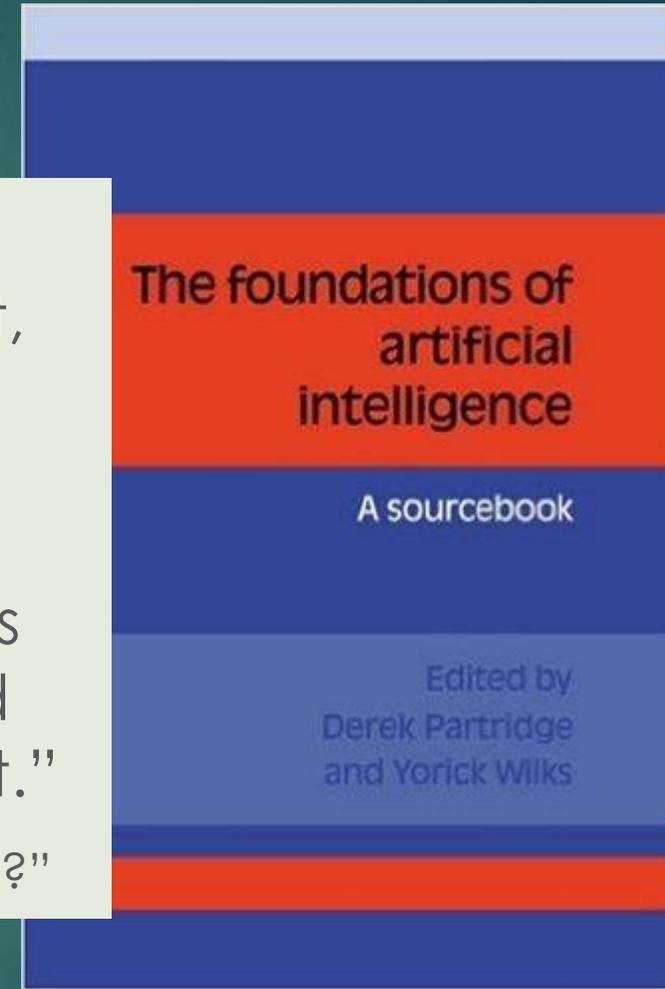


Terminology

Problem with the Definition

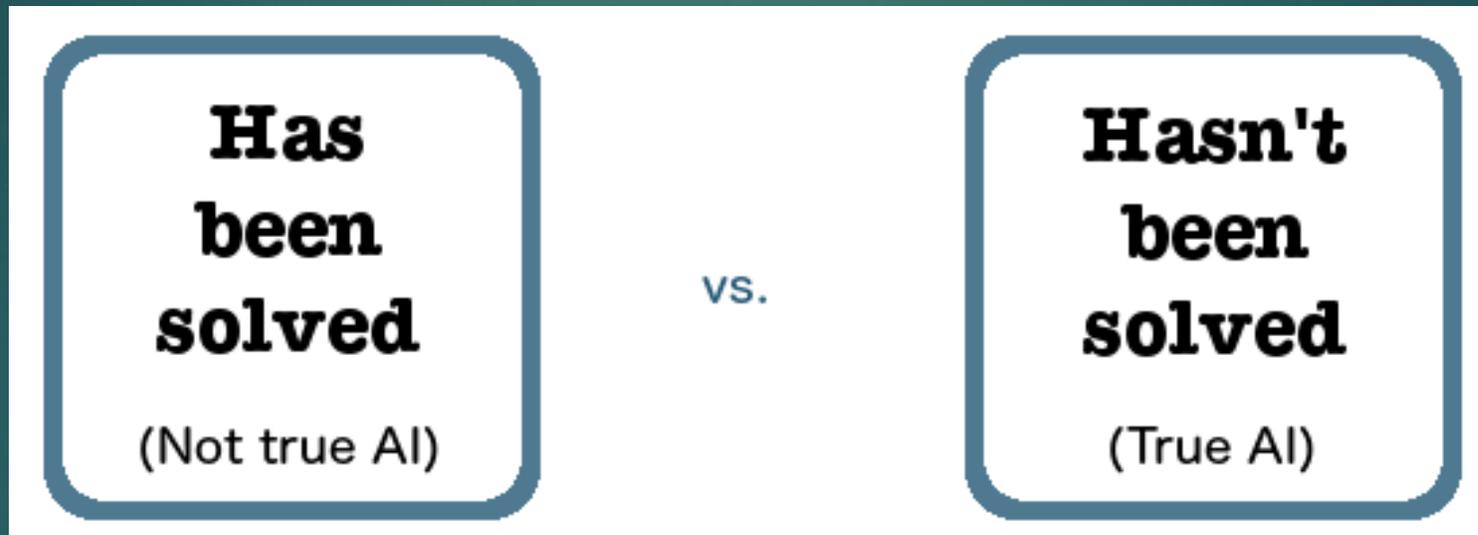
“Artificial intelligence is a subject that, due to the massive, often quite unintelligible, publicity that it gets, is nearly completely misunderstood by the people outside the field. Even AI’s practitioners are somewhat confused with respect to what AI is really about.”

Roger Schank “What is AI, Anyway?”

