# Introduction to Artificial Intelligence

Week 3

# Agents

Mr. Anderson….

# What is an Agent?

- An agent is anything which:
  - Lives in an environment
  - Can perceive the environment via its sensors
  - Can act upon the environment via its actuators
- Agents also have memory of the current and past perceptions of the environment
  - Percept – the current state
  - Percept Sequence – the complete history of Percepts

# Humans as Agents

- Environments
  - Home
  - School
  - Work
- Sensors
  - Eyes
  - Ears
  - Tongue
  - Nose
  - Skin
- Actuators
  - Hands
  - Feet
  - Speech

# Rationality


- What is rational at any given time depends upon:
  - The performance measure defines success
  - The agent's prior knowledge of the environment
  - The actions which an agent can perform
  - The agent's percept sequence to date
- Definition:
  - 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 percept sequence and whatever built-in knowledge the agent has.

# Agents are rational, not necessarily omniscient

- A jester knocks over the king's wine
  - "What an idiot!"
  - Did the jester make a cartwheel and miss the landing?
  - Did the jester see it being poisoned and the king did not?
- Agents need to gather information before making a decision of an action
  - "Why did you spill my wine jester?!"
- Note that agents may perceive differently from each other
- Agents have a degree of autonomy
  - The King does not control every action of the jester

# PEAS – Performance measure, Environment, Actuators, Sensors

- Agent Type
  - Jester
- Performance measure
  - The King is Happy
- Environment
  - The Court
- Actuators
  - Tumbling
  - Juggling
  - Joke Telling
- Sensors
  - Hearing Laughter
  - Seeing Smiles

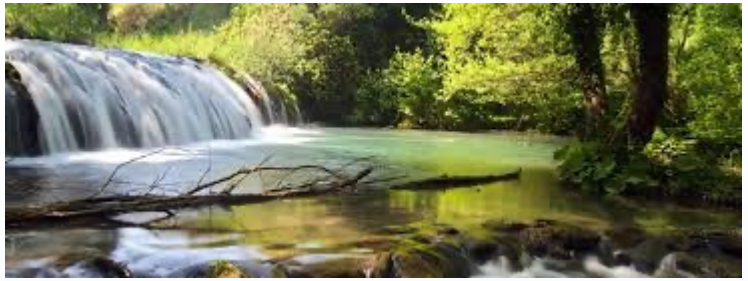
# Properties of the Environment (1)

- Fully Observable v. Partially Observable
  - Can the agent see everything in the world via its sensors
  - Does it miss elements which are relevant to the decision making process
- Single v. Multiple Agent
  - Is there only one agent within the space
  - Does there need to be some form of competitive or cooperation between agents
  - How do the agents communicate

# Properties of the Environment (2)

- Deterministic v. Stochastic
  - Can we determine the next state of the environment given the previous state and the action we are applying into it
  - We can be certain in environments which are fully observable and deterministic
- Episodic v. Sequential
  - Episodic environments allow for atomic actions not dependent upon those previous
  - Sequential actions are those in which the current decision has consequences on future actions

# Properties of the Environment (3)



- Static v. Dynamic
  - Does the environment change as the agent is thinking about its actions
  - Semidynamic if the environment does not change as time passes by but the agent's performance score does
- Discrete v. Continuous
  - Are there states in the environment, or does the environment smoothly act over time
    - Chess – discrete movements
    - Jenga – continuous actions of physics on the blocks
- Known v. Unknown
  - Does the designer of the agent have full knowledge of the rules of the environment

