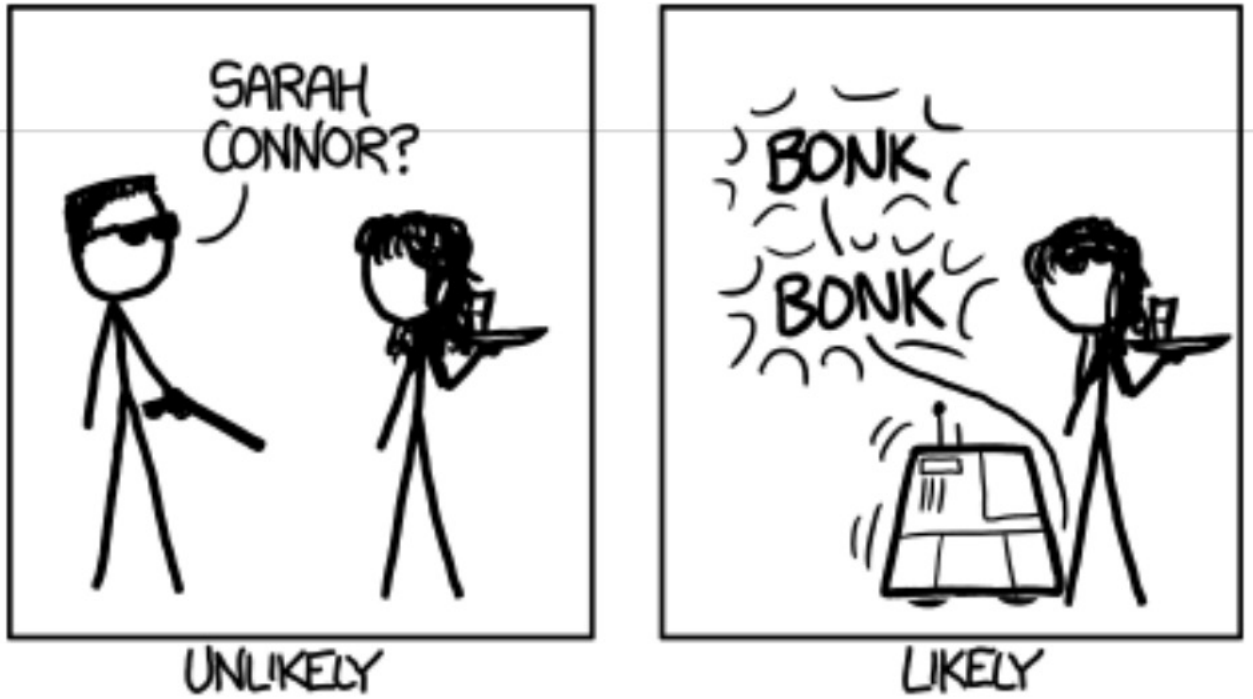
CSCI 3202: Intro to Artificial Intelligence

