

INTELLIGENT AGENTS

CHAPTER 2

Reminders

CLASS WILL MOVE to MonWed 4-5.30 in 10 Evans starting 9/9

Assignment 0 (lisp refresher) due 9/4

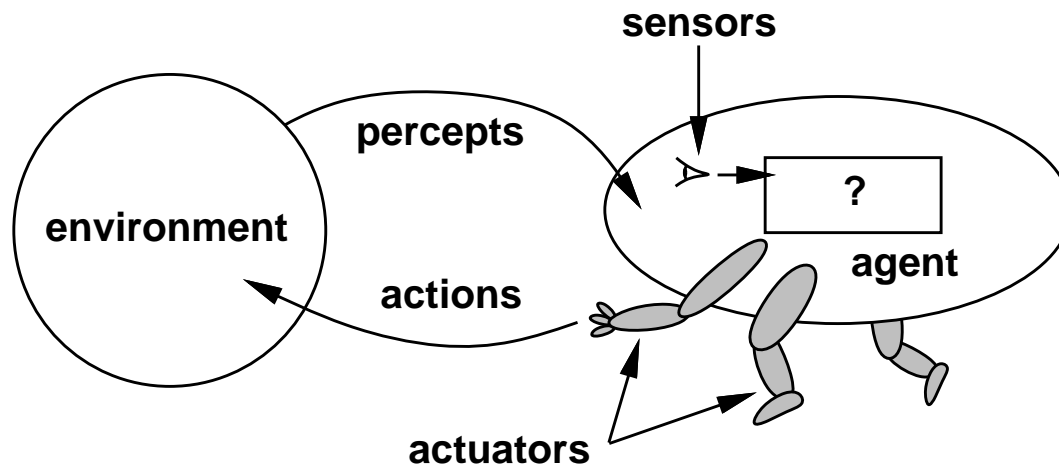
Lisp/emacs/AIMA tutorial: Wed Aug 28th, 4-6pm, 273 Soda

Class account forms

Outline

- ◇ Agents and environments
- ◇ Rationality
- ◇ PEAS (Performance measure, Environment, Actuators, Sensors)
- ◇ Environment types
- ◇ Agent types

Agents and environments



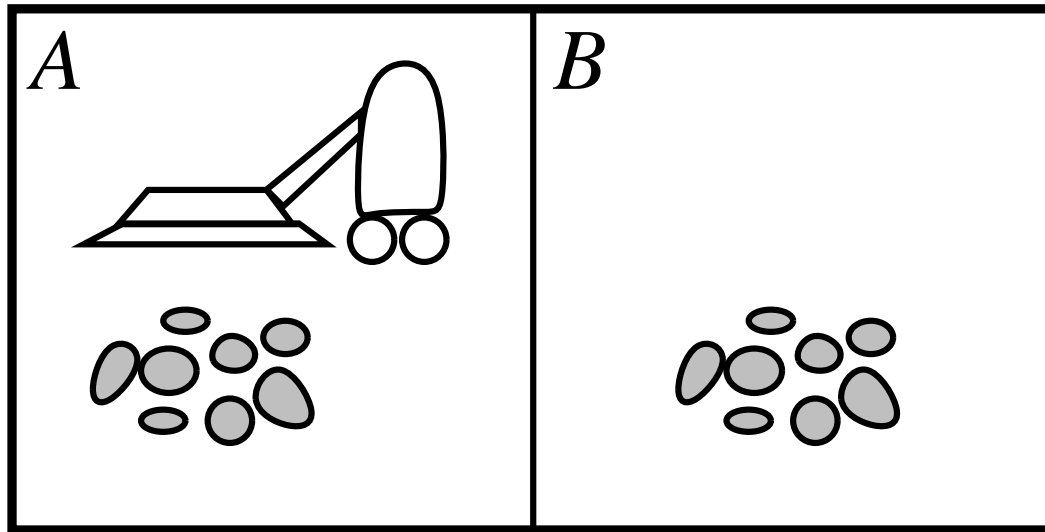
Agents include humans, robots, softbots, thermostats, etc.

