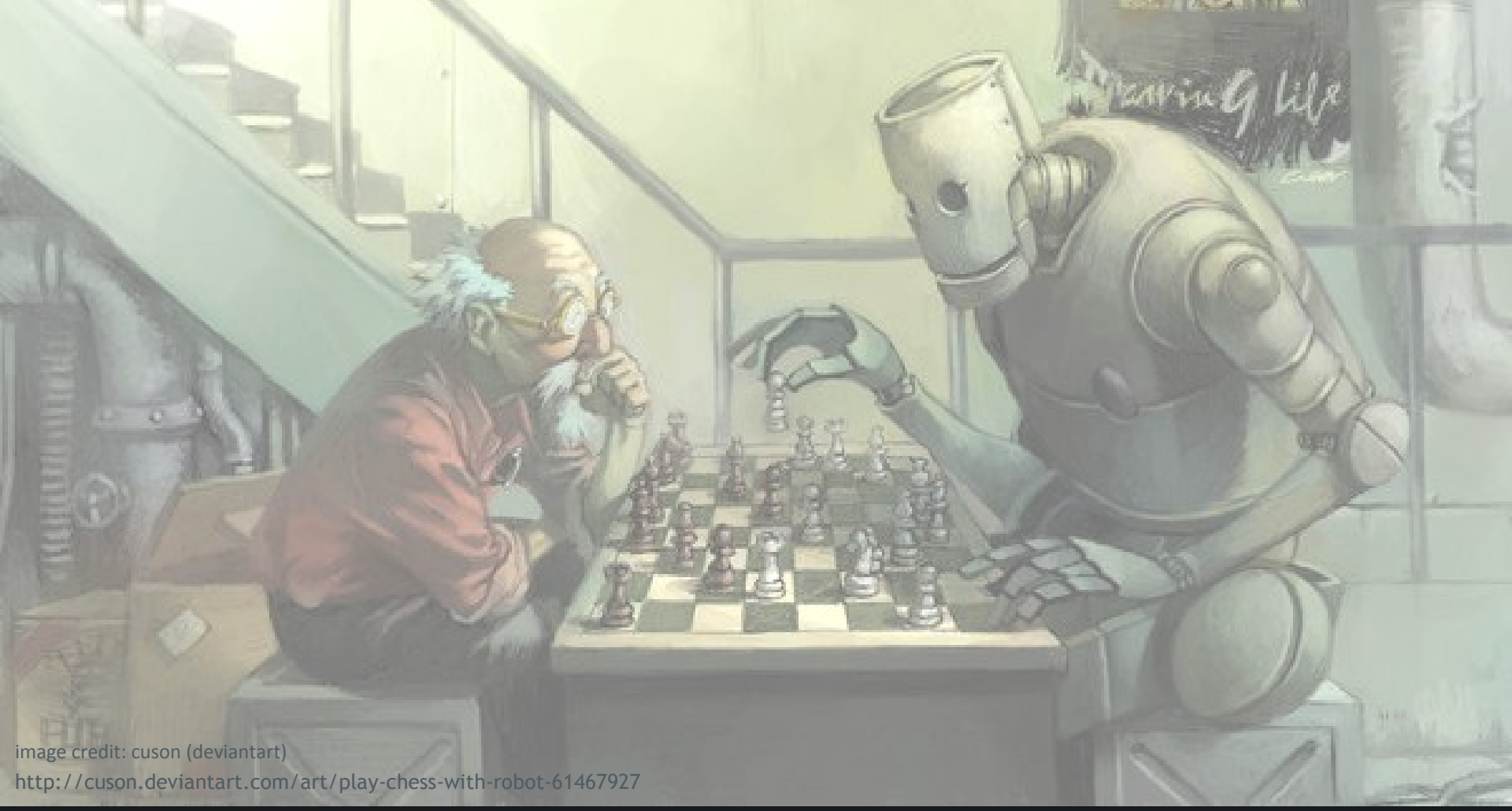


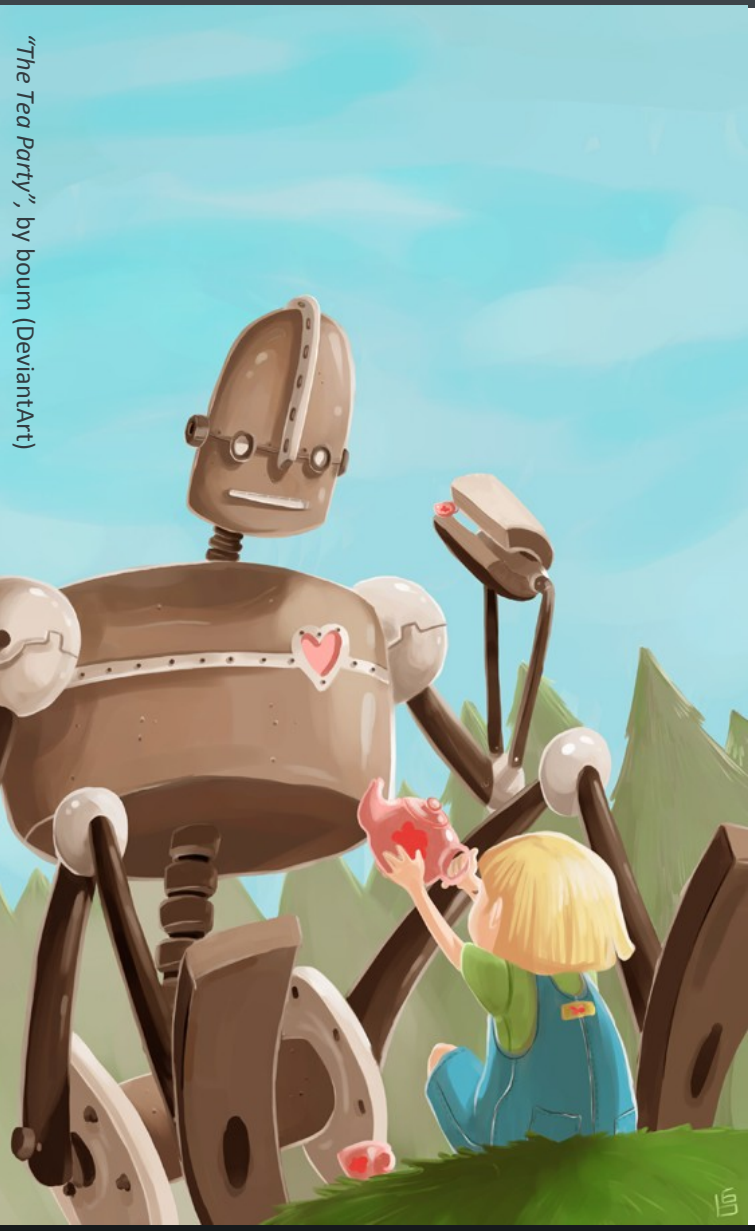
image credit: cuson (deviantart)
http://cuson.deviantart.com/art/play-chess-with-robot-61467927

What is AI?