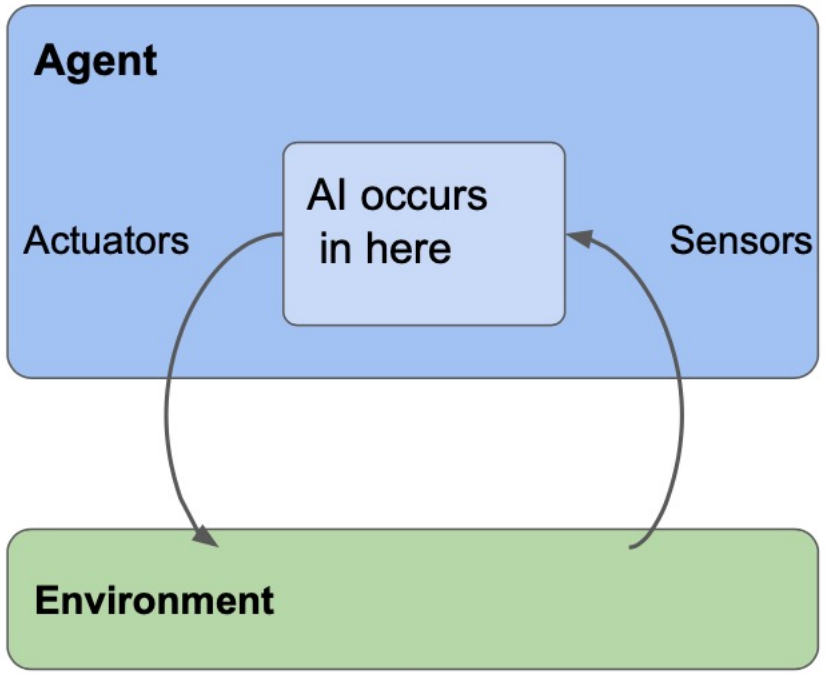
Agents



What is an agent?

An **agent** is an entity that perceives and acts.

- Perceives via sensors (percepts)
- Acts via actuators (actions)



A **percept** is the agent's perceptual inputs at any given instant.

A **percept sequence** is the complete history of everything the agent has ever perceived.

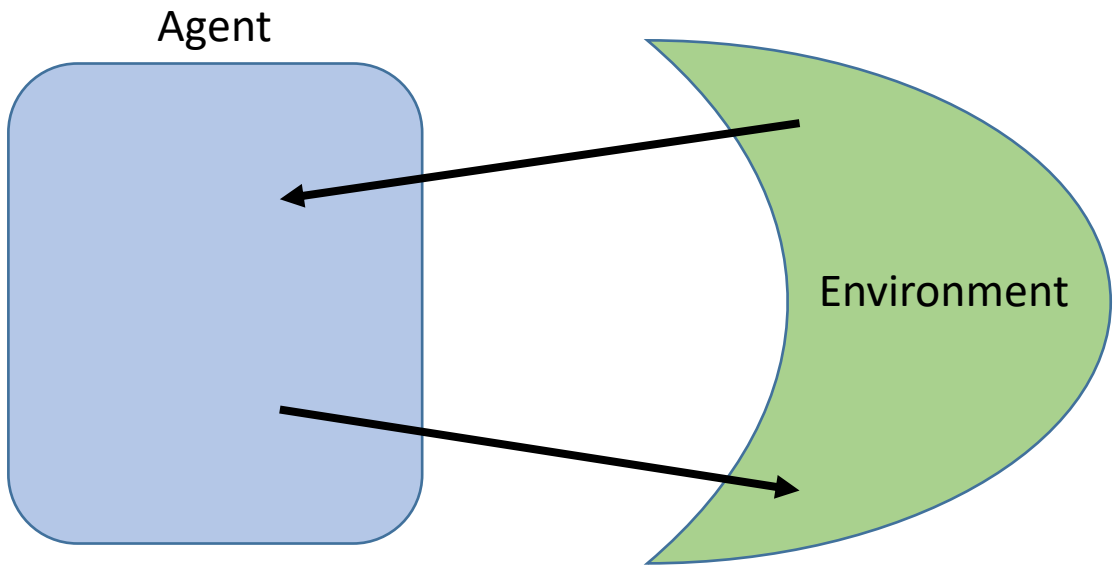
Agent function: maps a percept sequence to an action

- External characterization is the function.
- Implemented by the **agent program**

A **rational agent** is one that does the "right" thing.

What is an agent?