The **agent function** maps from percept histories to actions:

$$f : \mathcal{P}^* \rightarrow \mathcal{A}$$

The **agent program** runs on the physical **architecture** to produce f

Vacuum-cleaner world



Percepts: location and contents, e.g., $[A, Dirty]$

Actions: *Left*, *Right*, *Suck*, *NoOp*

A vacuum-cleaner agent

Percept sequence	Action
$[A, \textit{Clean}]$	\textit{Right}
$[A, \textit{Dirty}]$	\textit{Suck}
$[B, \textit{Clean}]$	\textit{Left}
$[B, \textit{Dirty}]$	\textit{Suck}
$[A, \textit{Clean}], [A, \textit{Clean}]$	\textit{Right}
$[A, \textit{Clean}], [A, \textit{Dirty}]$	\textit{Suck}
\vdots	\vdots

function REFLEX-VACUUM-AGENT($[location, status]$) **returns** an action

if $status = \textit{Dirty}$ **then return** \textit{Suck}
else if $location = A$ **then return** \textit{Right}
else if $location = B$ **then return** \textit{Left}

What is the **right** function?

Can it be implemented in a small agent program?

Rationality

Fixed **performance measure** evaluates the **environment sequence**

- one point per square cleaned up in time T ?
- one point per clean square per time step, minus one per move?
- penalize for $> k$ dirty squares?

A **rational agent** chooses whichever action maximizes the **expected** value of the performance measure **given the percept sequence to date**

Rational \neq omniscient

Rational \neq clairvoyant

Rational \neq successful

Rational \Rightarrow exploration, learning, autonomy

PEAS

To design a rational agent, we must specify the **task environment**

Consider, e.g., the task of designing an automated taxi:

Performance measure??

Environment??

Actuators??

Sensors??

PEAS

To design a rational agent, we must specify the **task environment**

Consider, e.g., the task of designing an automated taxi:

Performance measure?? safety, destination, profits, legality, comfort, ...

Environment?? US streets/freeways, traffic, pedestrians, weather, ...

Actuators?? steering, accelerator, brake, horn, speaker/display, ...

Sensors?? video, accelerometers, gauges, engine sensors, keyboard, GPS, ...

Internet shopping agent

Performance measure??

Environment??

Actuators??

Sensors??

Environment types

	Solitaire	Backgammon	Internet shopping	Taxi
<u>Observable??</u>				
<u>Deterministic??</u>				
<u>Episodic??</u>				
<u>Static??</u>				
<u>Discrete??</u>				
<u>Single-agent??</u>				

Environment types

	Solitaire	Backgammon	Internet shopping	Taxi
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Environment types

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<u>Single-agent??</u>				

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<u>Static??</u>	Yes	Semi	Semi	No
<u>Discrete??</u>	Yes	Yes	Yes	No
<u>Single-agent??</u>	Yes	No	No (except auctions)	No

The environment type largely determines the agent design

The real world is (of course) partially observable, stochastic, sequential, dynamic, continuous, multi-agent