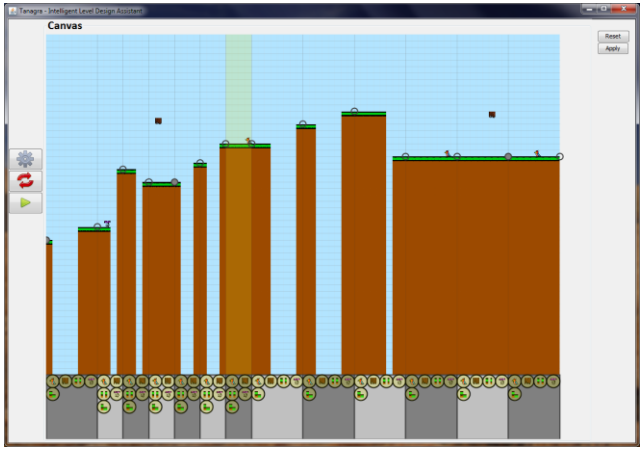
course introduction, intelligent agents

CS 4100/5100
Foundations of AI

A bit about me…



"The Tea Party", by boum (DeviantArt)



Class Overview

Provide a broad foundation in core AI topics:

- Logic and reasoning
- Planning
- Heuristic search
- Knowledge representation
- Machine learning

Website: http://www.ccs.neu.edu/course/cs5100f12

Class Overview

- Course Participation: 10%
- Midterm Exam: 20%
- Assignments: 35%
- Final Project: 35%

Getting Assistance

- Professor: Gillian Smith
- gillian@ccs.neu.edu
- Office hours: Tuesdays 2-4pm, WVH 478
  - or by appointment

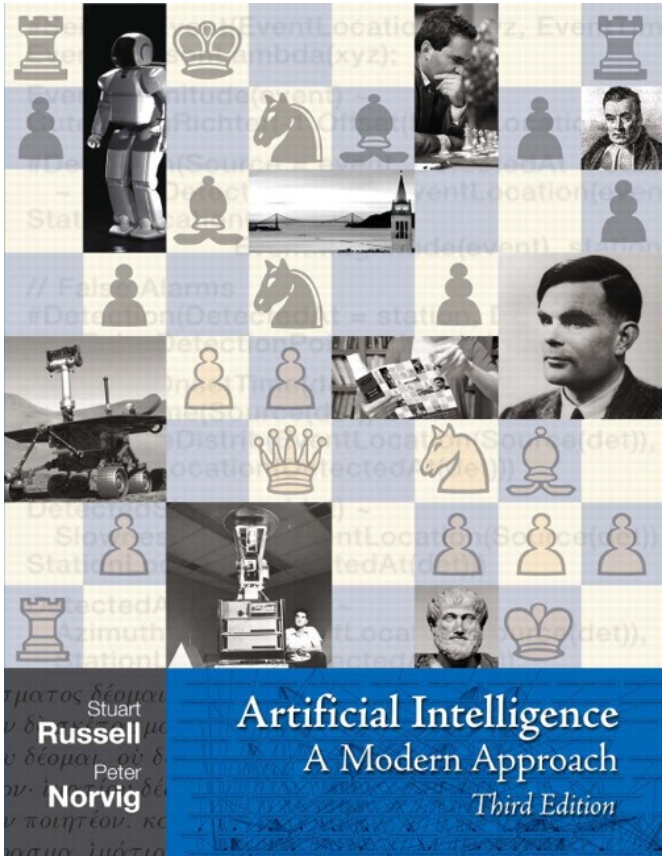
- TA: Cheng Li
- li.che@husky.neu.edu
- Office hours: TBA

Textbook

Artificial Intelligence: A Modern Approach

Third Edition

Stuart Russell, Peter Norvig



Course Participation

- Additional readings
- Discussion in-class
- Piazza online discussion forum
  - Link is in the syllabus

Reading Responses

- One page, due at **noon** on the day of class
- Brief, **two sentence** summary of the reading
- The rest should be **your opinion**
  - What are the shortcomings of the work?
  - What would you do to extend it?
  - What is the future work?
  - Is there anything you strongly disagree with? Strongly agree with?
  - How does the paper relate to your interests?

Collaboration Policy

- I **encourage** you to…
  - Share ideas with other students
  - Work together to come up with general solutions
  - Discuss papers prior to response
- I **require** you to…
  - Write your own code for assignments
  - Understand **every** aspect of code you turn in
  - Give detailed credit to people you have worked with or online resources
  - Ask if you have any questions about this policy

Collaboration Policy

- I **encourage** you to…
  - Share ideas with other students
  - Work together to come up with general solutions
  - Discuss papers prior to response
- I **require** you to…
  - Write your own code for assignments
  - Understand **every** aspect of code you turn in
  - Give detailed credit to people you have worked with or online resources
  - Ask if you have any questions about this policy
- **Plagiarism and copying is strictly forbidden, and will result in disciplinary action.**

Late Policy

- Every day an assignment is late, 10% off
- Each of you has **five** late days
  - Split them across assignments as you wish
  - Use for planned absences or unexpected issues
  - For assignments **only**
  - When turning in assignment late, specify how many late days you will use
- Unexpected, longer-term emergencies: see me!

Final Projects

- Groups of 3-4 students
  - More or less by my permission only (and have a really good reason)
- Your choice of topic
- Phases:
  - Pitch: October 4th
  - Proposal: October 18th
  - Presentation: November 29th/December 6th
  - Paper: December 13th

Questions?

A BRIEF HISTORY OF AI

1956: The Birth of AI

…solve kinds of problems now reserved for humans…

…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…

1960s: Initial Optimism

- Playing checkers

  (Arthur Samuel)

- General Problem Solver

  (Allen Newell & Herbert Simon)

means-end analysis

- Cornerstone of the General Problem Solver
- Used now in planners and other search problems