Perception-Action Cycle

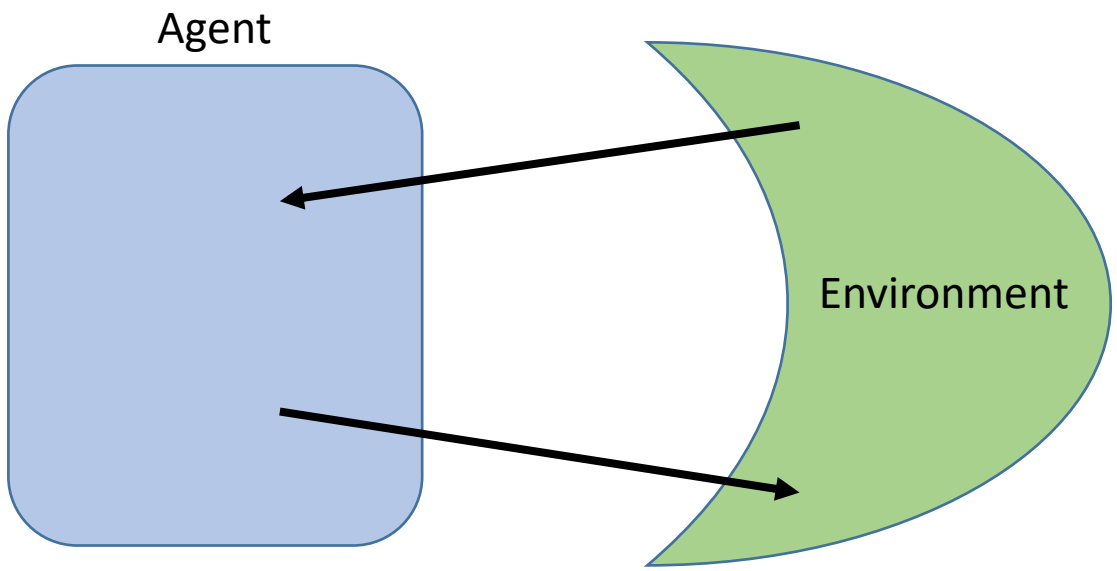


How does the agent make decisions based on the sensory data?

- Can’t yet build one system that does it all, but we can build a system that does one thing well.

What is an agent?

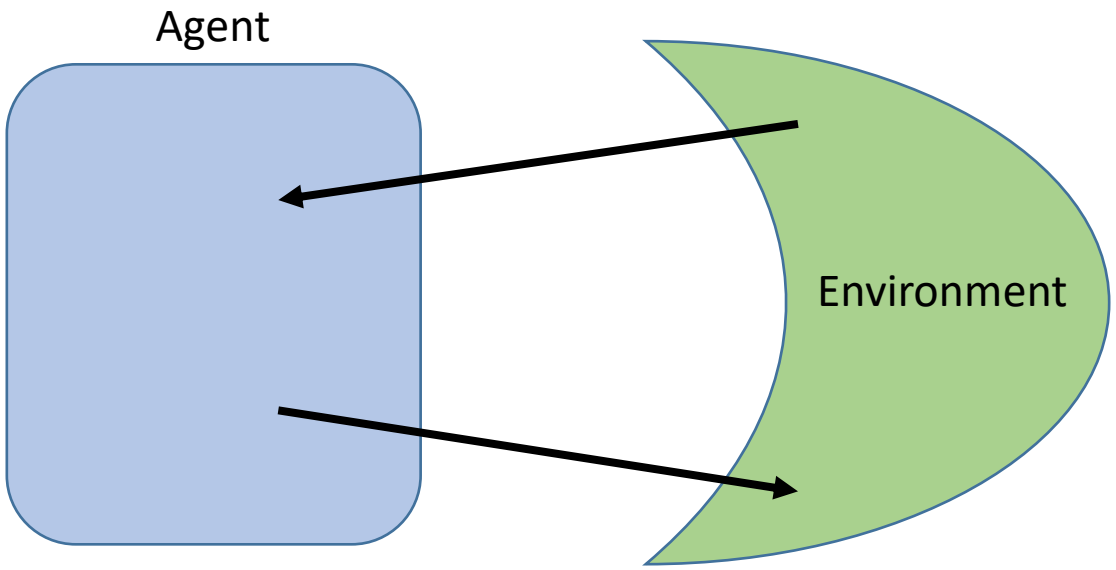
Example: Human Agent!