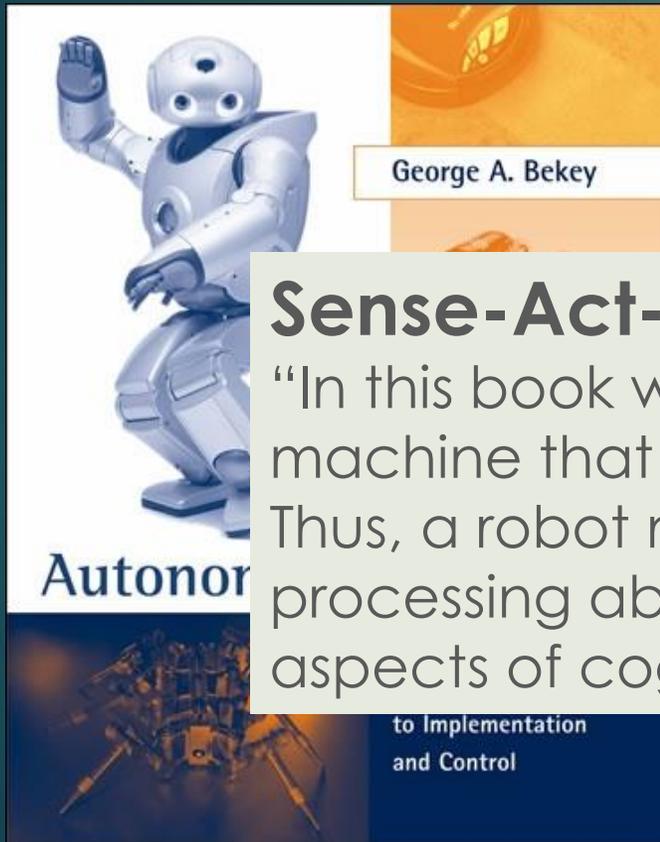


Terminology

The AI Effect



Terminology

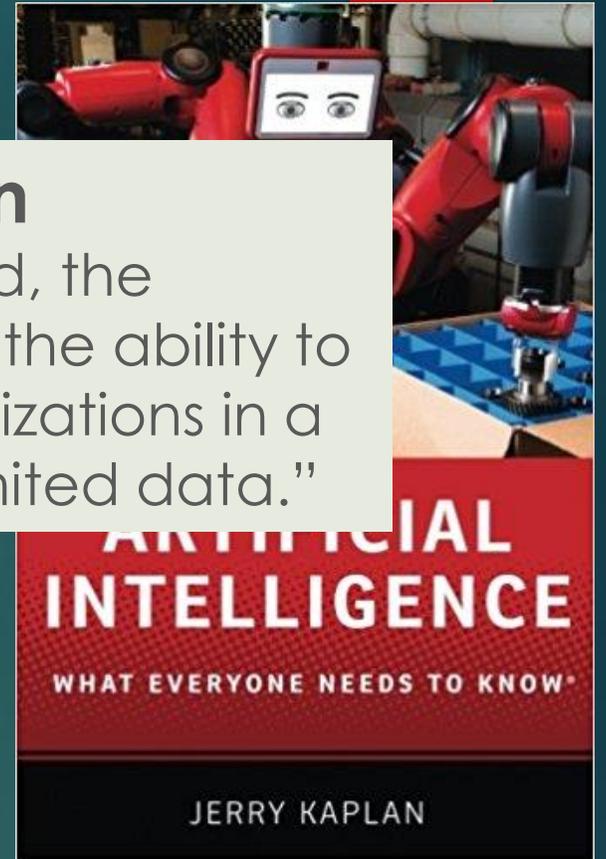


Sense-Act-Think Paradigm

“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.”

Operational Definition

“The essence of AI—indeed, the essence of intelligence—is the ability to make appropriate generalizations in a timely fashion based on limited data.”



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”

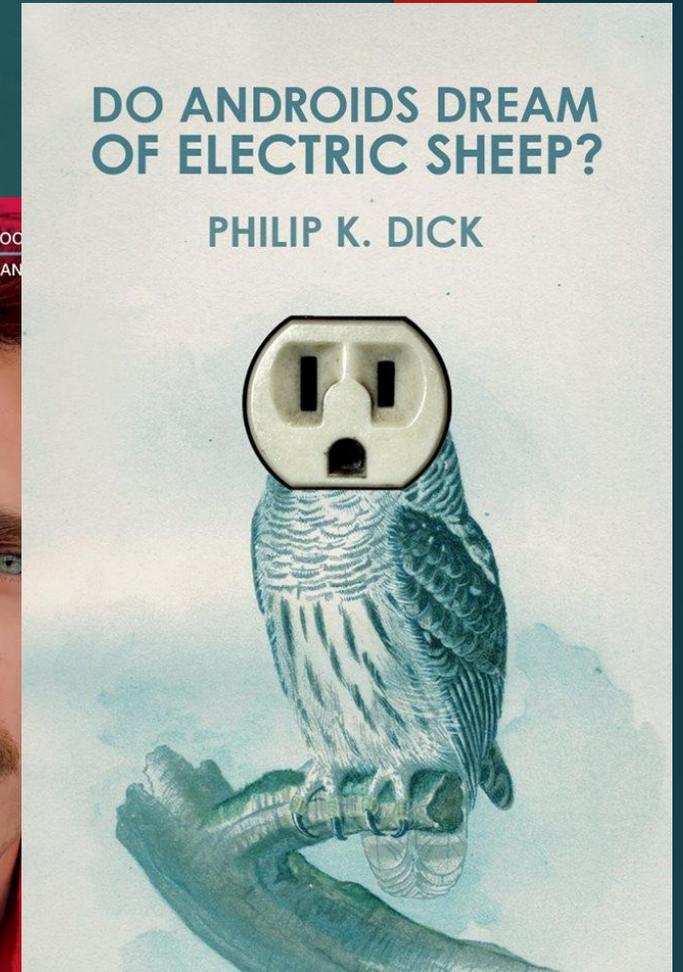
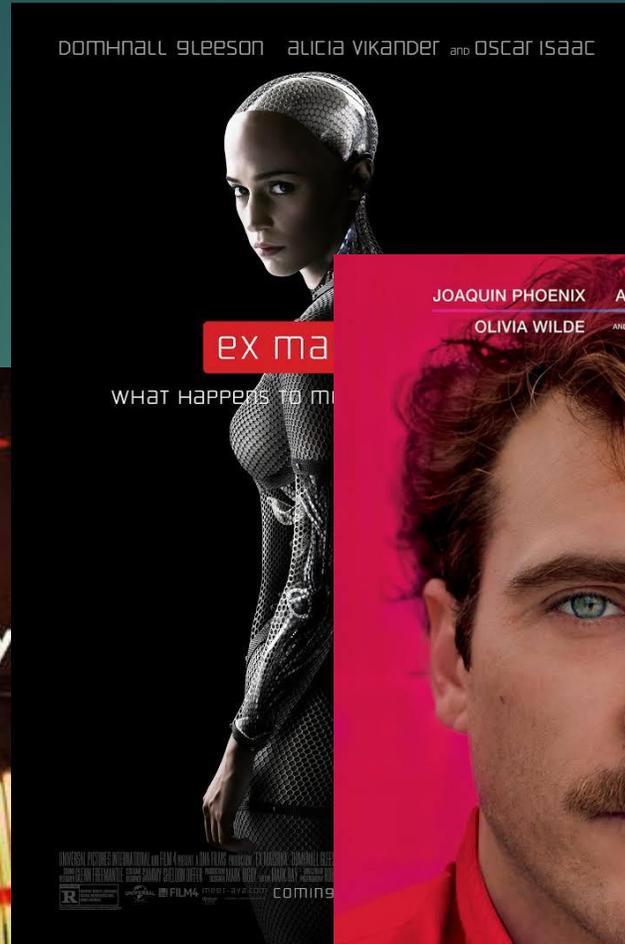
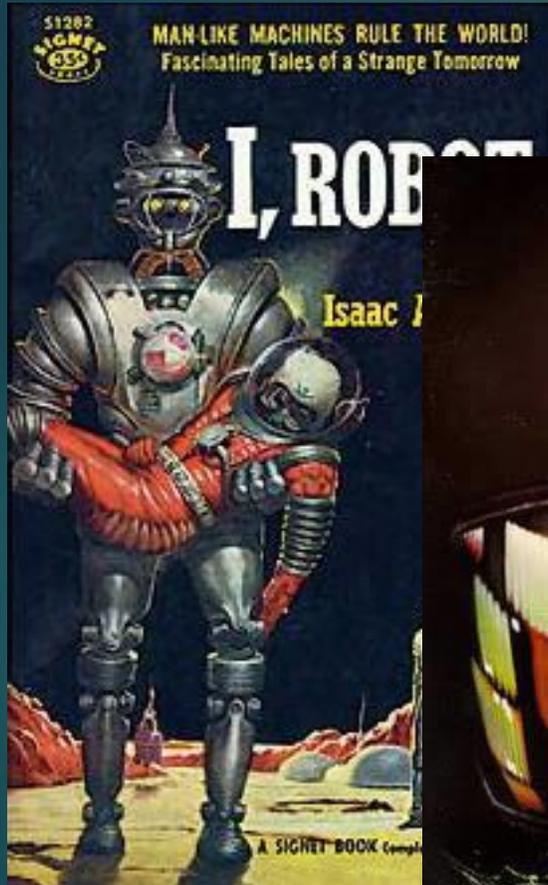
Roger Schank “What is AI, Anyway?”

