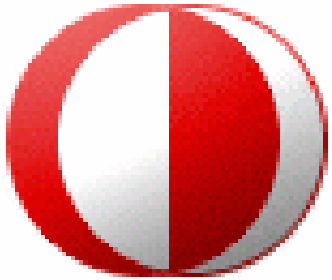


Intelligent Agents

Department of Electrical and Electronics Engineering
Spring 2005
Dr. Afşar Saranlı

Thanks to Professor Andrew W. Moore (Carnegie Mellon University) http://www.cs.cmu.edu/~awm/tutorials
Also: Artificial Intelligence: A Modern Approach, 2nd Ed., Russel & Norvig

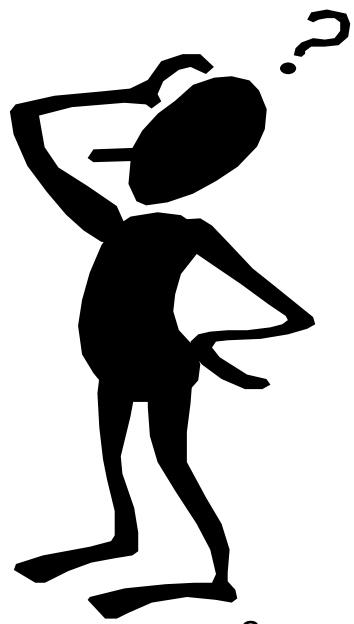
Overview

We will discuss:

- **The nature of Agents (perfect or otherwise)**
- **The diversity of Environments**
- **Resulting agent types**

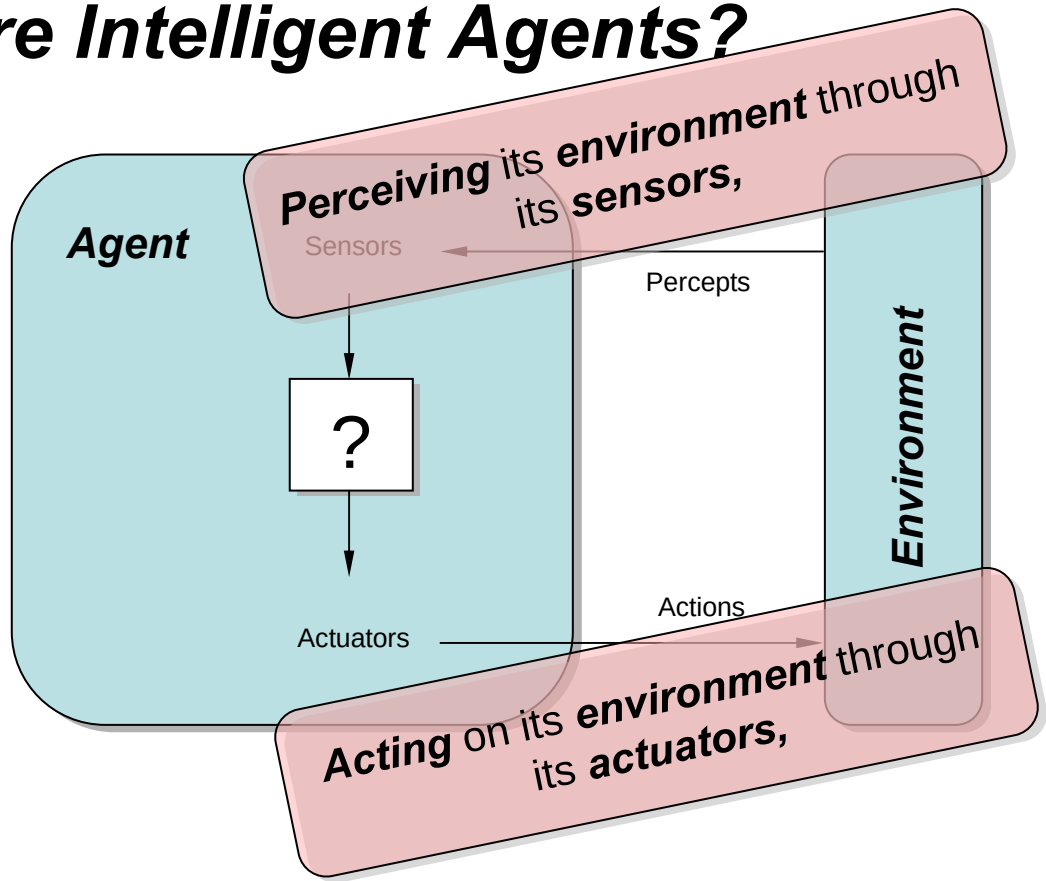
The Intelligent Agent

What are Intelligent Agents?