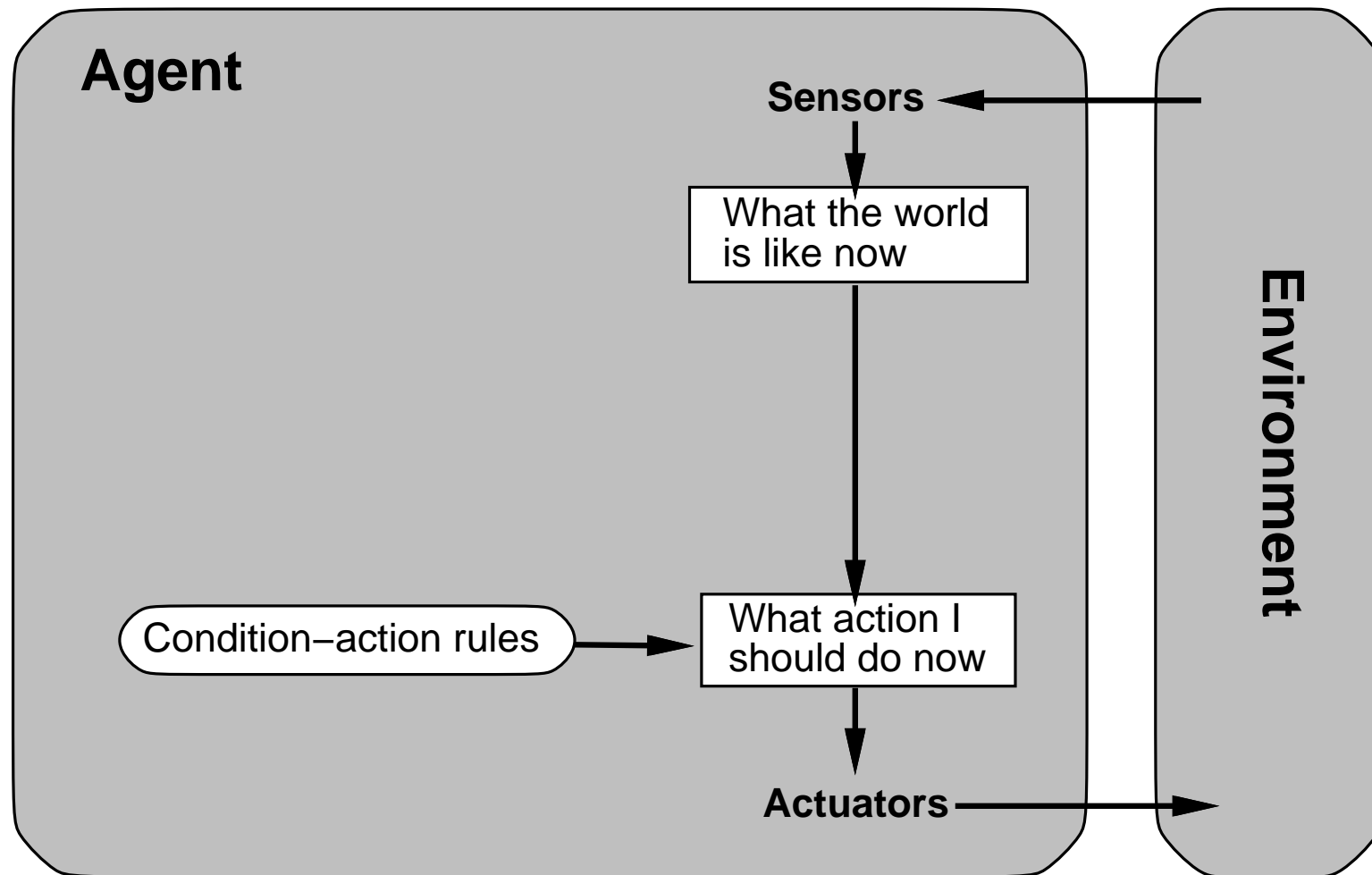
Agent types

Four basic types in order of increasing generality:

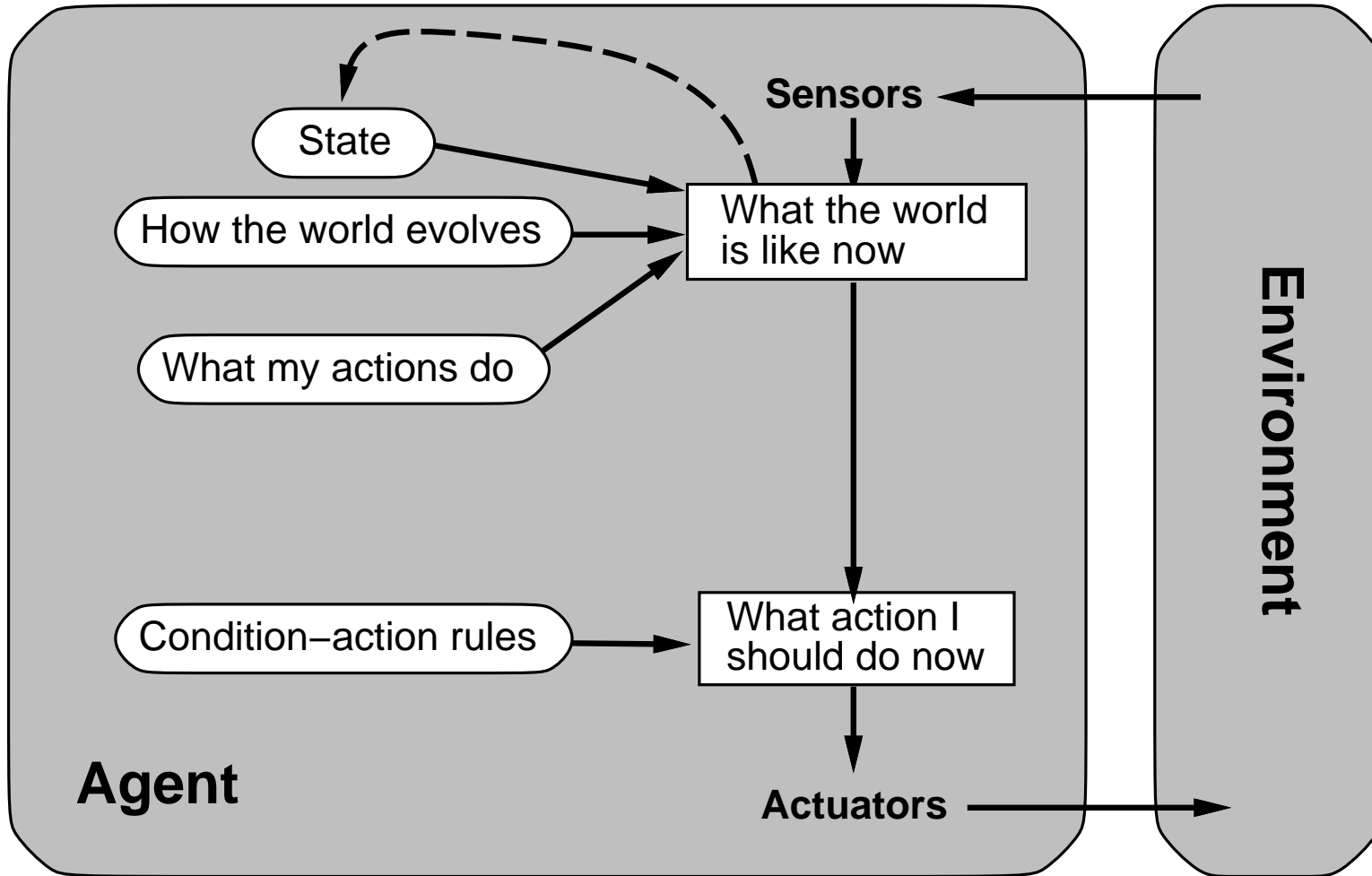
- simple reflex agents
- reflex agents with state
- goal-based agents
- utility-based agents