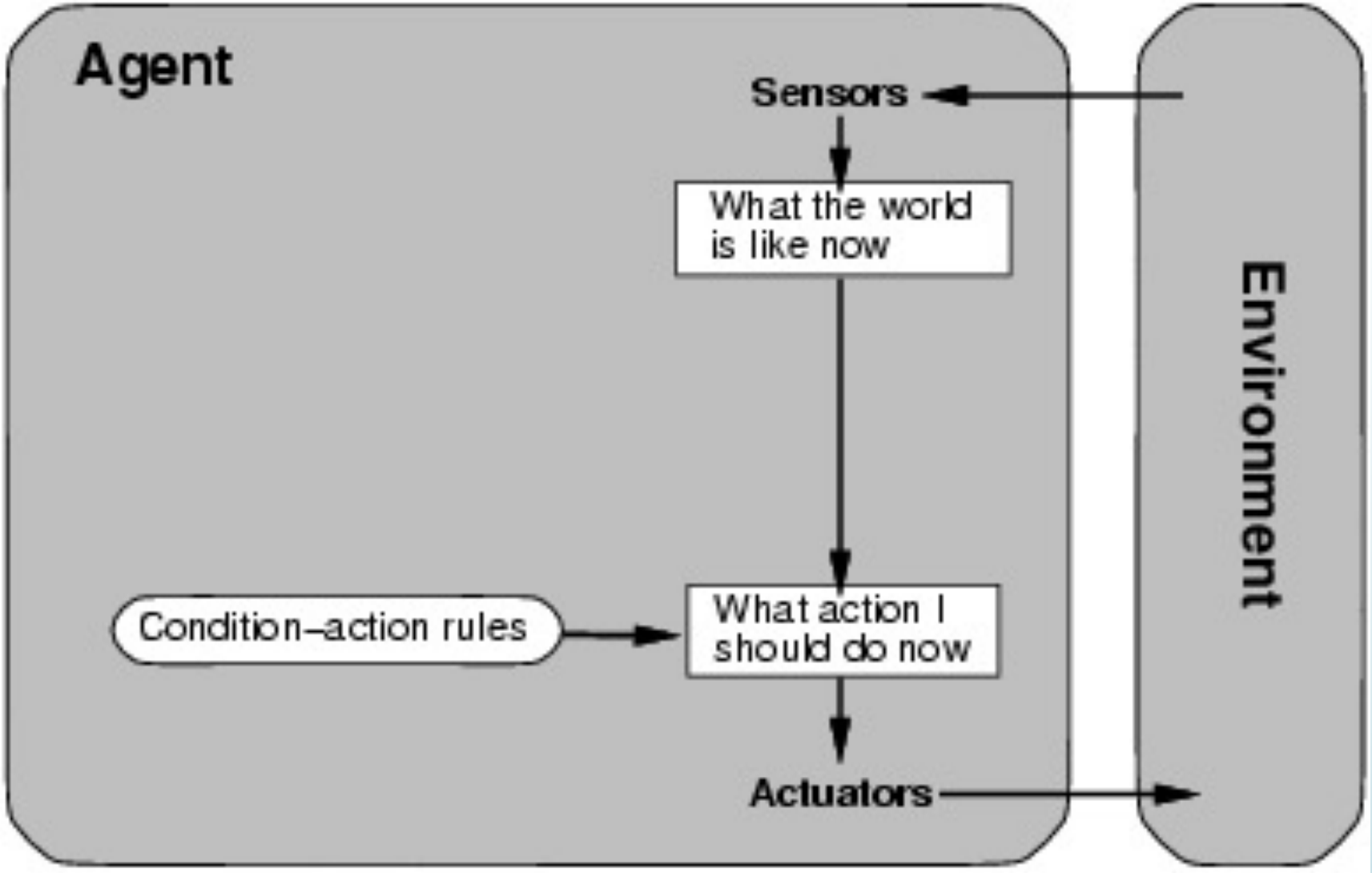
# The worst case

- An environment which is partially observable, multiagent, stochastic, sequential, dynamic, continuous, and unknown.
- Ordering in a new restaurant in a new country
  - Can't see how they make the food
  - Have to deal with the waiter, other customers
  - Can't predict when the food will come or how exactly it will taste
  - Depending on what I order, I might order more or might order an ambulance
  - Maybe they don't have anymore what I would like to order
  - Time keeps on ticking
  - Don't know the cultural rules