The Intelligent Agent

What are Intelligent Agents?



The Intelligent Agent

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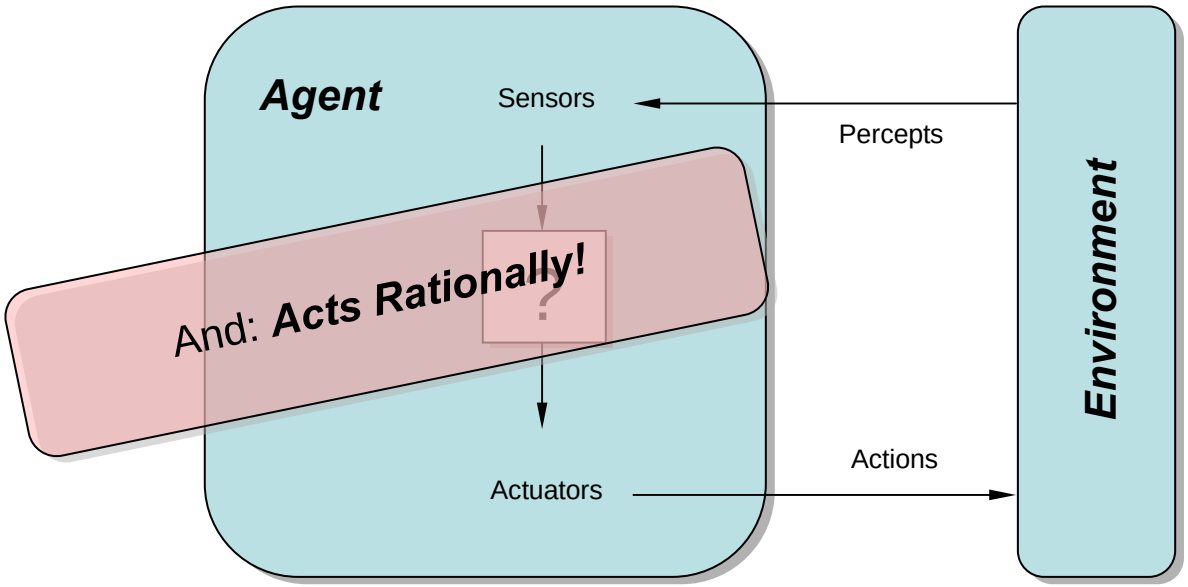
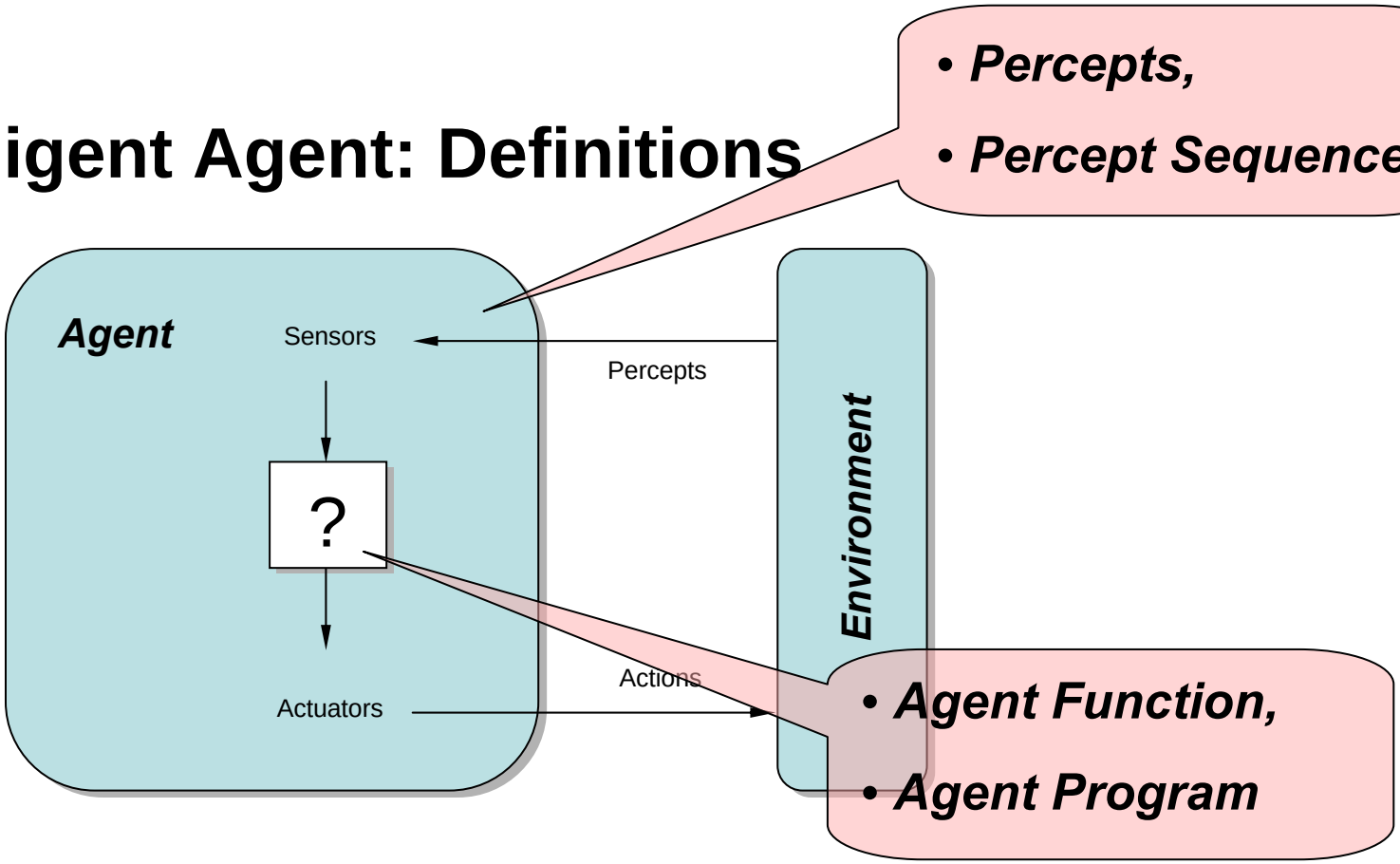