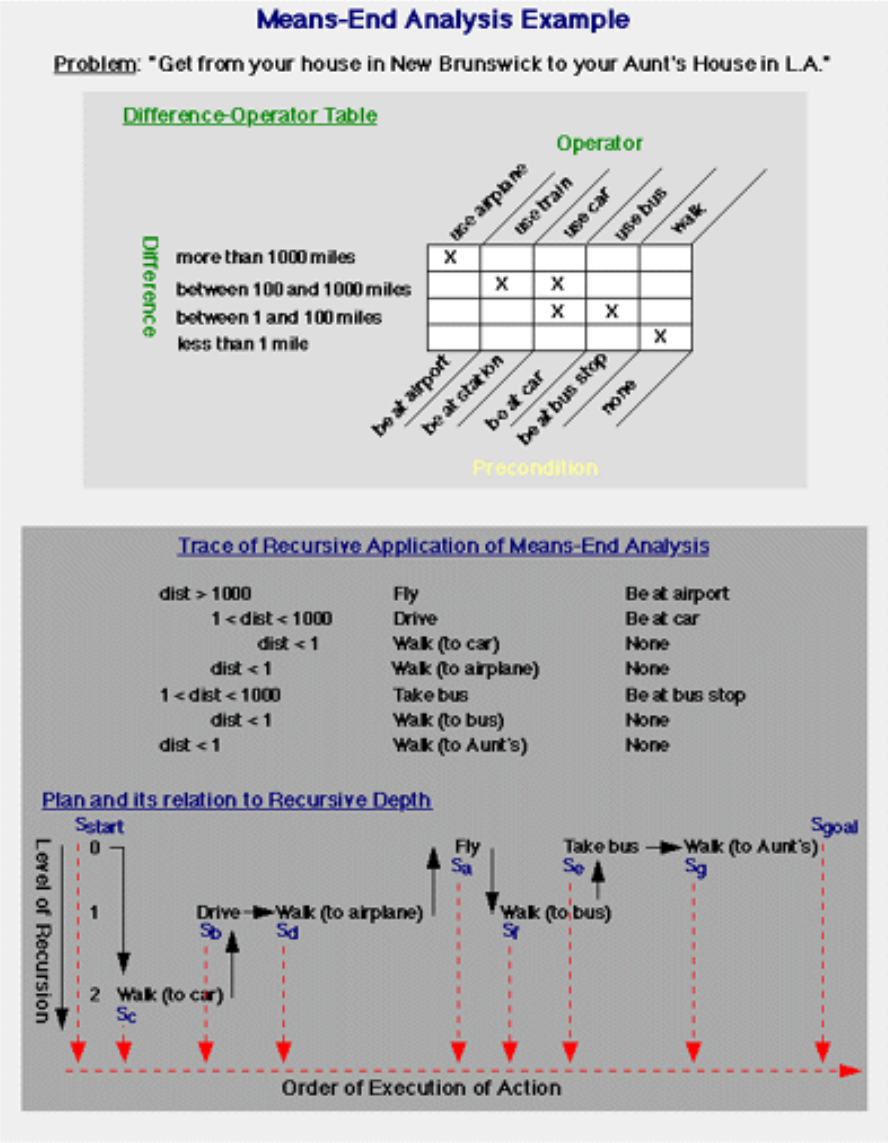
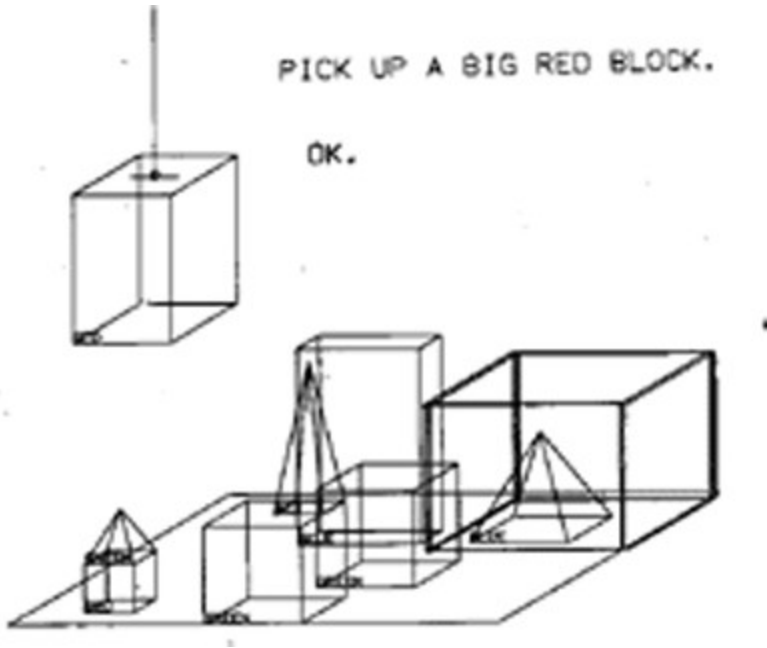


image credit: http://www-rci.rutgers.edu/~cfs/472_html/Planning/GPS_472.html

1970s – 80s: Knowledge-Based Systems

- Microworlds
  - SHRDLU
- "Expert" systems
  - DENDRAL, MYCIN
- **knowledge acquisition bottleneck**