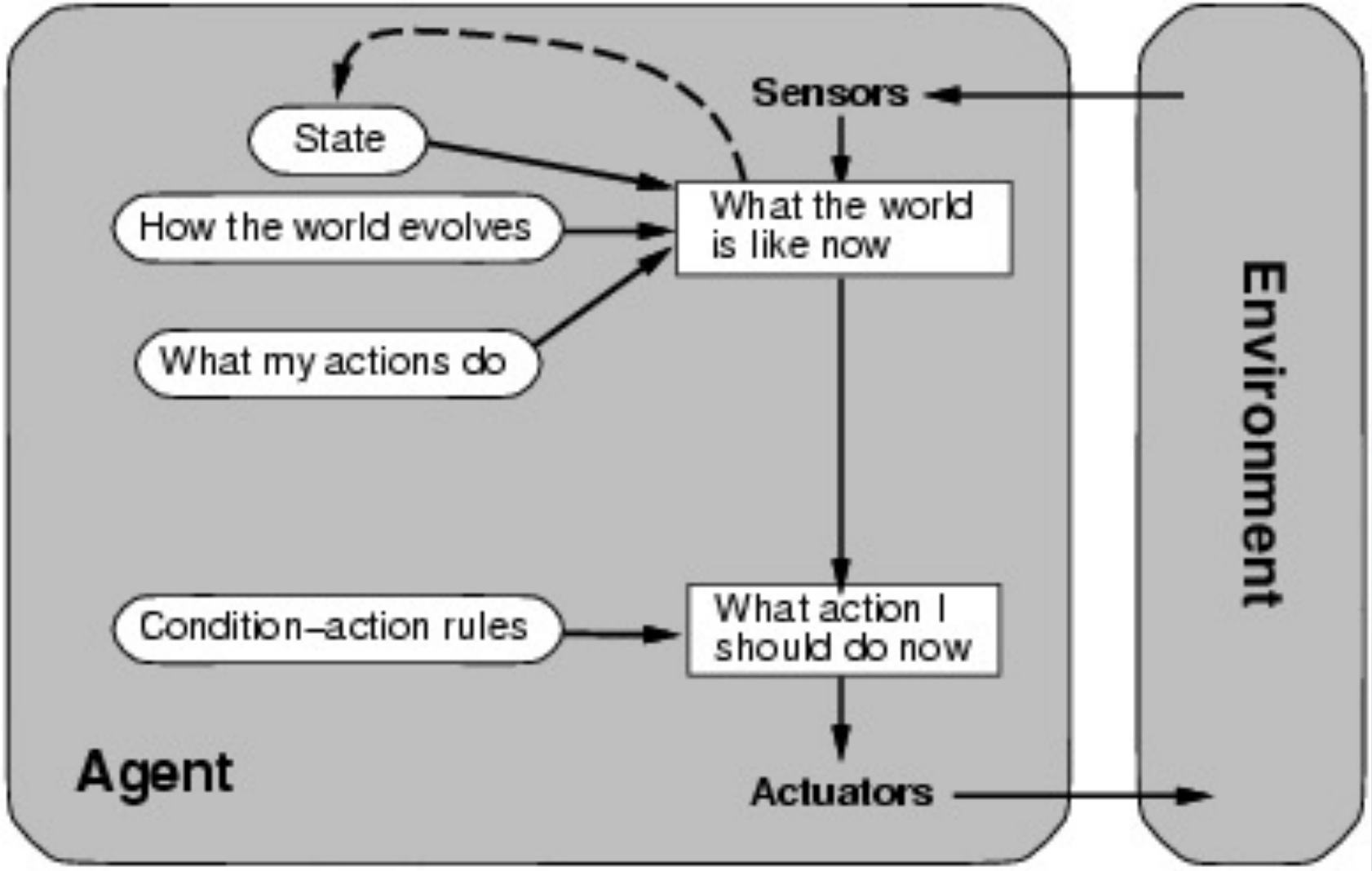
# Testing an AI

- We do not just want one environment but an environment class
  - Run multiple simulations with many different changes to the environment
- Self-driving Car
  - Traffic level
  - Lights
  - Weather
- Card Game Player
  - Against many other desks
  - Other player agents