All these can be turned into learning agents

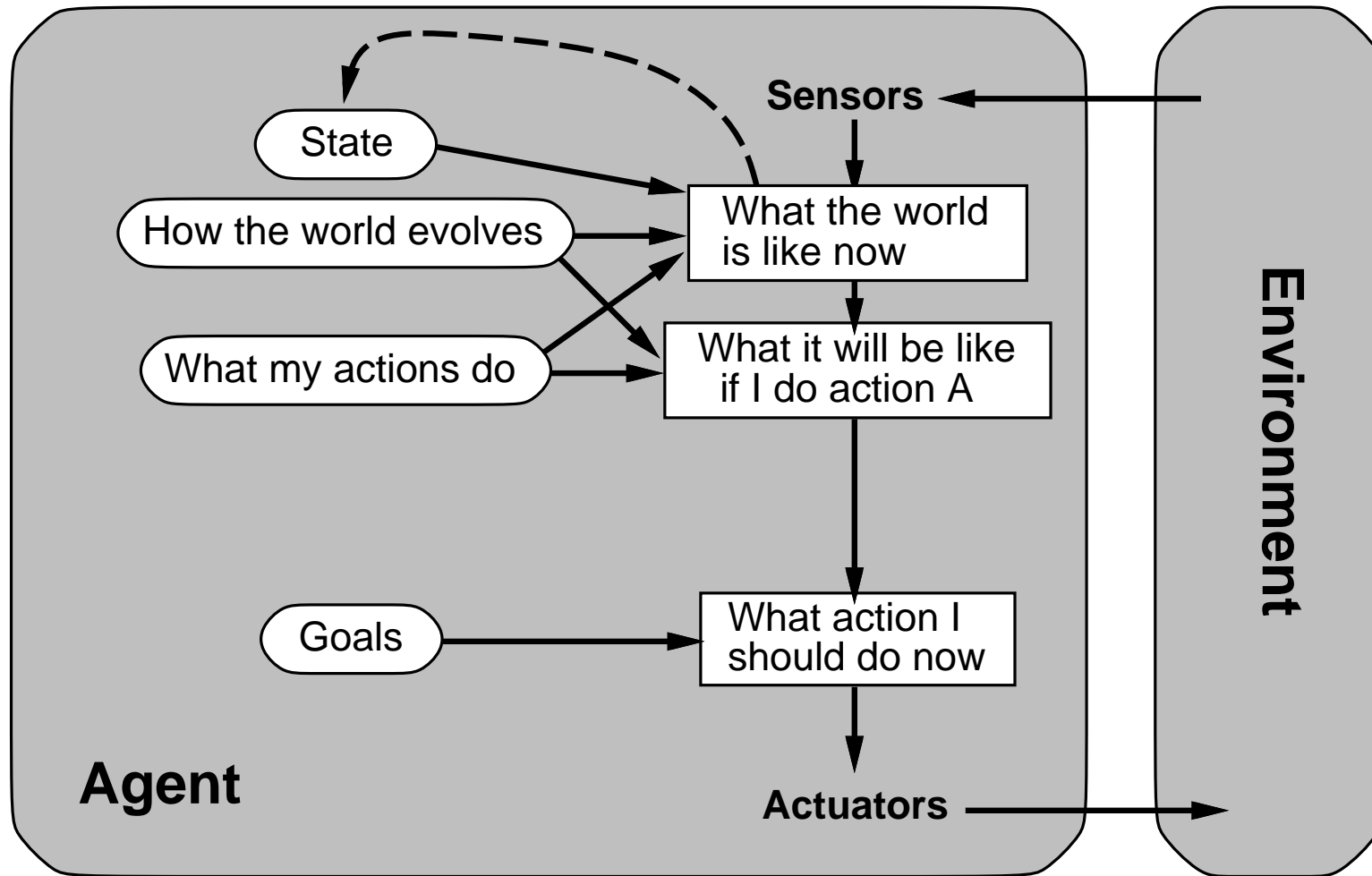
Simple reflex agents



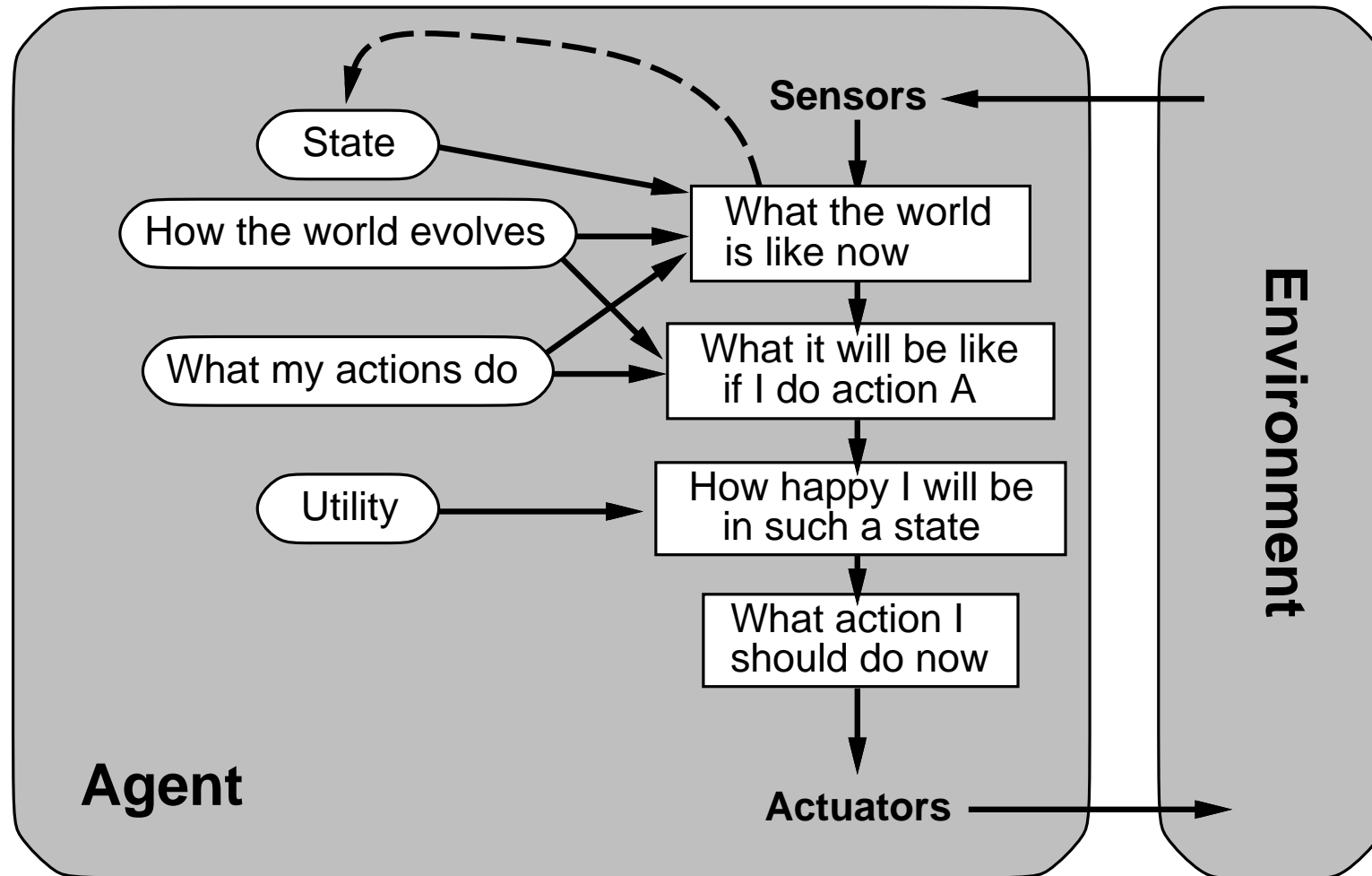
Reflex agents with state