The Intelligent Agent

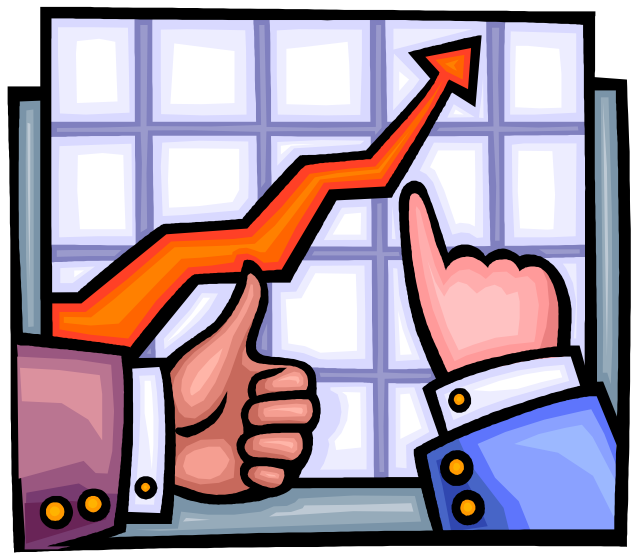
Intelligent Agent: Definitions



Good Behavior: Rationality

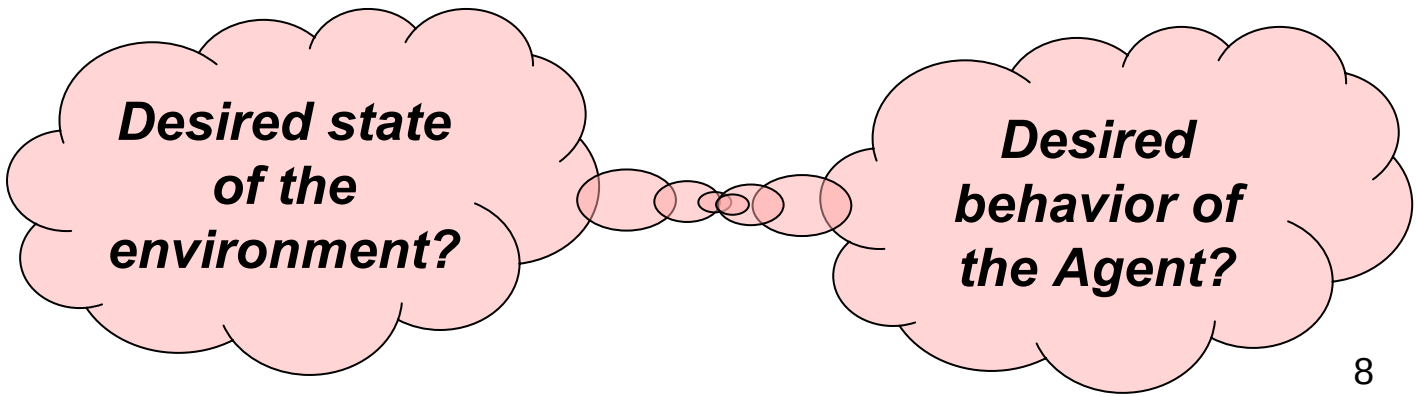
- **A Rational Agent does the *right thing!***
- **What it the right thing?**