Foundations of
artificial
intelligence

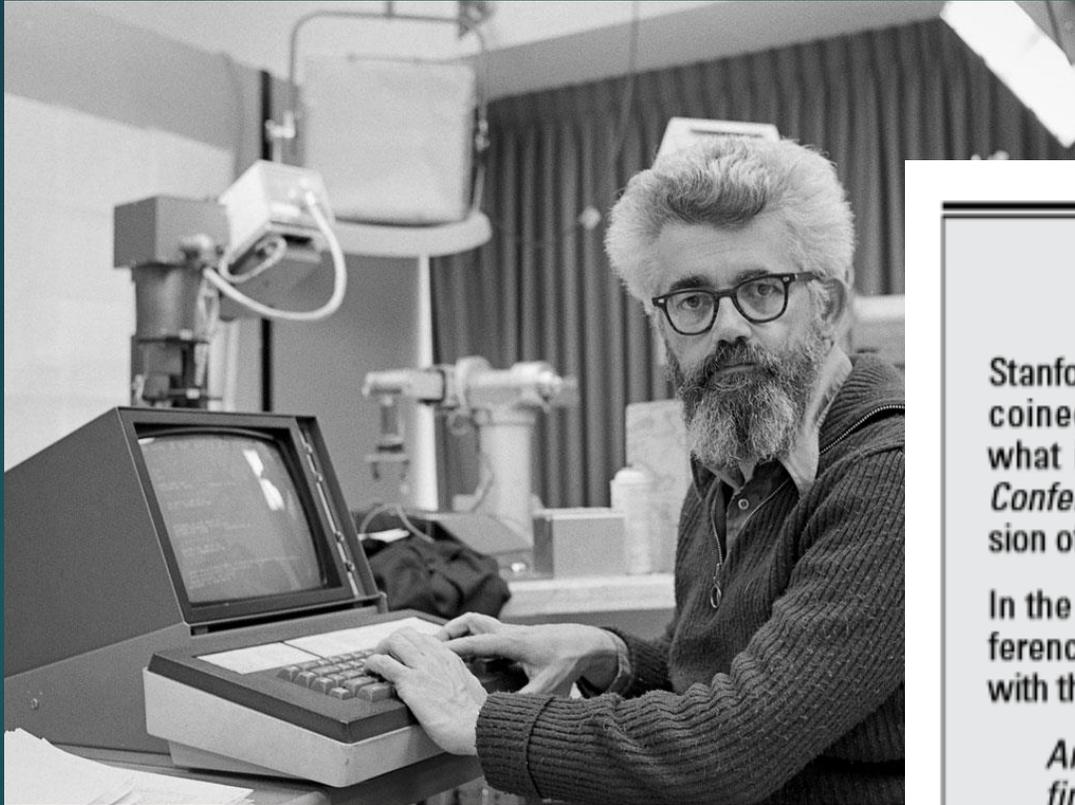
A sourcebook

Edited by
Derek Partridge
and Yorick Wilks

Science Fiction



History – “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)

History – “Robot”



BBC

Karel Čapek's
RUAR
ROSSUM'S UNIVERSAL ROBOTS

ED BY DAVID SHORT

LET THE ROBOT REVOLUTION BEGIN

PRESENTATION BY WESTSIDE CHRISTIAN THEATRE IN COOPERATION WITH ALPENROSE DAIRY WINGS AT THE ALPENROSE OPERA HOUSE: 6149 SW SHATTUCK ROAD, PORTLAND, OREGON
APRIL 25/26 AT 7:00PM - SUN: APRIL 27 AT 2:30PM - FRI/SAT: MAY 2/3 AT 7:00PM - SUN: MAY 4 AT 2:30PM
TICKETS AT THE DOOR: \$8.50 ADULTS, \$6.50 SENIORS, \$4.50 STUDENTS WITH ID, ROBOTS FREE WITH L.O.H. PASSPORT
ONLINE TICKETS: WWW.WCHSONLINE.ORG

 WESTSIDE CHRISTIAN
HIGH SCHOOL

History

```
Welcome to
          EEEEE LL   IIII ZZZZZZ  AAAAA
          EE   LL   II    ZZ  AA  AA
          EEEEE LL   II    ZZ  AAAAAA
          EE   LL   II    ZZ  AA  AA
          EEEEE LLLLL IIII ZZZZZZ  AA  AA

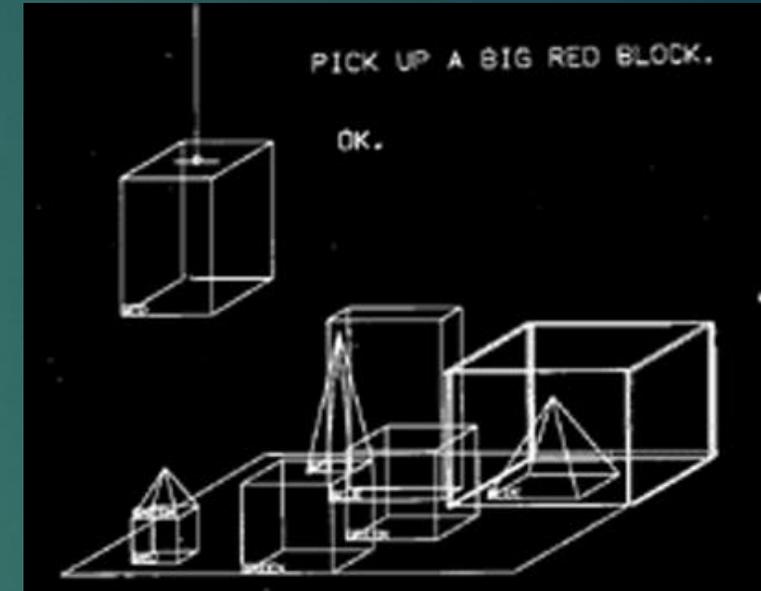
Eliza is a mock Rogerian psychotherapist.
The original program was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.

ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:   It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:   █
```