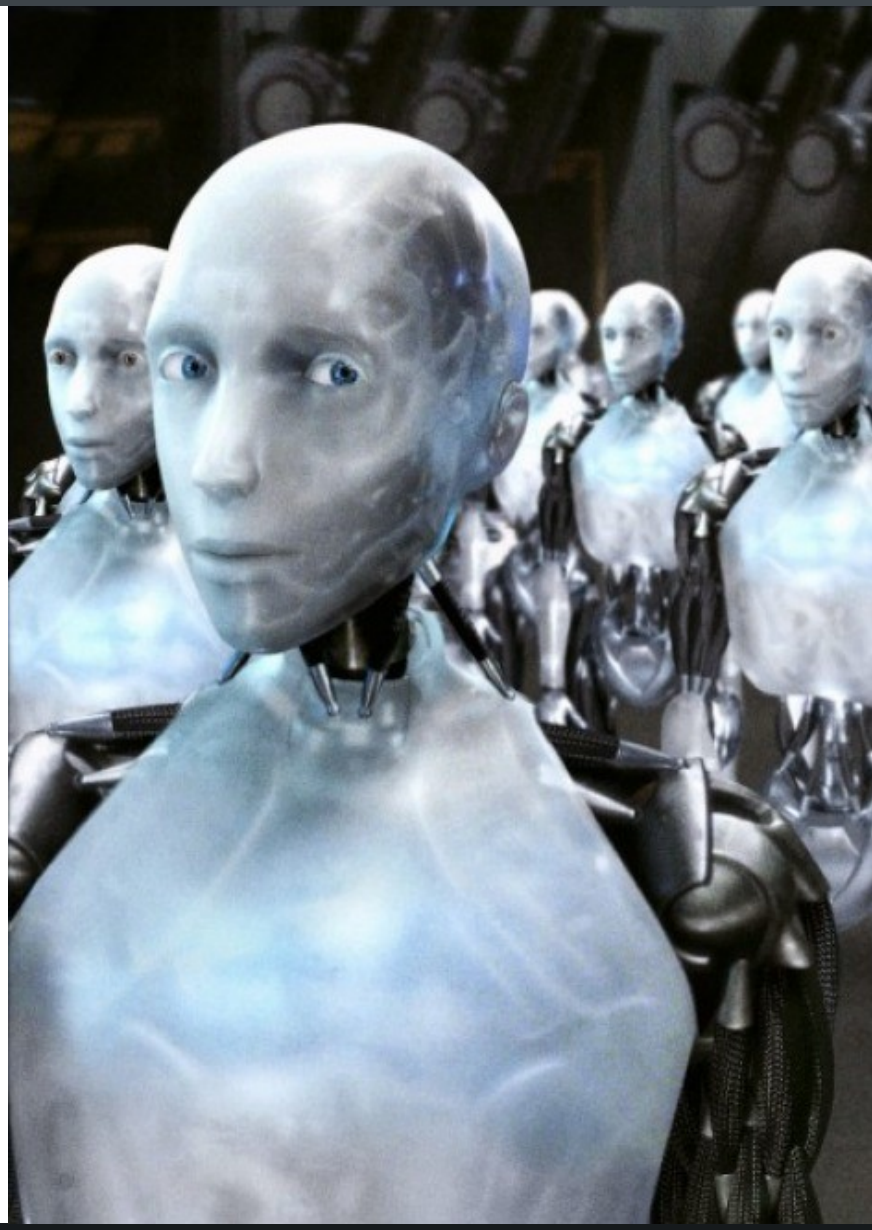


1980s – 90s: The AI Winter

- Overcoming the KA bottleneck
- Industry oversells AI's promise

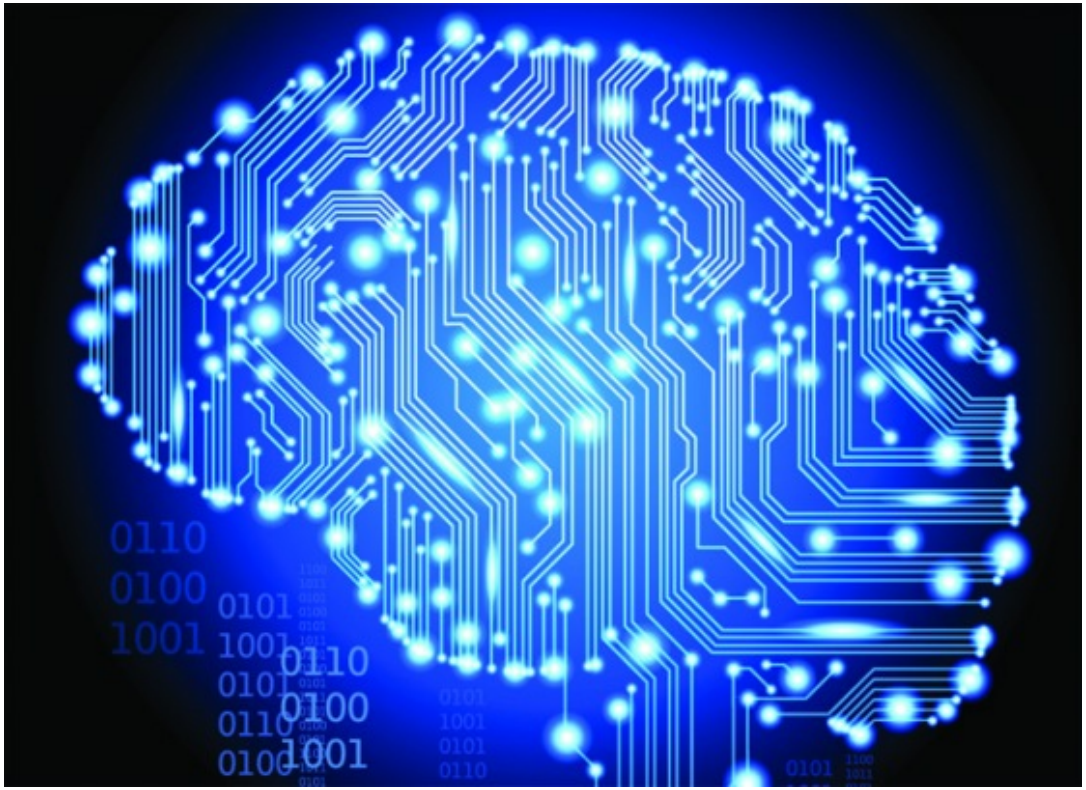
1990s: Resurgence

- Probabilistic approaches
- Adoption of scientific rigor
- Return to dreams of **human-level AI**



2000s: Big Data

- Focus on data
- Solution to KA bottleneck?