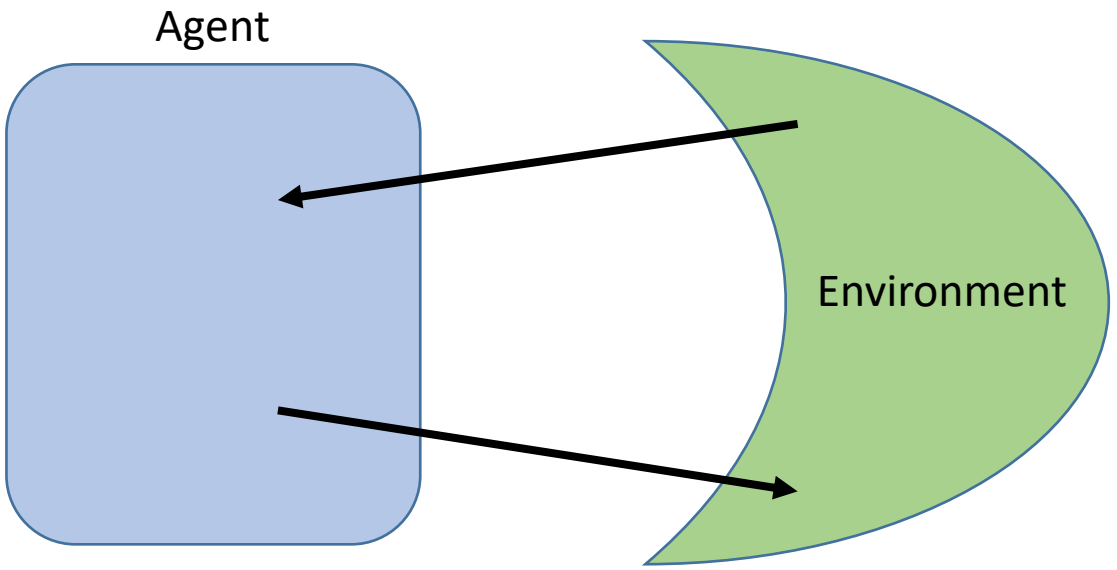
What is an agent?

In this class - we will work on the function that drives the agent's behavior. You can't generally control the environment, but you can control the agent.

Example: Trading Agents



Example: Robotics



What is an agent?

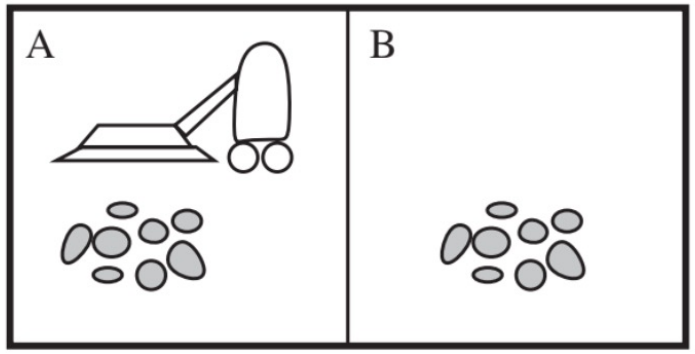


Figure 2.2 A vacuum-cleaner world with just two locations.

Percept sequence	Action
$[A, Clean]$	$Right$
$[A, Dirty]$	$Suck$
$[B, Clean]$	$Left$
$[B, Dirty]$	$Suck$
$[A, Clean], [A, Clean]$	$Right$
$[A, Clean], [A, Dirty]$	$Suck$
⋮	⋮
$[A, Clean], [A, Clean], [A, Clean]$	$Right$
$[A, Clean], [A, Clean], [A, Dirty]$	$Suck$
⋮	⋮

Figure 2.3 Partial tabulation of a simple agent function for the vacuum-cleaner world shown in Figure 2.2.

What is an agent?

The **performance measure** evaluates the behavior of the agent in an environment. A rational agent acts so as to maximize the expected value of the performance measure given the precept sequence it has seen so far.

Example: Vacuum-cleaner agent

1) Suppose we measure performance strictly by the amount of dirt cleaned up in a single eight-hour shift.

2) Reward agent for having clean floor. One point for each clean square, with a penalty for electricity usage.