Joseph Weizenbaum's
ELIZA (1966)



Shakey – SRI (1970)

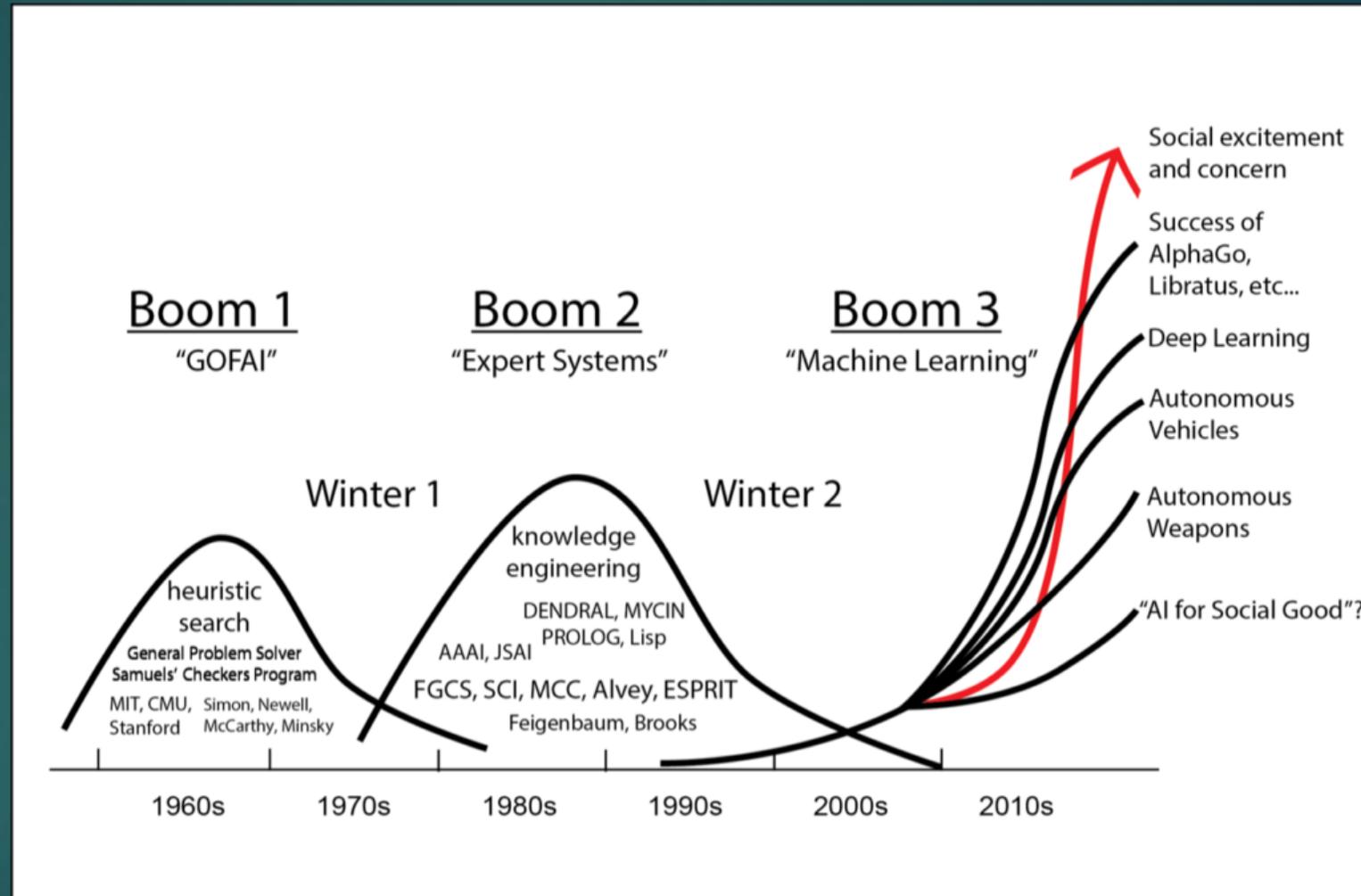


Terry Winograd's SHRDLU (1970)