- **One approximation:**
  Actions which lead to the success of the Agent within the Environment!



Performance Measure

- **Success: *Performance Measure***
- **Should we ask the Agent?**
- **Maybe not. Rather:**
  We would prefer objective measures, often imposed by the designer



Performance Measure

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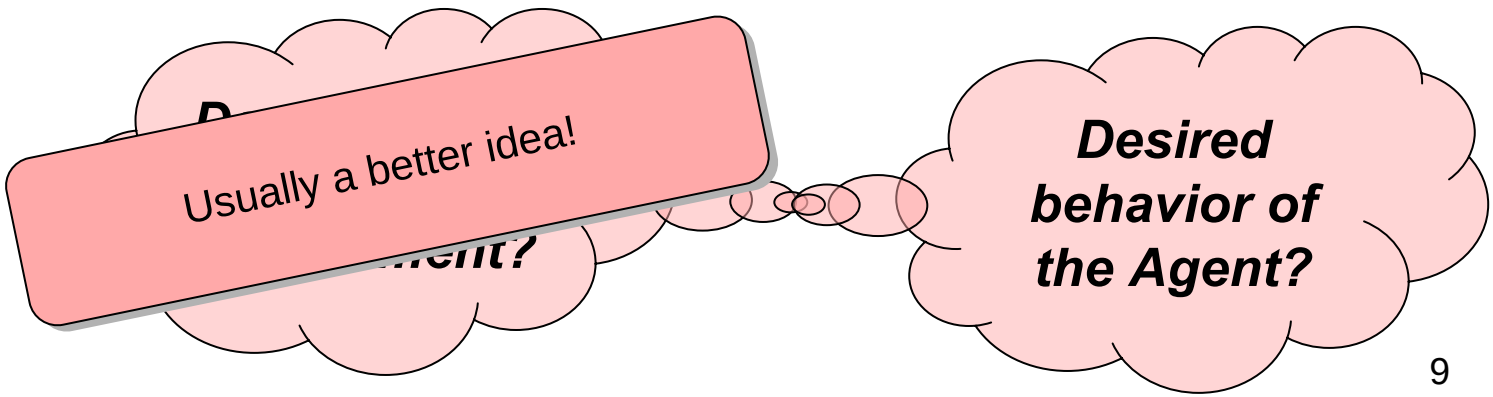


Rational Agent: Definition

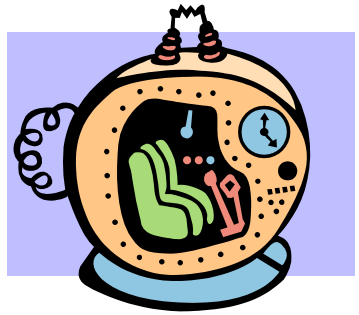
- **Rationality at any given time depends:**
  - **The performance measure that defines success,**
  - **The agent's "a-priori" knowledge of the Environment,**
  - **The actions that the Agent can perform,**
  - **The Agent's percept sequence to date.**

Rational Agent: Definition

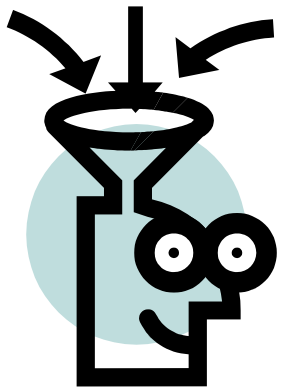
- **Now we can define a *Rational Agent:***

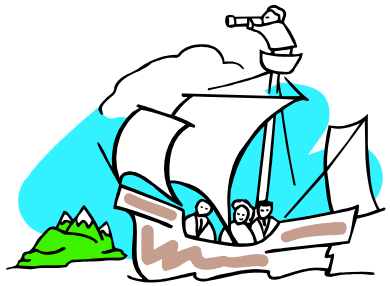
  For each possible percept sequence, A Rational Agent should select an action that *is expected to maximize its performance measure*, given evidence provided by its percept sequence and whatever built-in knowledge the Agent has.