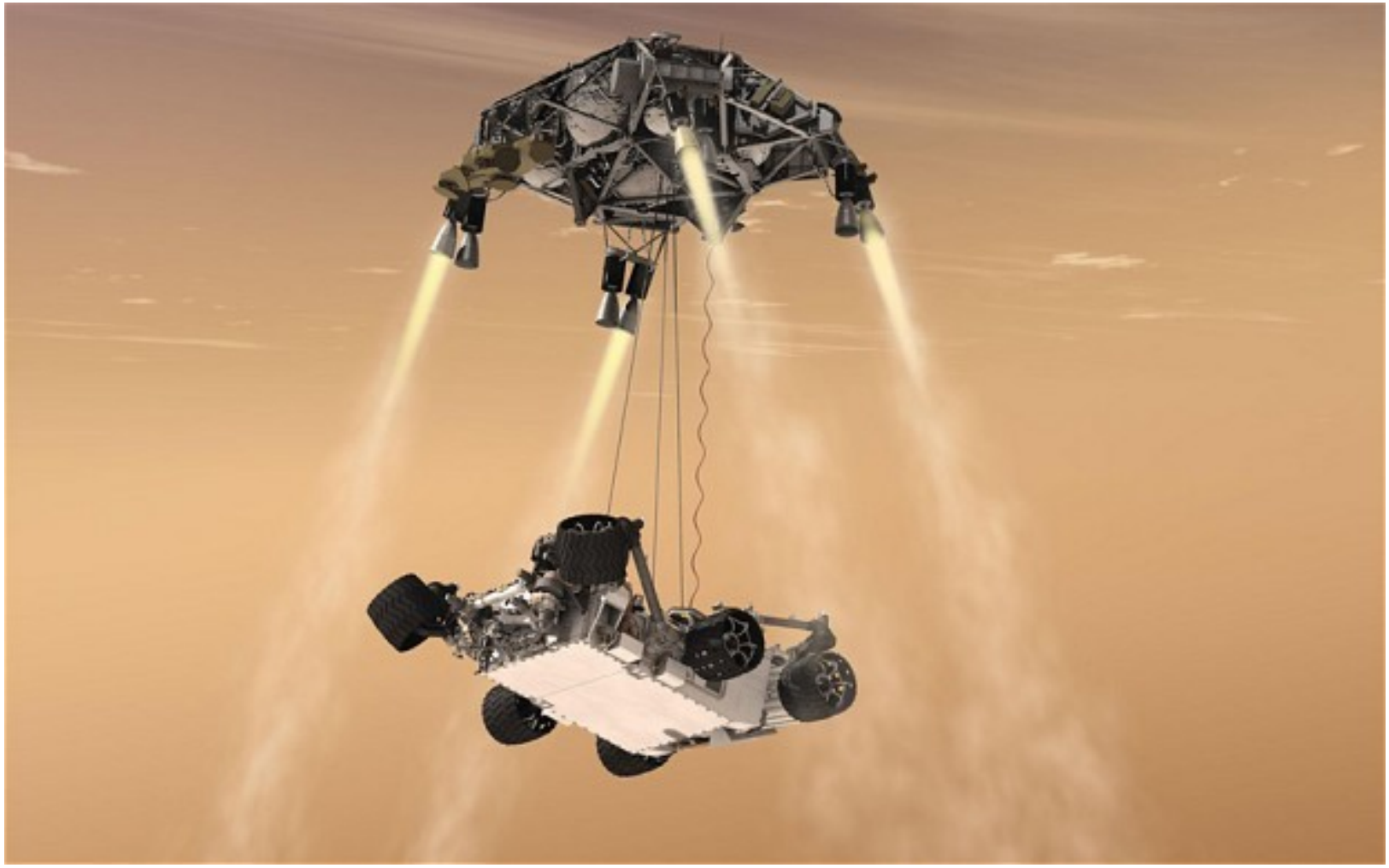


AI APPLICATION AREAS

Games

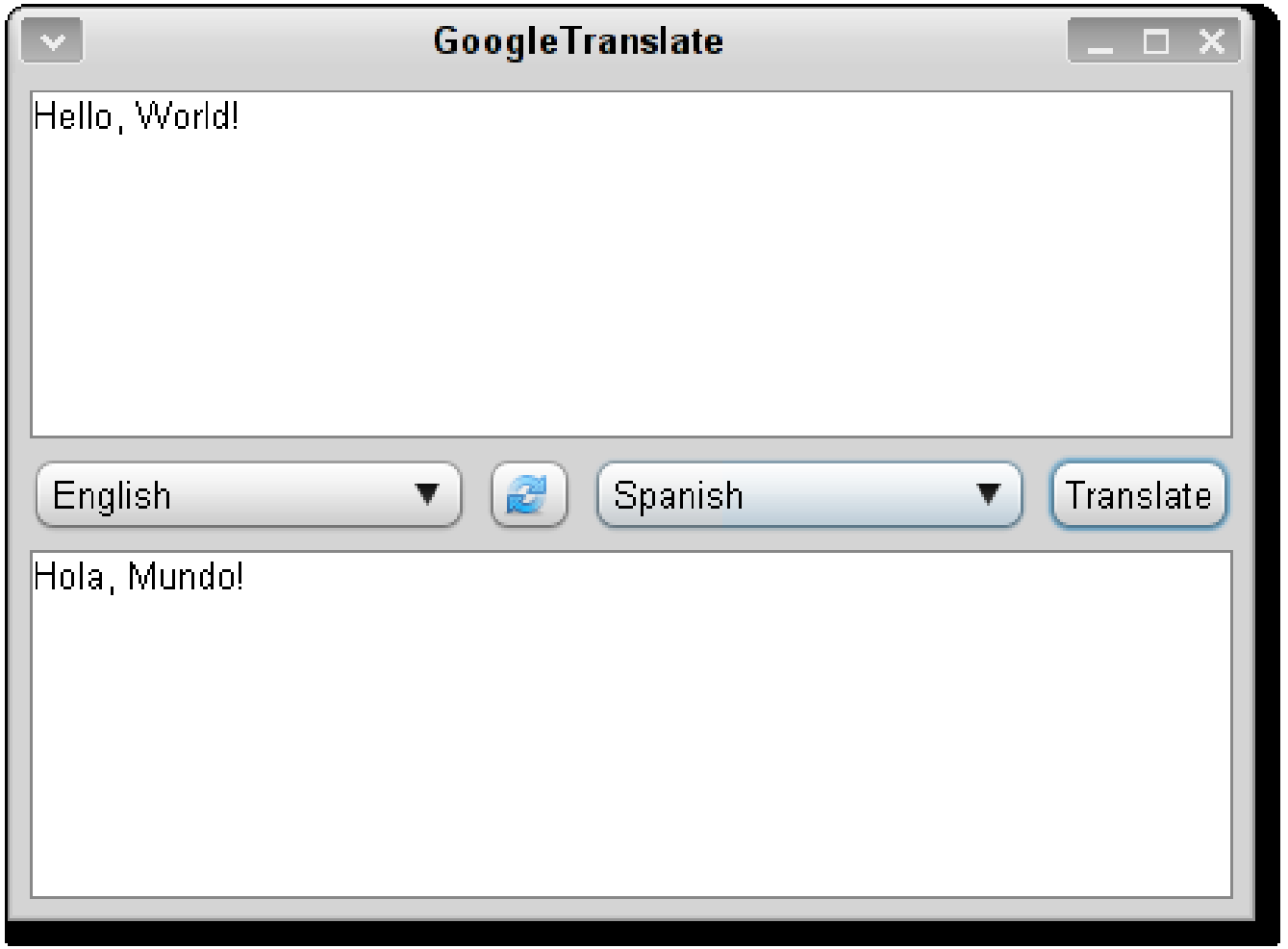

2804
Terran Siege Tank
Master Sergeant
Kills: 3
MENU
Tank Mode

Robotics



Computer Vision

Machine Translation



Scheduling

Creativity

Natural Language Understanding

INTELLIGENT AGENTS

Thinking Humanly

- Cognitive modeling
- Focus not just on correct answers, but on how you get there

Acting Humanly

- Turing Test

- Focus areas:
  - Natural Language Processing
  - Knowledge Representation
  - Automated Reasoning
  - Machine Learning

  - Computer Vision
  - Robotics

ELIZA

Person : Men are all alike.
ELIZA : In what way?
Person : They're always bugging us about something or other.
ELIZA : Can you think of a specific example?
Person : Well, my boyfriend made me come here.
ELIZA : Your boyfriend made you come here?
Person : He says I'm depressed much of the time.
ELIZA : I am sorry to hear that you are depressed.
Person : It's true. I am unhappy.
ELIZA : Do you think coming here will help you not to be unhappy?
Person : I need some help, that much seems certain.
ELIZA : What would it mean to you if you got some help?
Person : Perhaps I could learn to get along with my mother.
ELIZA : Tell me more about your family

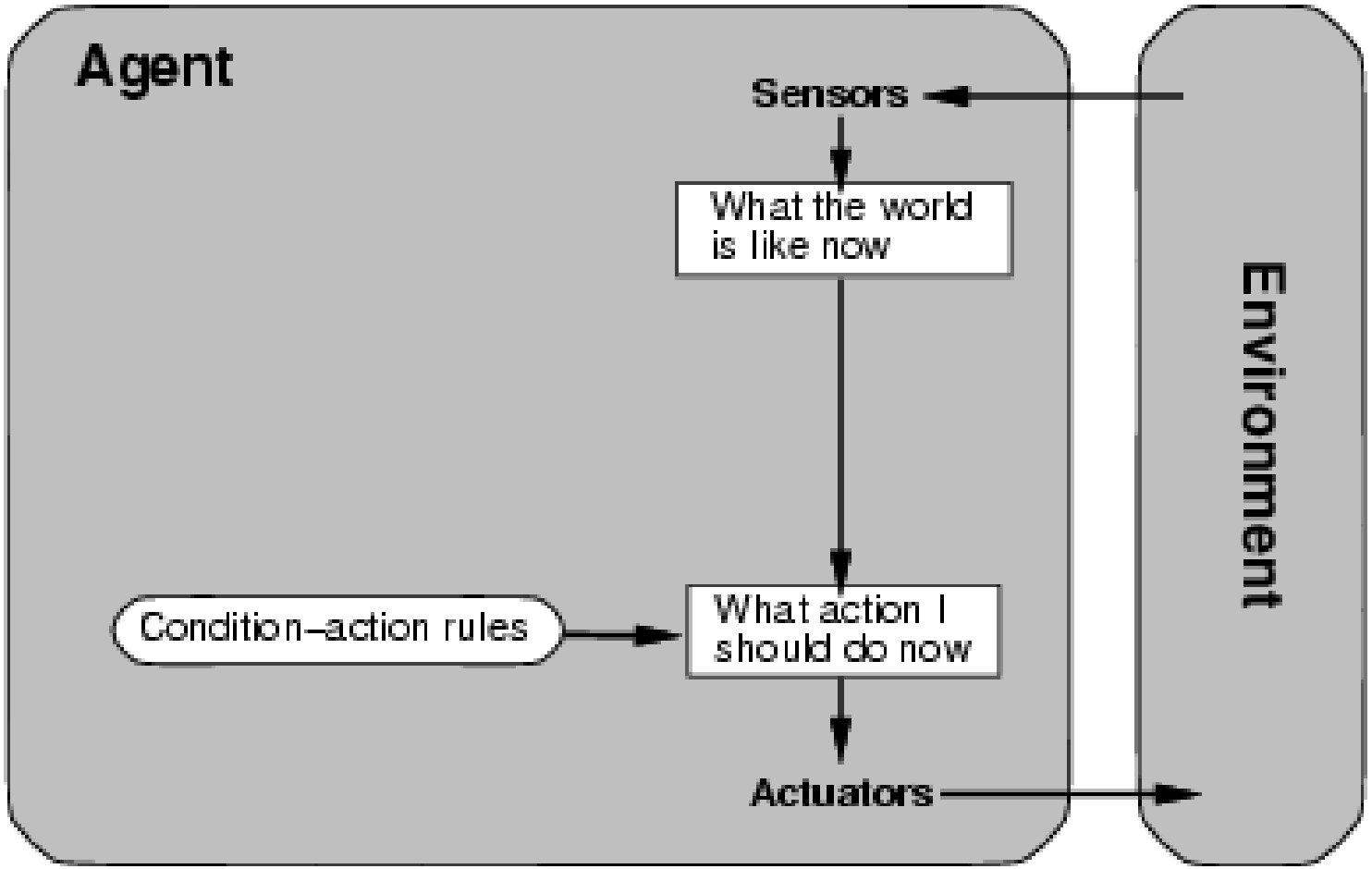
Thinking Rationally

- Purely logical thought and reasoning
- Mathematically well-defined
- Problems with scalability and expressiveness