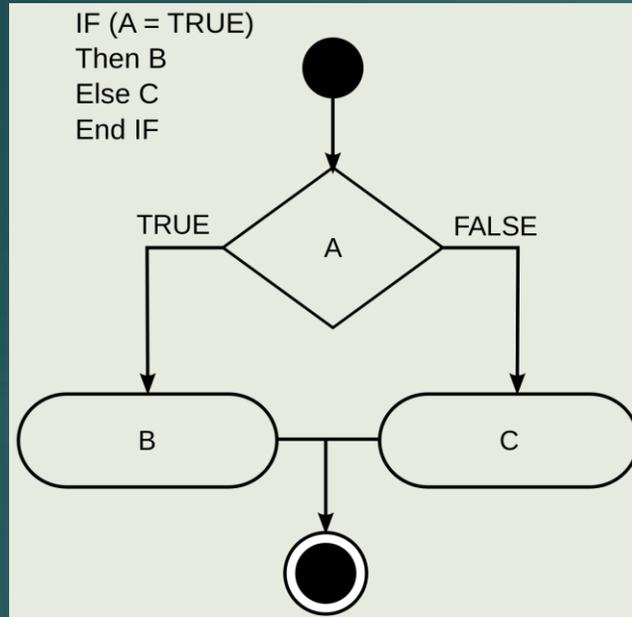
History

Optimism

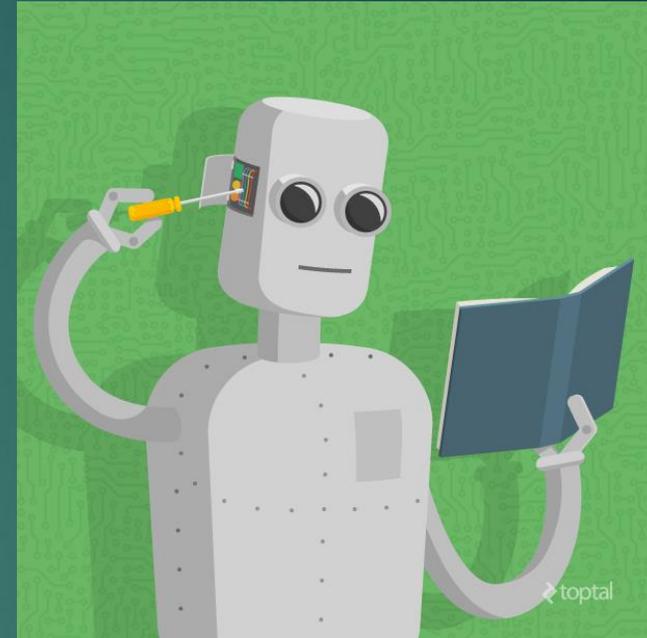
Downturn
“AI Winters”



Approaches and Methods



Symbolic Reasoning
GOFAI



Machine Learning

<https://www.youtube.com/watch?v=R9OHn5ZF4Uo>

Approaches and Methods

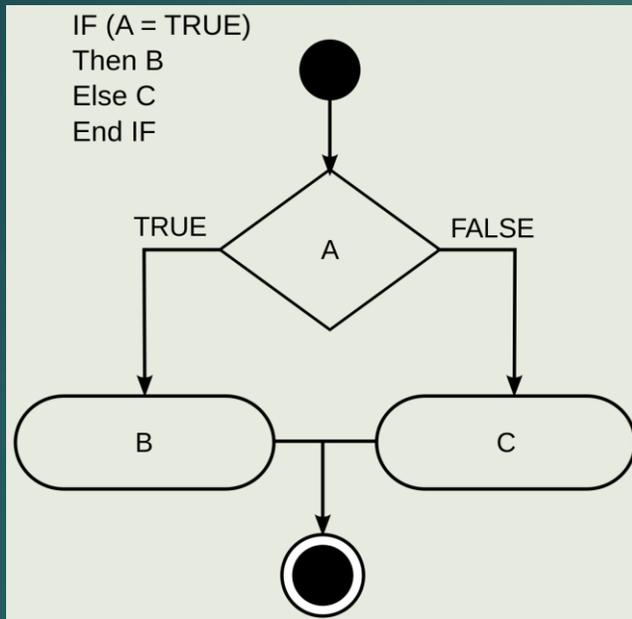
▶ Symbolic Reasoning

- ▶ **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)

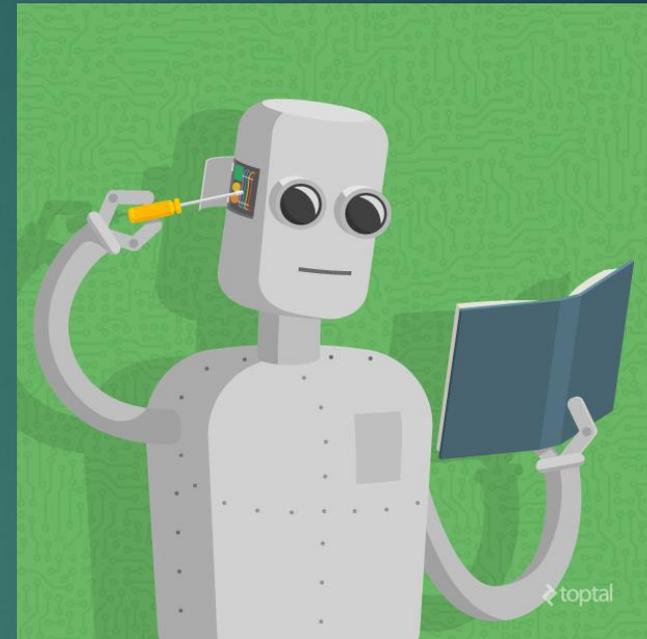
▶ Machine Learning

- ▶ **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



both/and

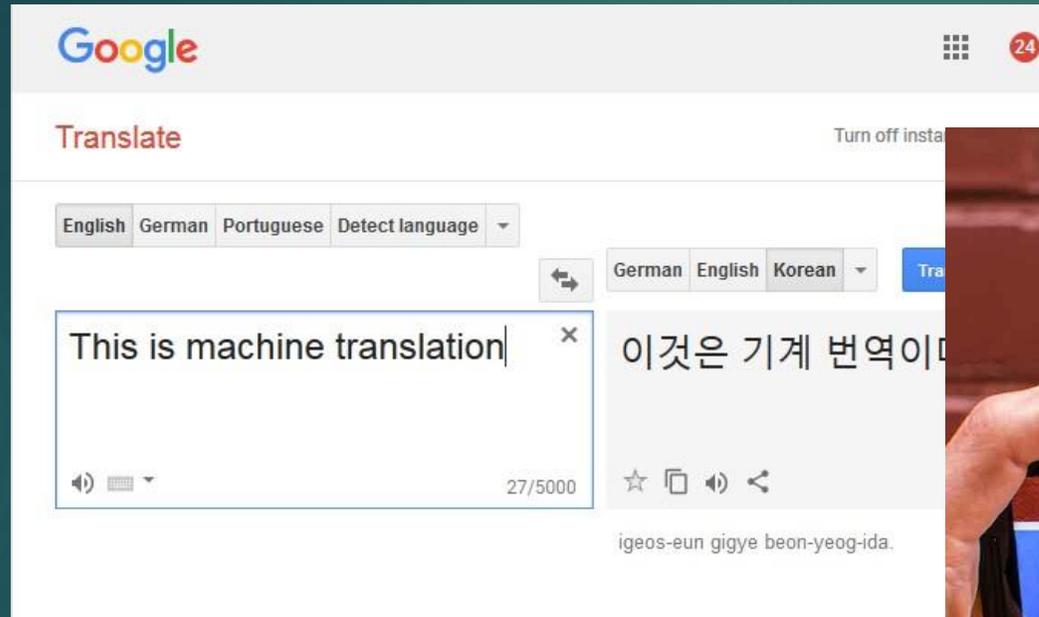


Symbolic Reasoning is more appropriate for problems that require abstract reasoning—problems where programmers can abstract a desired behavior or outcome into distinct steps that can be encoded and followed by a computer.