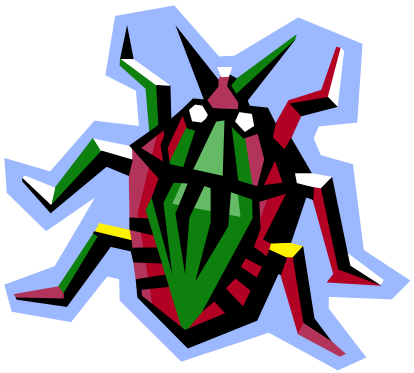
Other Aspects



- Rationality vs Omniscience
- Information Gathering – Exploration
- Learning
- Autonomy

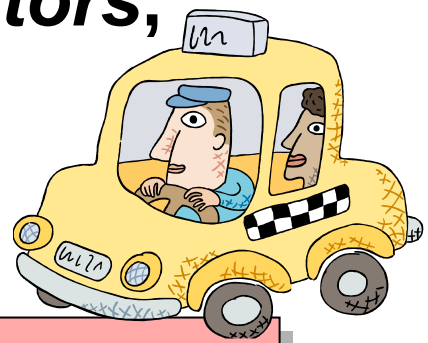






The Nature of Environments

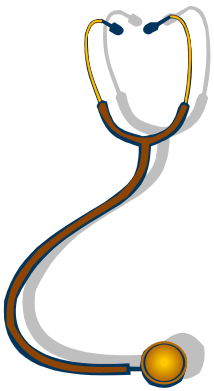
- **Specifying the Task Environment: (*Performance*, *Environment*, *Actuators*, *Sensors*: PEAS Description)**
- **Example: Taxi Driver**



Agent Type	Performance Measure	Environment	Actuators	Sensors
Taxi Driver	Safe, fast legal, comfortable trip, maximize profits	Roads, other traffic, pedestrians, customers	Steering, accelerator, brake, signal, horn, display	Cameras, sonar, speedometer, GPS, odometer, accelerometer, engine sensors, keyboard

The Nature of Environments

- **Example: Medical Diagnosis System**



Agent Type	Performance Measure	Environment	Actuators	Sensors
Medical Diagnosis System	Healthy patient, minimize costs and lawsuits	Patient, hospital, staff	Display questions, tests, diagnoses, treatments, referrals	keyboard entry of symptoms, findings, patient's answers

Properties of Task Environments

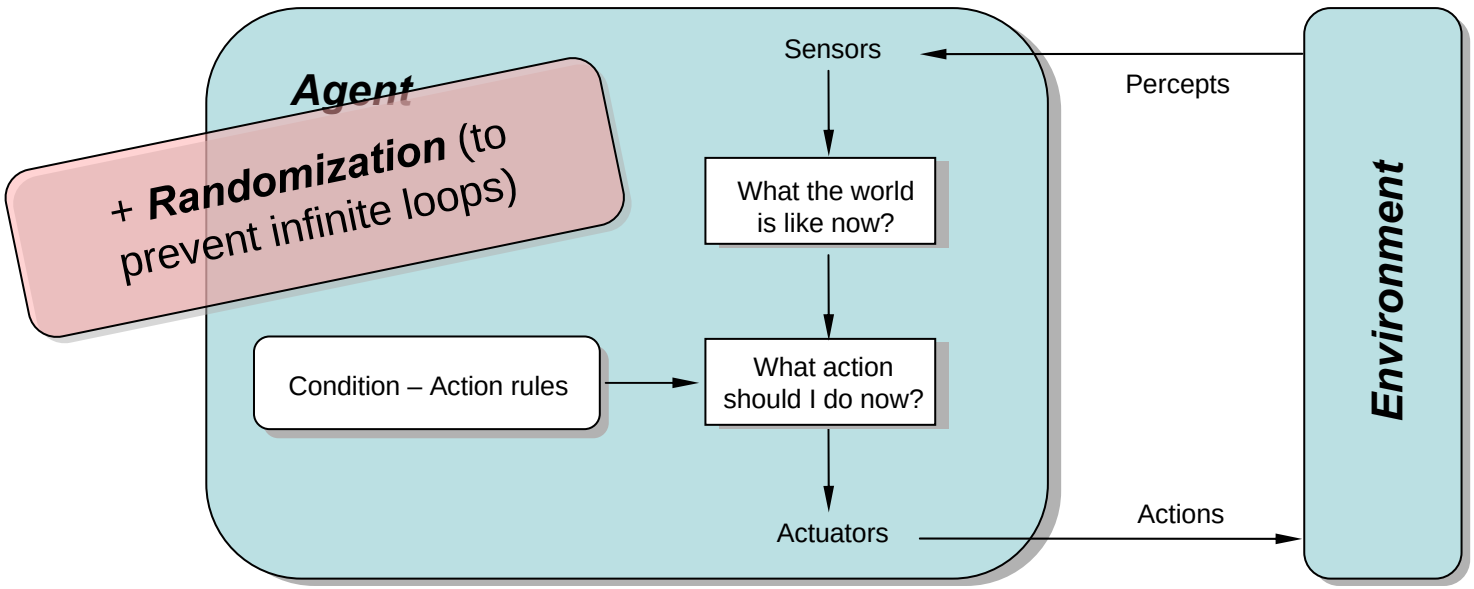
- **Fully Observable** vs. **Partially Observable,**
- **Deterministic** vs. **Stochastic,**
- **Episodic** vs. **Sequential,**
- **Static** vs. **Dynamic,**
- **Discrete** vs. **Continuous,**
- **Single agent** vs. **multi-agent.**