Acting Rationally

- Acting towards a goal
- Always doing the “right” thing

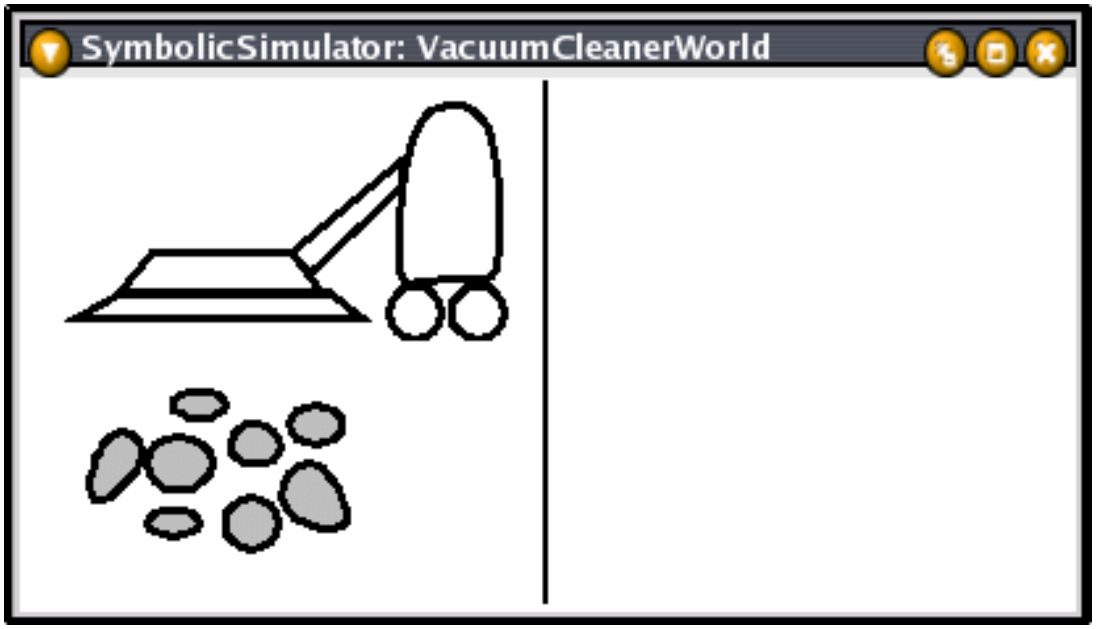
Agent-Based AI



Agent Design

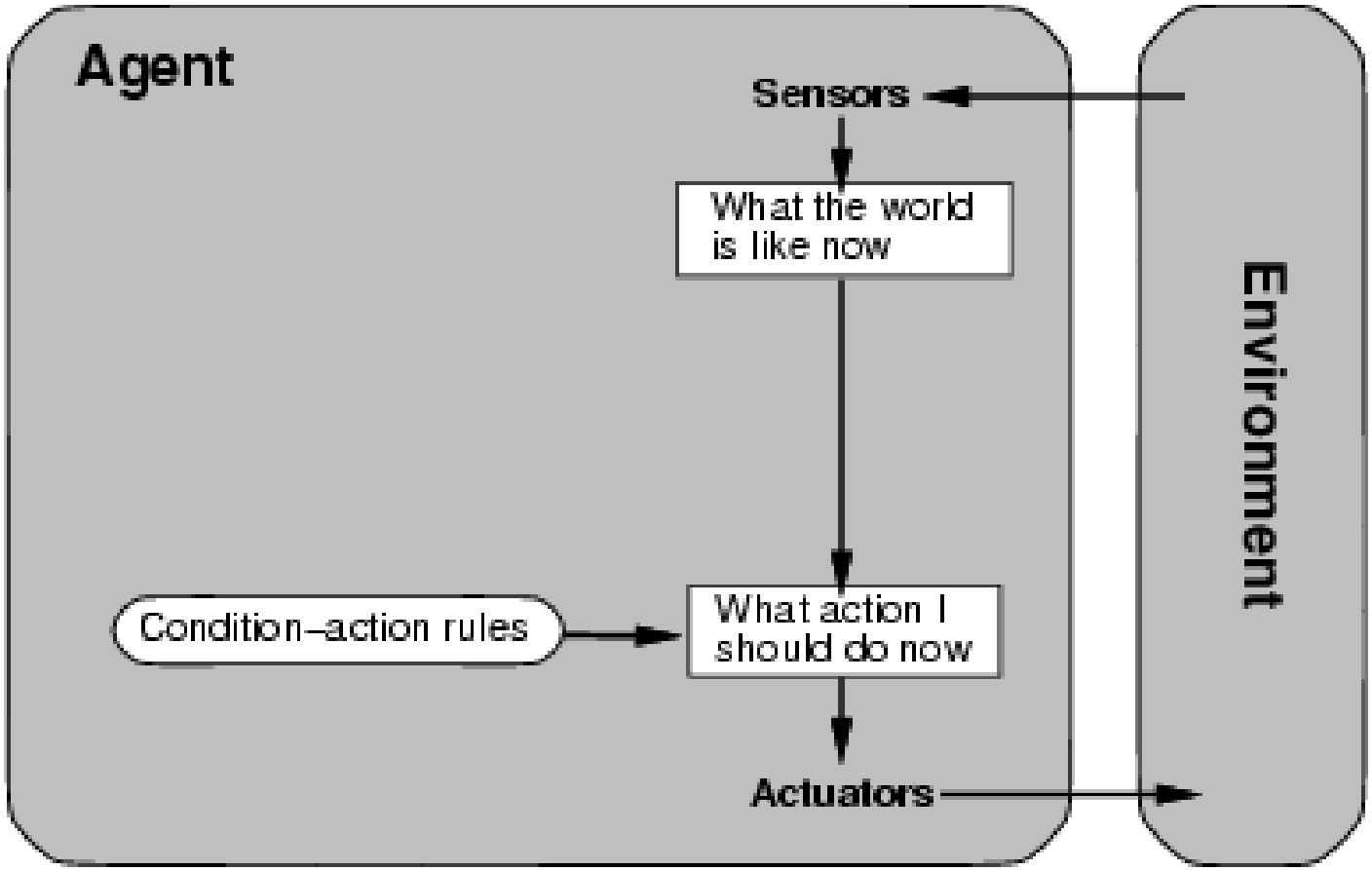
- What can the agent do?
  - Range of **actions**
- What is the environment? (Input: **percepts**)
  - How is it **interpreted**?
- What does the agent know?
  - History of previous inputs and actions (how far back?)
  - Properties of environment: **world knowledge**
  - Knowledge of its own **goals** and preferences
  - **Strategies** for behavior
- How does the agent choose to act?
  - Mapping from percept sequence -> action called an **agent function**