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. Machine Translation



Examples/Applications

2. Speech Recognition and NLP

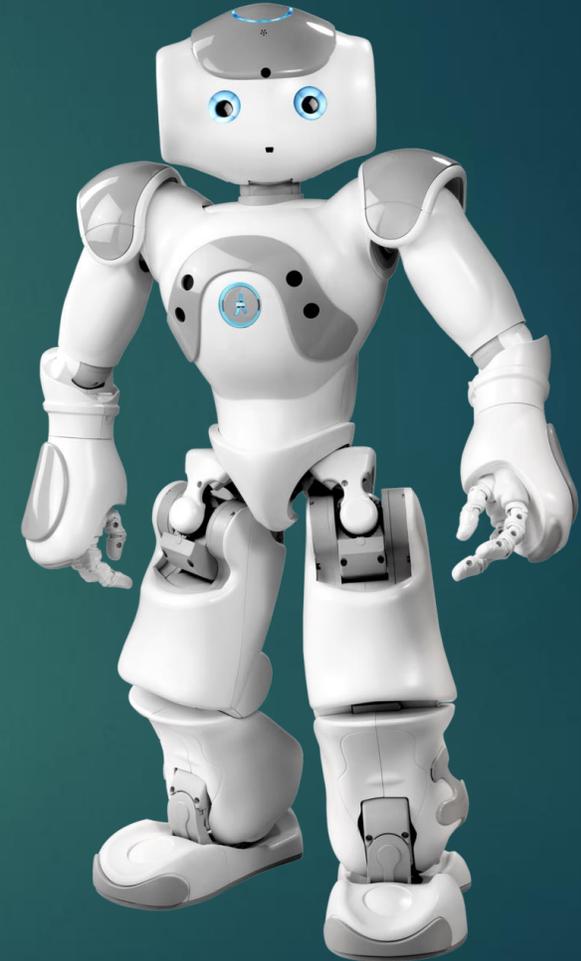


Examples/Applications

3. Robotics



Autonomous Vehicles



Social Robots

Examples/Applications

4. Computational Creativity

IBM Watson Health

Life sciences Oncology Value-based care Government Imaging Blog

Accelerate Scientific Breakthroughs

Life sciences researchers are using IBM Watson for Drug Discovery to make scientific breakthroughs and increase our knowledge of disease – faster than ever before.

[Hear from an expert](#) [See the evidence](#)



IBM Watson Music

cognitive music

collaboration by Alex Da Kid + IBM Watson

[Watch the story \(3:18\)](#)

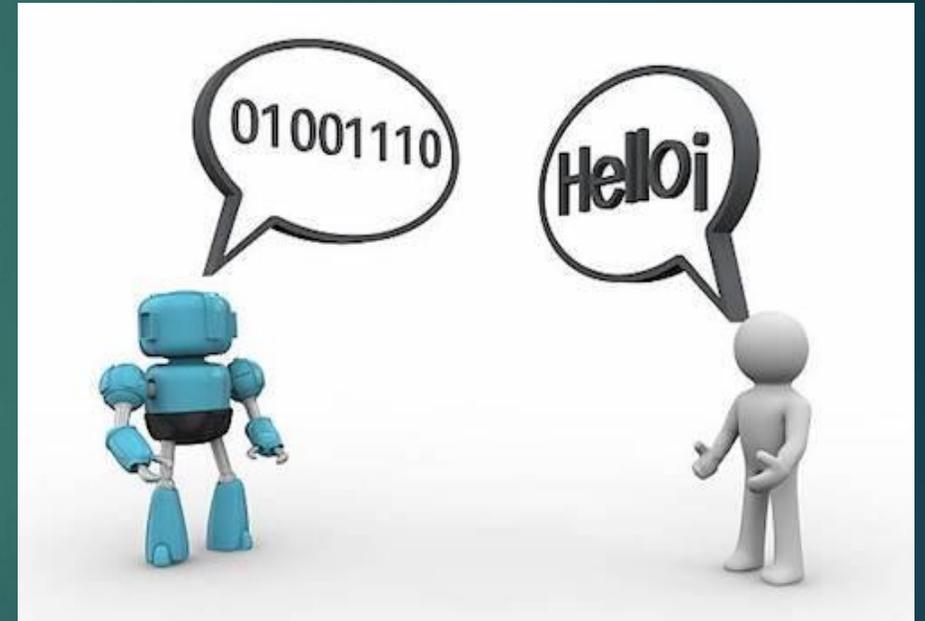
Share [Twitter](#) [Facebook](#) [LinkedIn](#) [Tumblr](#)

...nitive era, artists like Alex Da Kid can collaborate with Watson to inspire the hit
...o see
...who works



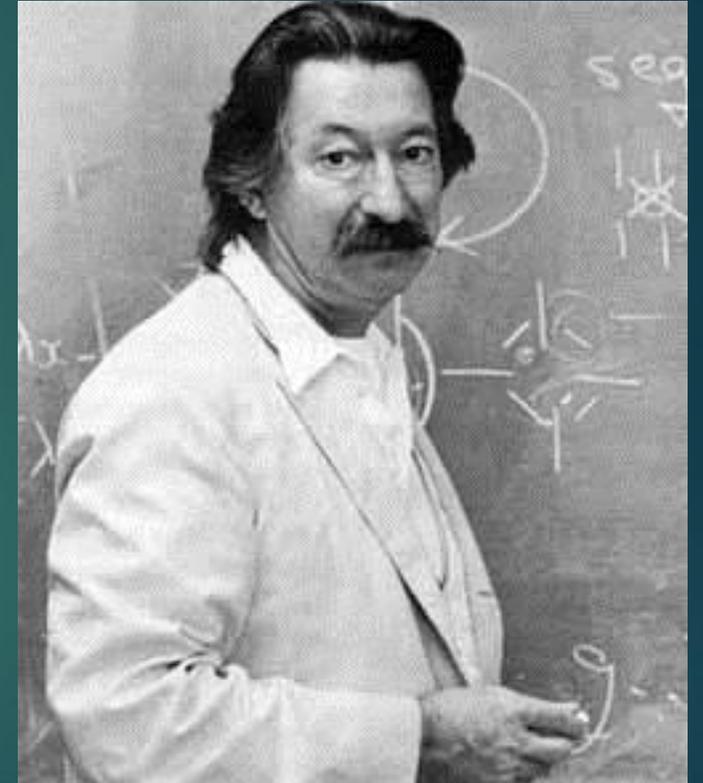
Today

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



Communication & AI

- ▶ ELIZA (1966)
 - ▶ First chatbot – computer program able to engage in natural language conversations with human users
 - ▶ Demonstrate what Alan Turing described with the Game of Imitation
 - ▶ Created by Joseph Weizenbaum
 - ▶ Emulate the conversational style of a Rogerian therapist