Structure of Agents

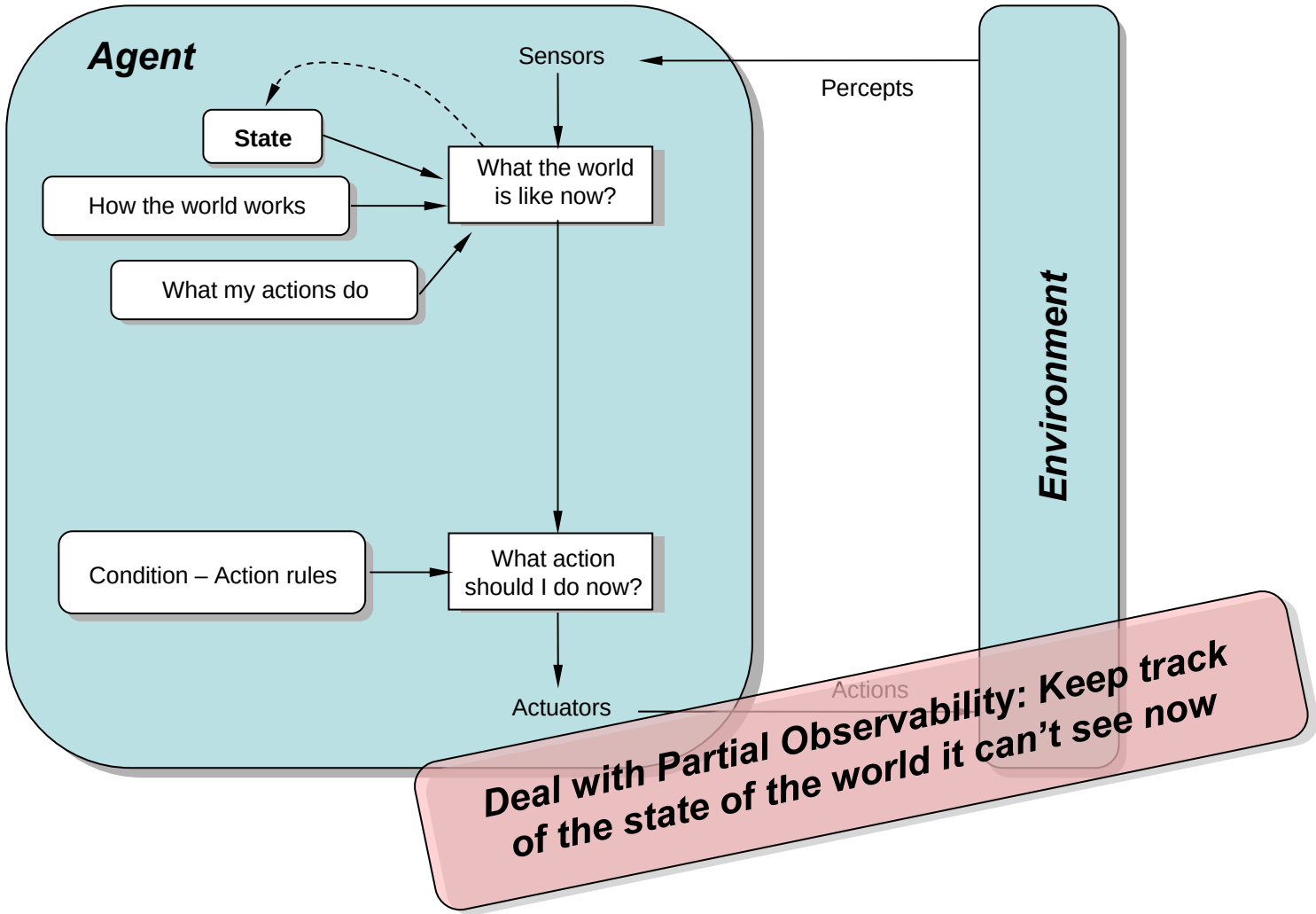
Agent = Architecture + Program

- **Simplest program: Table Driven Agent (Not necessarily possible to implement!)**
- ***Simple reflex agents*,**
- ***Model-based reflex agents*,**
- ***Goal based agents*,**
- ***Utility-based agents*,**
- **Finally: *Learning agents***