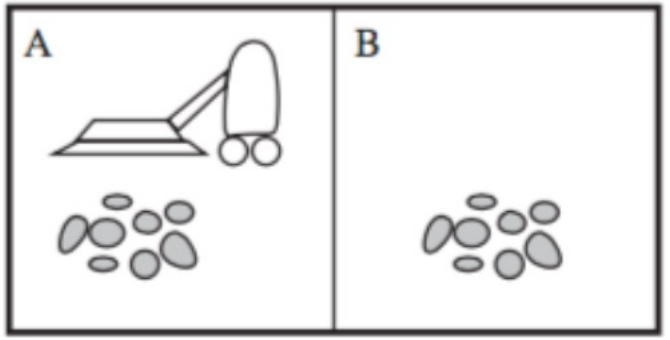
What is an agent?

Design performance measures to track what we actually want in the environment.

Example: Suppose our vacuum agent is programmed such that:

If the current square is dirty, vacuum it.
If the current square is clean, move to the other square.

Is this agent rational?



What is an agent?

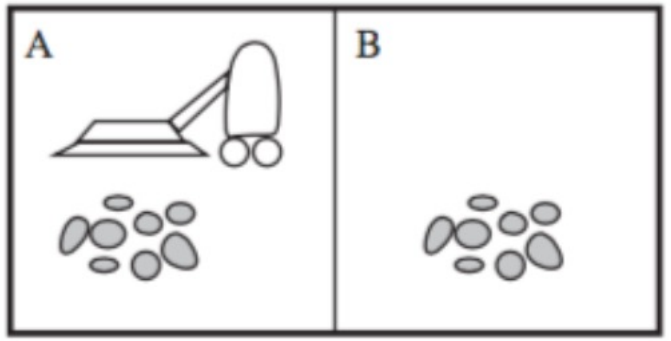
rational agent - For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the precept sequence and whatever built-in knowledge the agent has.

Rationality based on the following four principles:

1) performance measure (utility)
2) environment familiarity
3) actions that are possible
4) sequences of percepts (memory)

What is an agent?

Example: Suppose our vacuum agent is programmed such that:



If the current square is dirty, vacuum it.
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Is this agent rational?

Task Environments

Task environments are essentially the “problems” to which rational agents are the “solutions”.

P E A S : **P**erformance, **E**nvironment, **A**ctuators, **S**ensors

Example: PEAS description of the task environment for a taxi

Agent Type	Performance Measure	Environment	Actuators	Sensors
Taxi Driver	safe, fast, legal, comfortable trip, maximize profit	roads, other traffic, pedestrians, customers	steering, accelerator, brake, signal, horn, display	cameras, sonar, speedometer, GPS, odometer, accelerometer, engine sensors, keyboard

Task Environments

Agent can observe all relevant aspects of the environment.

Some parts missing from sensor data.

Can't make any observations but still must make a choice.

Fully Observable vs. **Partially Observable** vs. **Unobservable**

No need to maintain any internal state to keep track of the world.

What your agent can sense at any given time is completely sufficient to make the optimal decision.

Need memory on the part of the agent to make the optimal decision.

e.g. noisy environment, inaccurate sensors

Task Environments

Deterministic vs. **Stochastic**

- No randomness when you move a piece
- Effect of moving a piece is completely predetermined.

- Can’t predict the outcome of the dice.
- There is randomness present in the environment.

Task Environments

Discrete vs. **Continuous**

- Finitely many action choices.

- Infinitely many action choices.

Task Environments

Benign vs. **Adversarial**

- Environment might be stochastic, but there is no objective that would contradict your own objective.
- An opponent is out to get you. (like in games)

Task Environments

Single Agent vs. **Multi-Agent**

Task Environments

Episodic vs. **Sequential**

Agents experience is divided into atomic episodes.

In each episode, the agent receives a percept and then performs a single action.

Next episode is not dependent on the actions taken in previous episode.

e.g. classification tasks

Current decision could affect all future decisions.

Task Environments

Static vs. **Dynamic**

- The environment remains constant.

- The environment can change while the agent is deliberating.

Task Environments

Example: Checkers

Partially or Fully Observable

Deterministic or Stochastic

Continuous or Discrete

Benign or Adversarial

Task Environments

Example: Poker

Partially or Fully Observable

Deterministic or Stochastic

Continuous or Discrete

Benign or Adversarial