Communication & AI

- ▶ ELIZA Demo

- ▶ *Talk with ELIZA* – Direct experience with the application
- ▶ *How it Works* – “Pop the hood” and see how the application works
- ▶ *Do it Yourself* – Write your own basic version of an ELIZA-type application

Talk to ELIZA

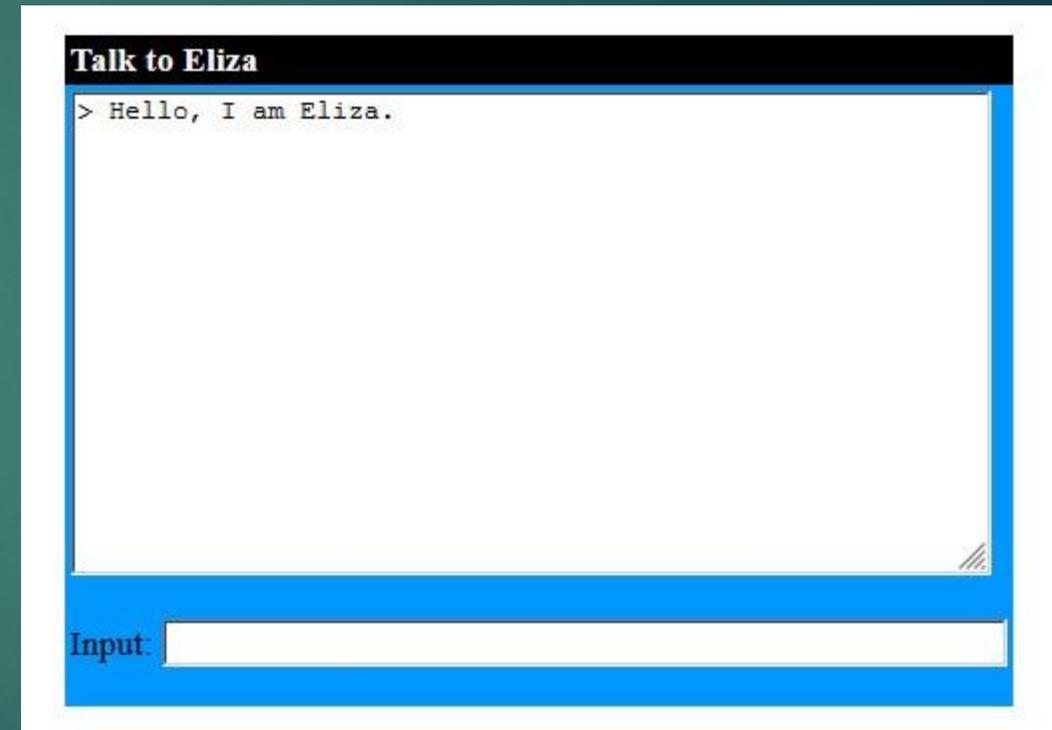
<http://gunkelweb.com/coms493/eliza.html>

```
Welcome to

EEEEEE LL      IIII ZZZZZZZ AAAAA
EE      LL      II      ZZ  AA  AA
EEEEEE LL      II      ZZZ  AAAAAAA
EE      LL      II      ZZ  AA  AA
EEEEEE LLLLLL IIII ZZZZZZZ AA  AA

Eliza is a mock Rogerian psychotherapist.
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ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:   It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:   █
```



How it Works

ELIZA was, technically speaking, a rather simple piece of programming, "consisting mainly of general methods for analyzing sentences and sentence fragments, locating so-called key words in texts, assembling sentence from fragments, and so on. It had, in other words, no built-in contextual framework of universe of discourse. This was supplied to it by a 'script.' In a sense ELIZA was an actress who commanded a set of techniques but who had nothing of her own to say" (Weizenbaum 1976, 188).

JOSEPH WEIZENBAUM

COMPUTER
POWER
AND
HUMAN
REASON

FROM JUDGMENT
TO CALCULATION

How it Works



500+ lines of code

```
1 <HTML><HEAD>
2 <META NAME="Description" CONTENT="Talk to Eliza!">
3 <TITLE>Eliza, Computer Therapist</TITLE>
4
5 <SCRIPT language="JavaScript"><!--
6
7 // Chat Bot by George Dunlop, www.peccavi.com
8 // Note - Eliza is a Classic Model of chat Bots.. but this implementation is mine :)
9 // May be used/modified if credit line is retained (c) 1997 All rights reserved
10
11     loaded = false;           // load flag for interlocking the pages
12
13 // OBJECT TYPE DEFINITIONS
14
15 // Keys
16
17     maxKey = 36;
18     keyNotFound = maxKey-1;
19     keyword = new Array(maxKey);
20
21     function key(key,idx,end){
22         this.key = key;           // phrase to match
23         this.idx = idx;           // first response to use
24         this.end = end;           // last response to use
25         this.last = end;         // response used last time
26     }
27     maxresponses =116;
28     response = new Array(maxresponses);
29
30     maxConj = 19;
31     max2ndConj = 7;
32     var conj1 = new Array(maxConj);
33     var conj2 = new Array(maxConj);
34     var conj3 = new Array(max2ndConj);
35     var conj4 = new Array(max2ndConj);
36
37
38 // Funtion to replaces all occurances of substring substr1 with substr2 within strng
39 // if type == 0 straight string replacement
40 // if type == 1 assumes padded strings and replaces whole words only
41 // if type == 2 non case sensitive assumes padded strings to compare whole word only
42 // if type == 3 non case sensitive straight string replacement
43
44     var RPstrg = "";
45
46     function replaceStr( strng, substr1, substr2, type){
47         var pntr = -1; aString = strng;
48         if( type == 0 ){
49             if( strng.indexOf( substr1 ) >= 0 ){ pntr = strng.indexOf( substr1 ); }
50         } else if( type == 1 ){
51             if( strng.indexOf( " "+ substr1 + " " ) >= 0 ){ pntr = strng.indexOf( " " + substr1 + " " ) + 1; }
52         } else if( type == 2 ){
```

Do It Yourself

```
1
2 <html>
3 <body>
4
5 <script language="javascript">
6
7 response1 = prompt("I am ELIZA. How can I help you?");
8
9 if (response1)
10 response2 = prompt("hello, nice to meet you");
11
12 if (response2)
13 response3 = prompt("What would you like to talk about?");
14
15 </script>
16
17 <a href="eliza_demo.html">Start Again</a>
18
19 </body>
20 </html>
21
```