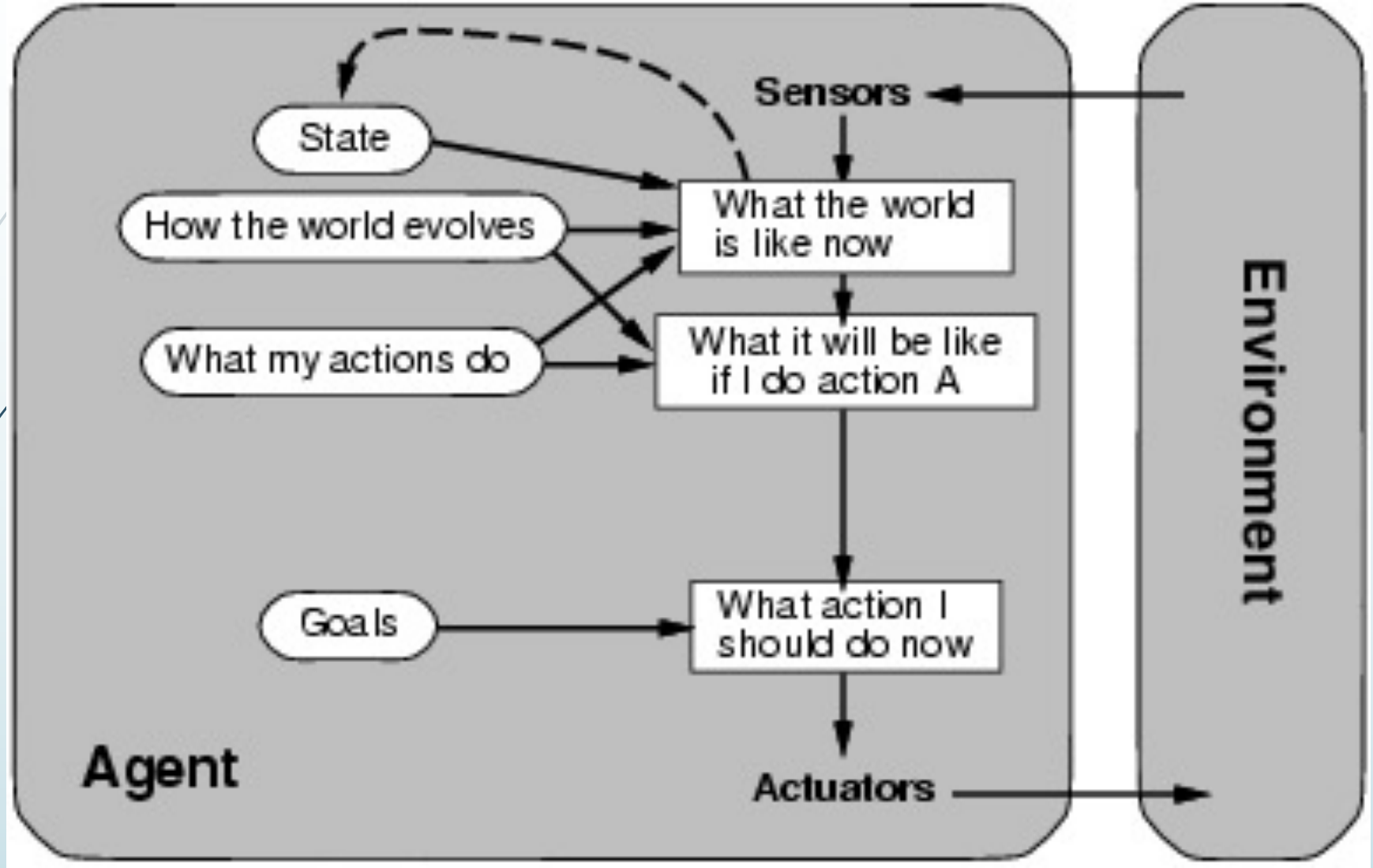
# Simple reflex agents



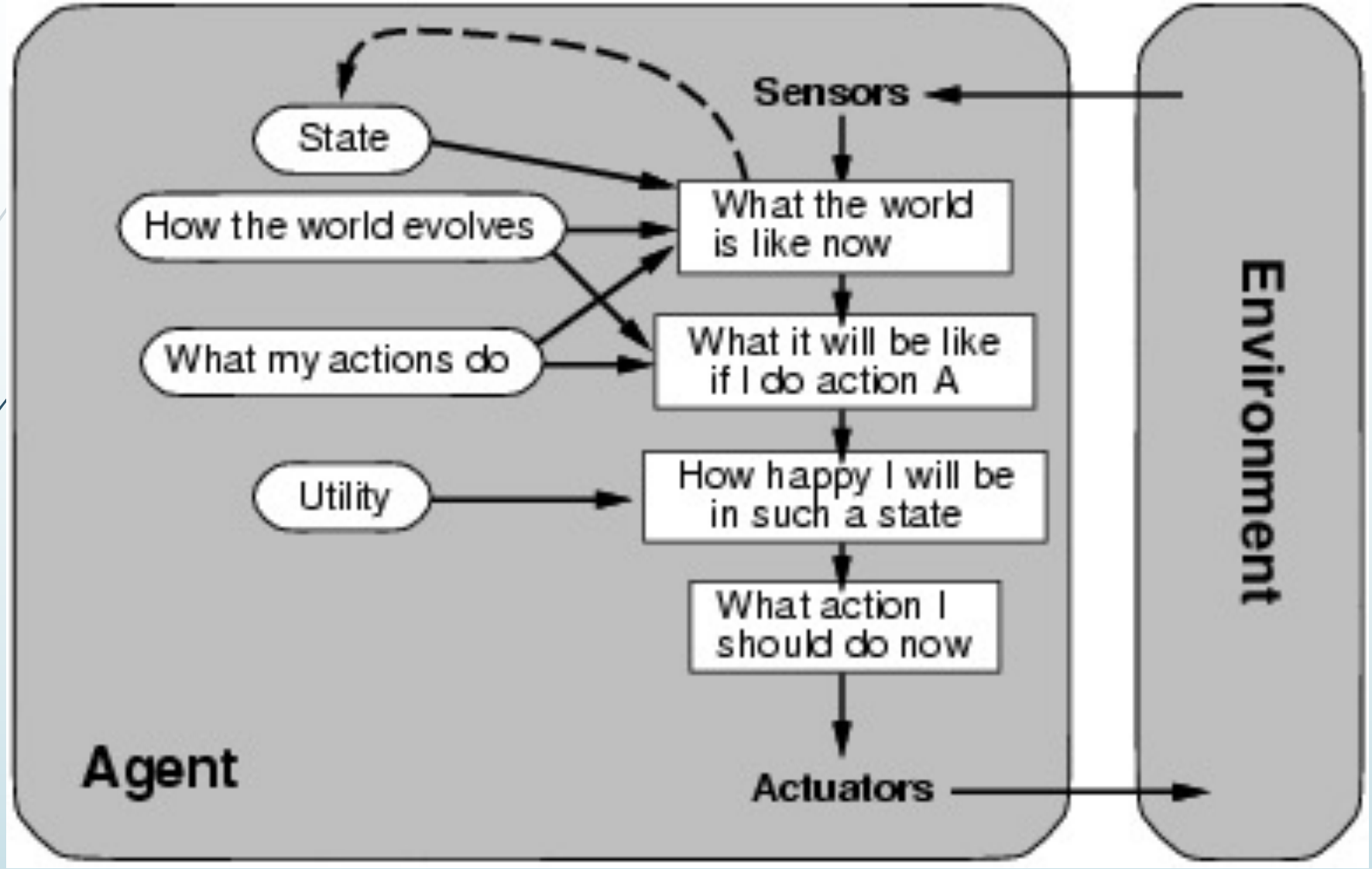
# Model-based reflex agents



# Goal-based agents



# Utility-based agents



# Learning agents