Example: Vacuum Cleaner World

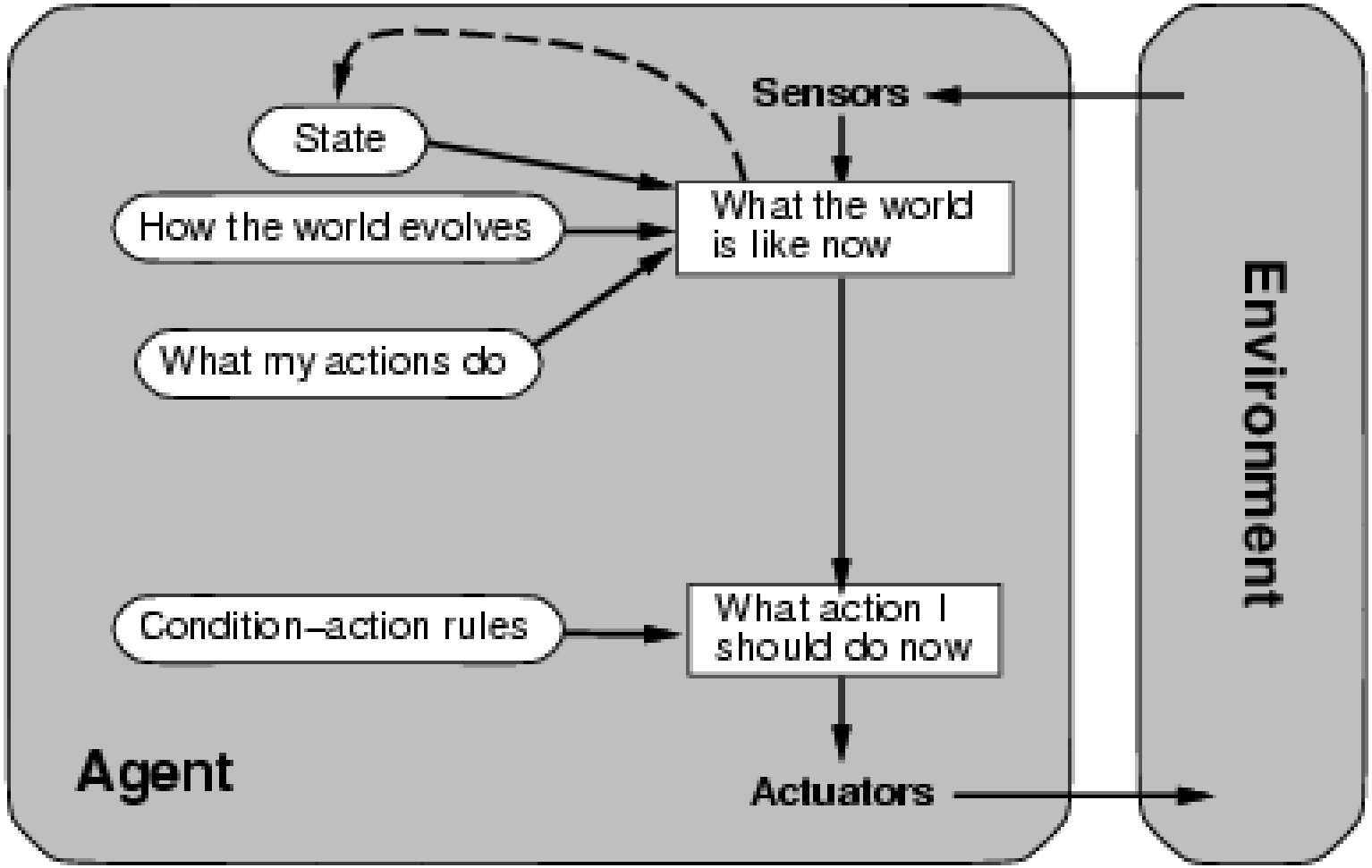


What are the **actions**? What are the **percepts**?