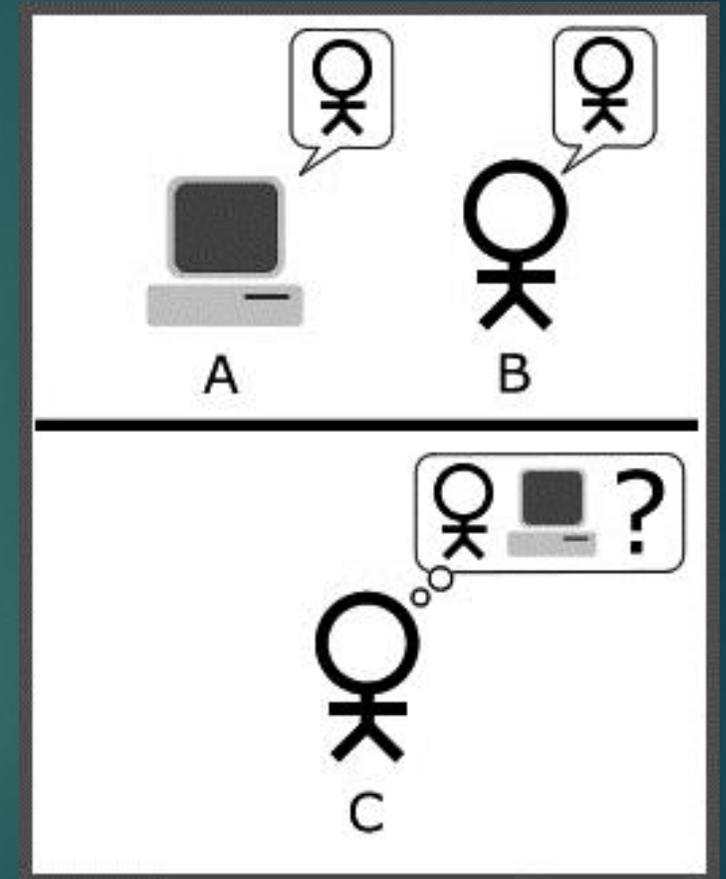
Save As
eliza_demo.html

```
1
2 <html>
3 <body>
4
5 <script language="javascript">
6
7 response1 = prompt("I am ELIZA. How can I help you?");
8
9 if (response1)
10 response2 = prompt("hello, nice to meet you");
11
12 if (response2)
13 response3 = prompt("What would you like to talk about?");
14
15 if (response3)
16 response4 = prompt("Is this something that worries you?");
17
18 if (response4)
19 response5 = prompt("Why is that? Tell me more about it.");
20
21 </script>
22
23 <a href="eliza_demo.html">Start Again</a>
24
25 </body>
26 </html>
27
```

```
1
2 <html>
3 <body>
4
5 <script language="javascript">
6
7 response1 = prompt("I am ELIZA. How can I help you?");
8
9 if (response1)
10 response2 = prompt("What is your name?");
11
12 if (response2)
13 response3 = prompt("Hello, " + response2 + " What would you like to talk about?");
14
15 if (response3)
16 response4 = prompt("Is this something that worries you?");
17
18 if (response4)
19 response5 = prompt("Why is that? Tell me more about it.");
20
21 </script>
22
23 <a href="eliza_demo.html">Start Again</a>
24
25 </body>
26 </html>
27
```

Questions

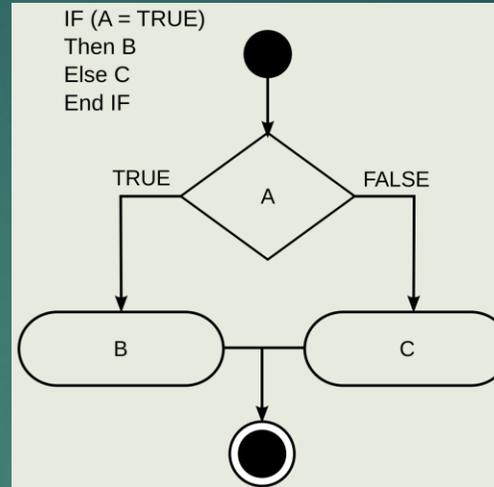
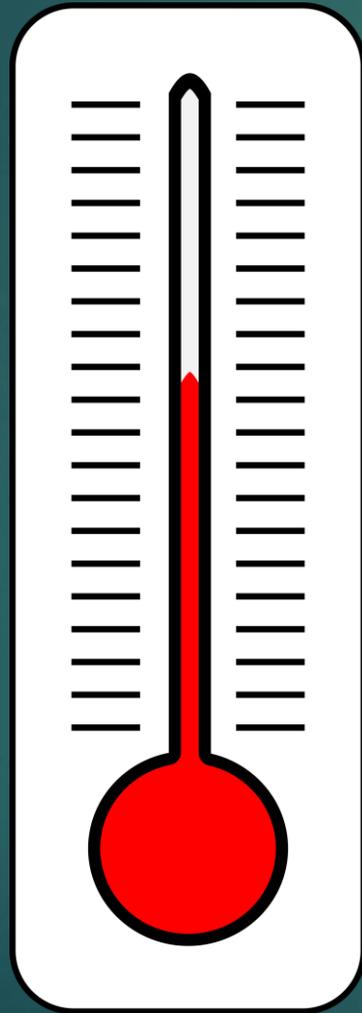
- ▶ Can ELIZA talk?
- ▶ Does ELIZA understand language?
- ▶ Is ELIZA intelligent?
- ▶ Could ELIZA pass the Turing Test?
- ▶ How does ELIZA illustrate Searle's "Chinese Room" thought experiment?



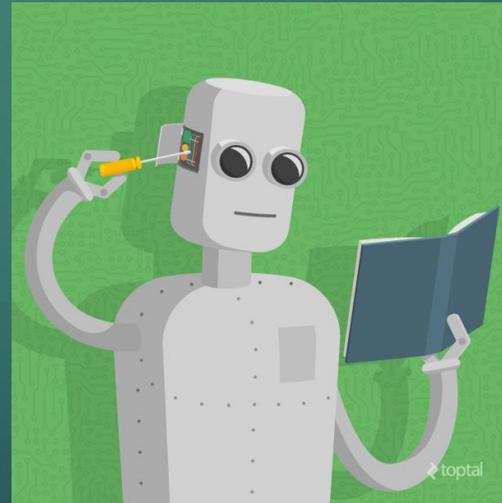
Preview

- ▶ Terminology & Details
- ▶ Texts
 - ▶ 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)
- ▶ Maker Exercise #1 - Algorithms

Algorithm Exercise



Temp Conversion – v1
Symbolic Reasoning
GOFAI approach



Temp Conversion – v2
Machine Learning
Neural Network