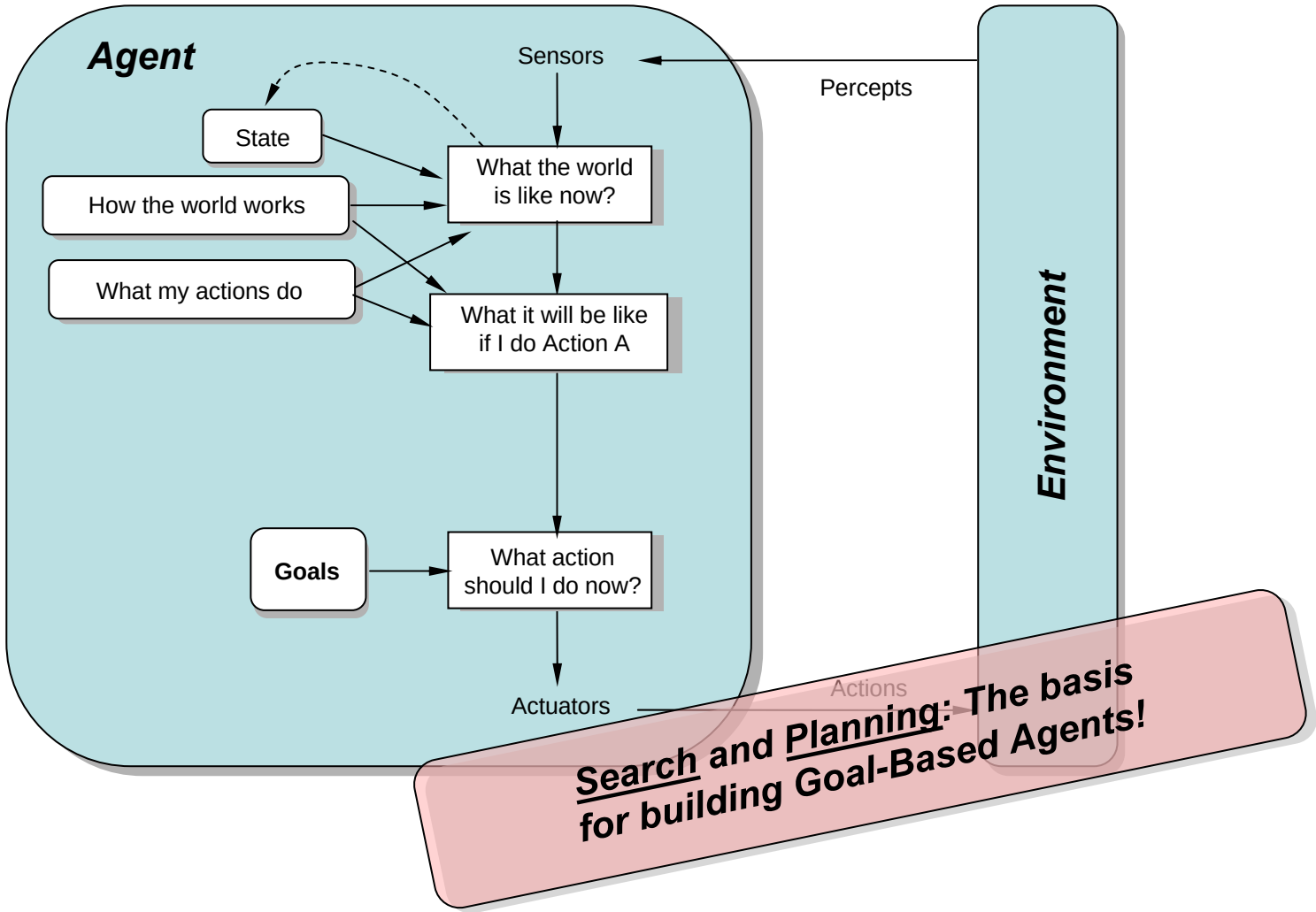
Simple Reflex Agents



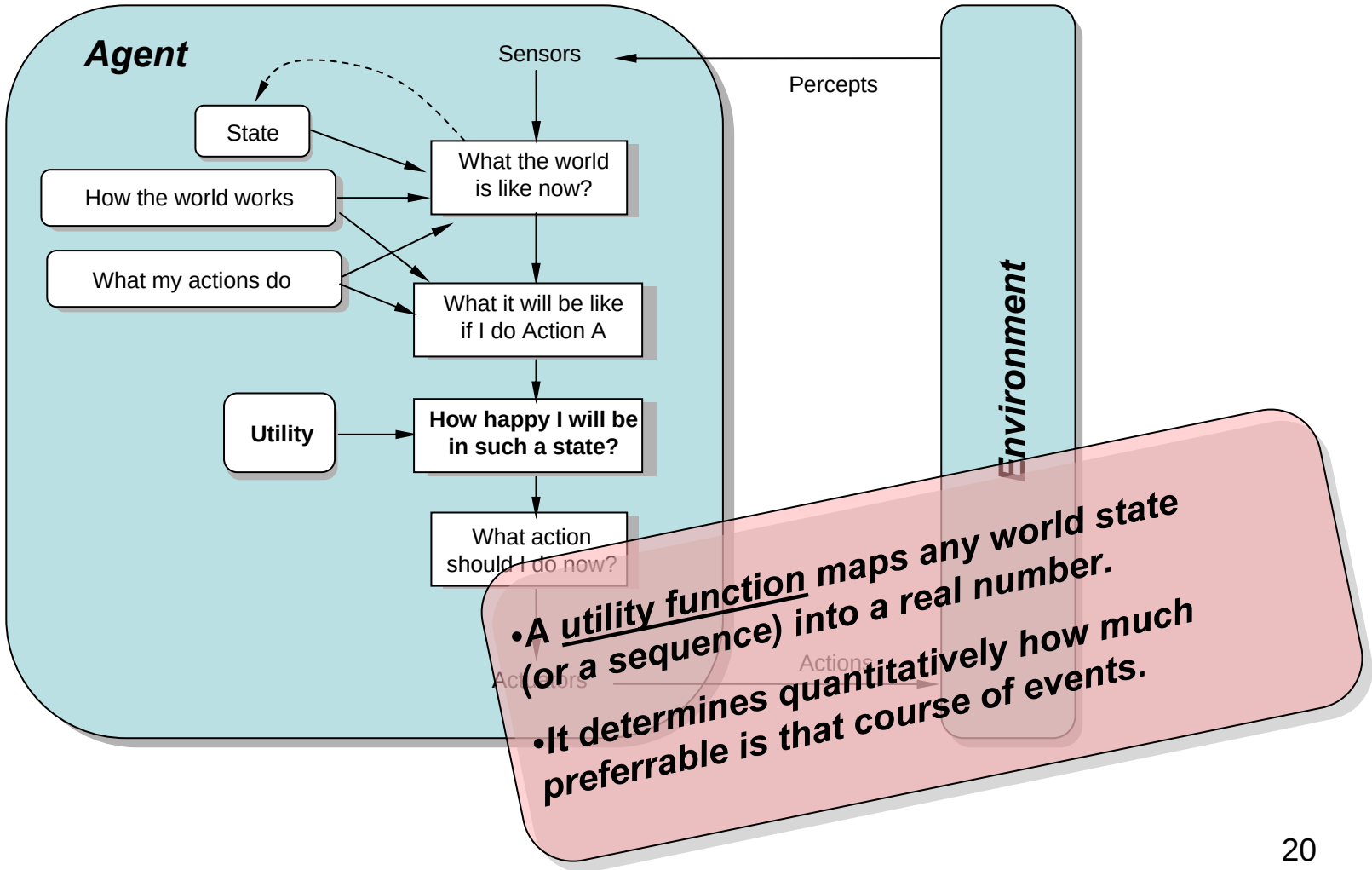
Model-Based Reflex Agents



Goal-Based Agents



Utility-Based Agents



Learning Agents