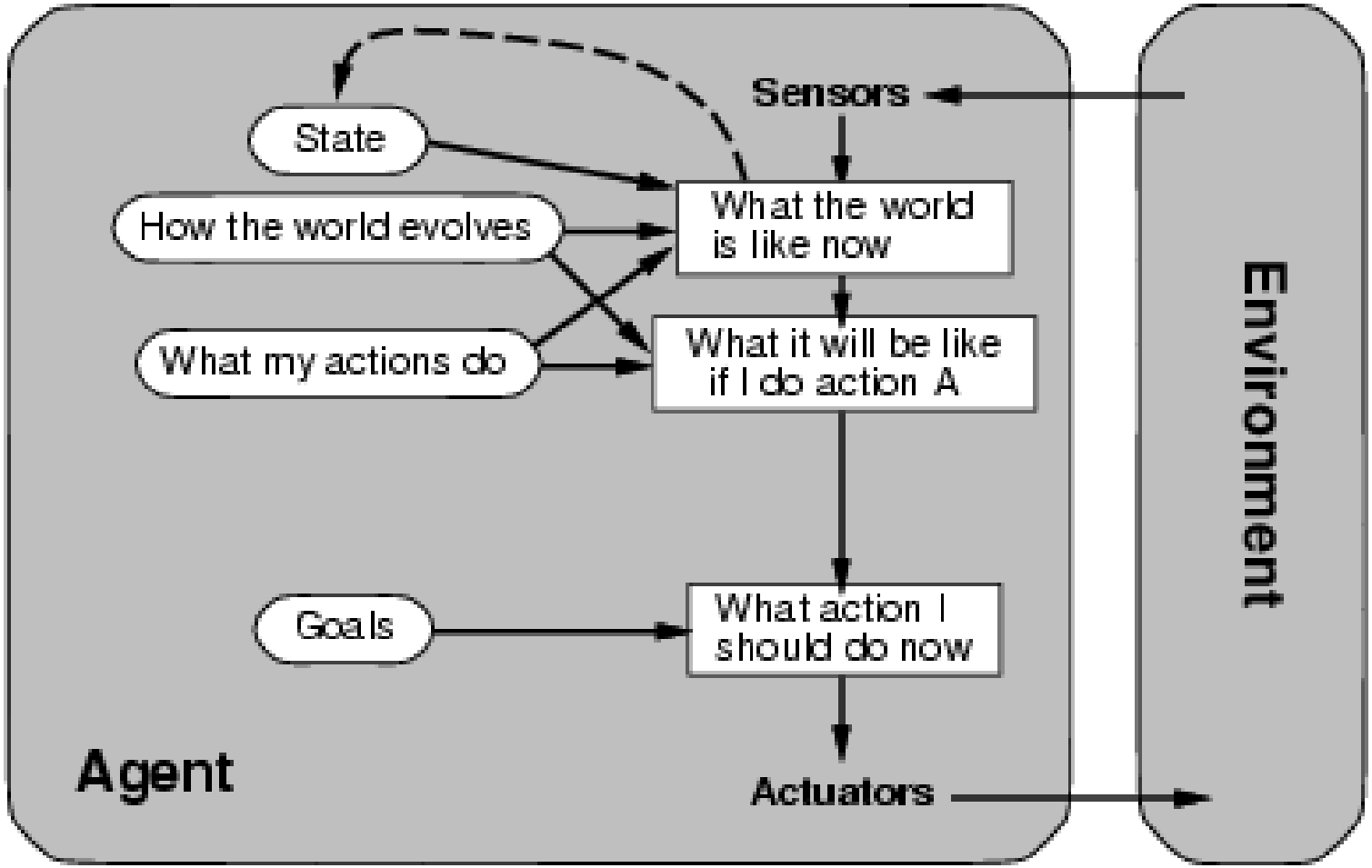
Kinds of Agents: Simple Reflex Agent



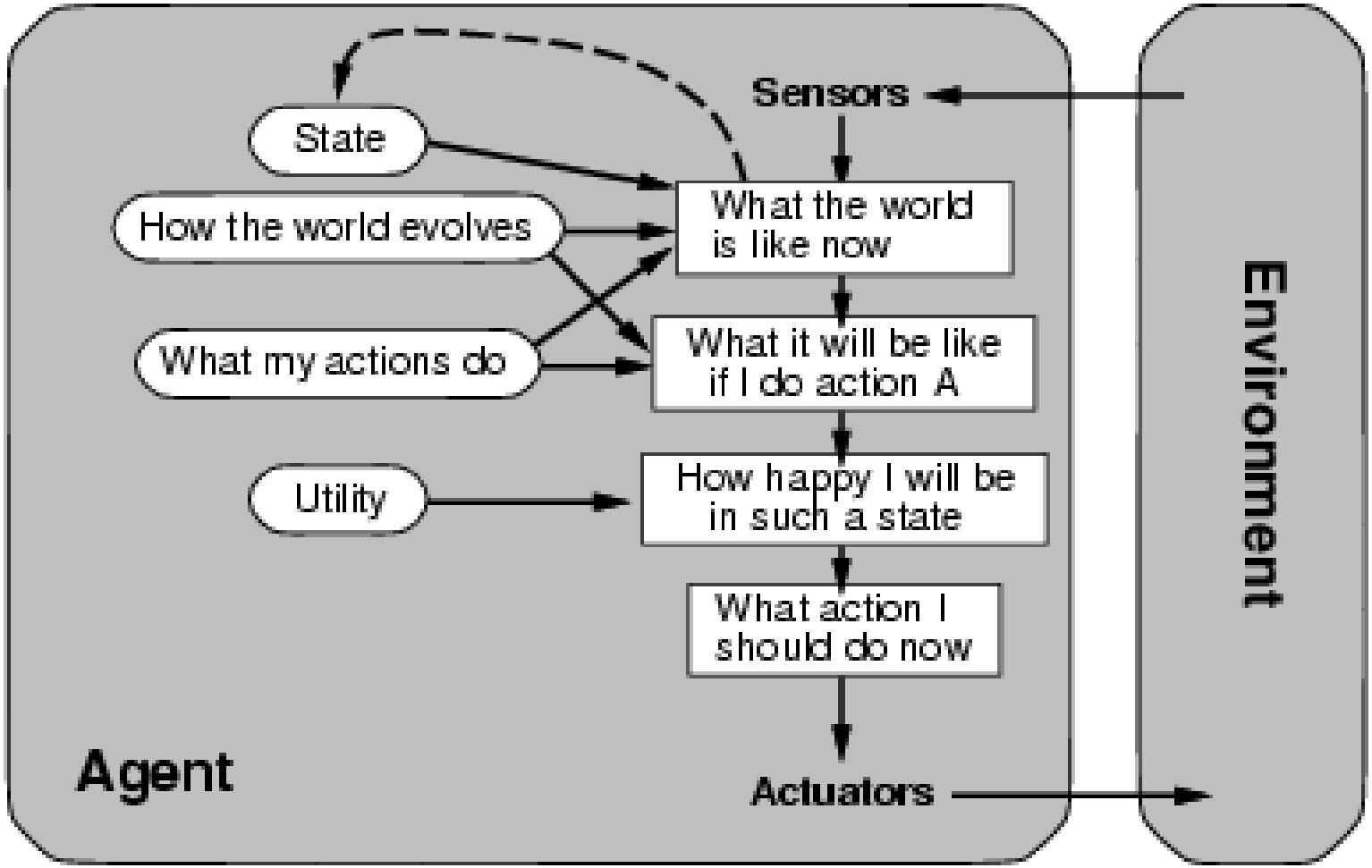
Kinds of Agents: Model-Based Agent



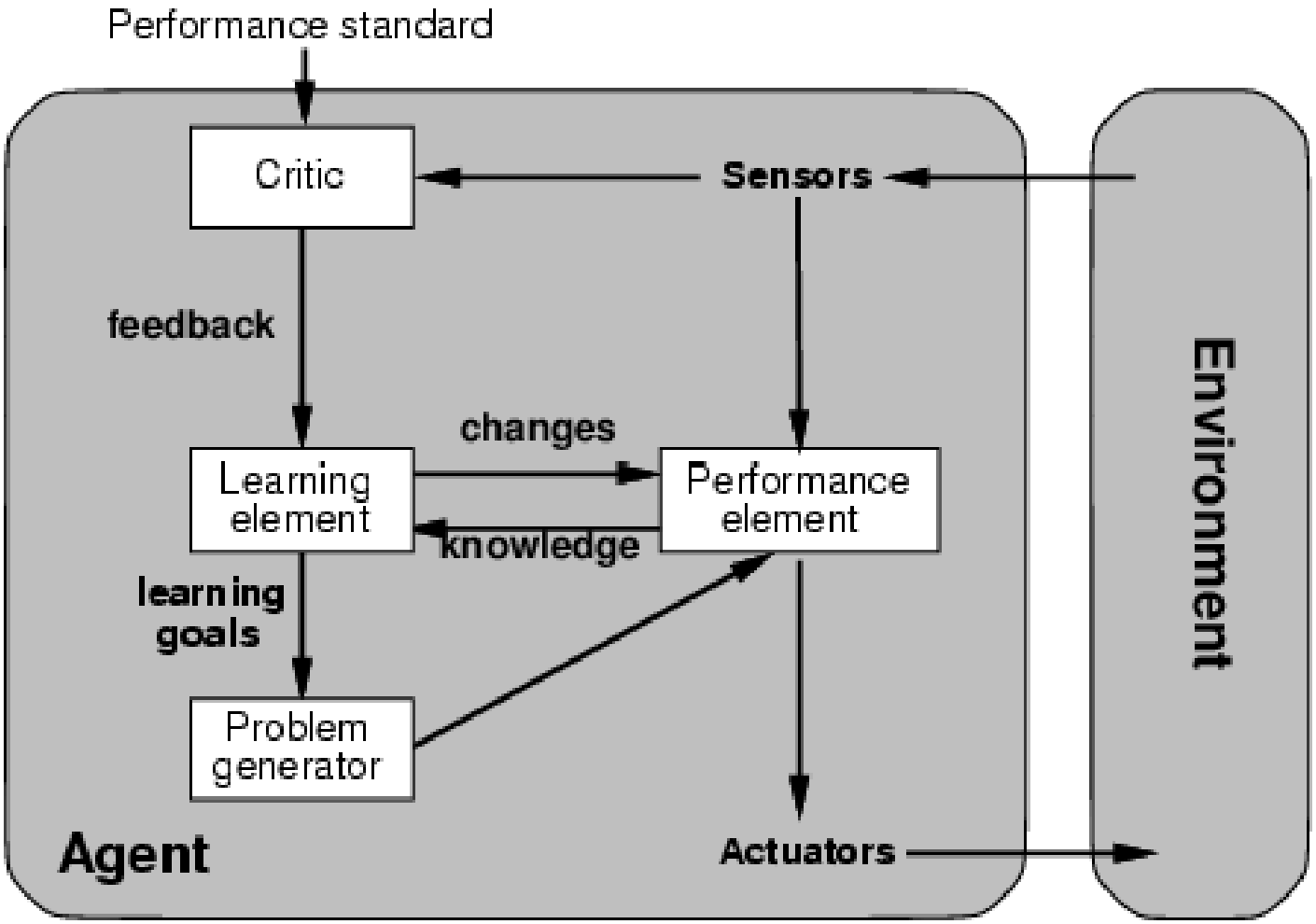
Kinds of Agents: Goal-Based Agent



Kinds of Agents: Utility-Based Agent



Kinds of Agents: Learning Agent



Group Exercise: Design a Taxi Agent

Knowledge Representation: Goals

- General purpose
- Environment and behavior
- Consequences of behavior
- Well-structured, represent to computer

Knowledge Representation: Solution

- Formal logic!