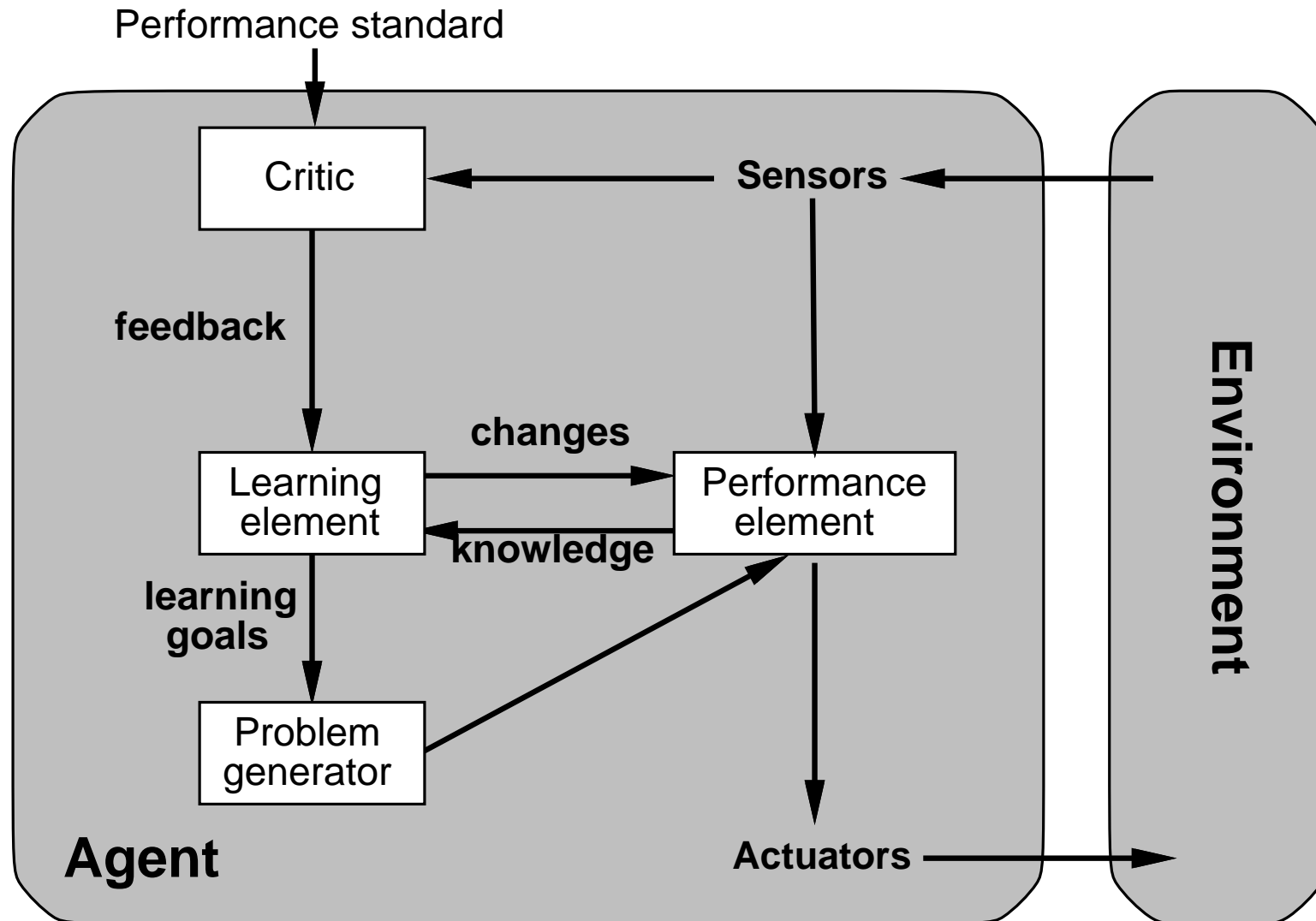
Goal-based agents



Utility-based agents



Learning agents



AIMA code

The code for each topic is divided into four directories:

- agents: code defining agent types and programs
- algorithms: code for the methods used by the agent programs
- environments: code defining environment types, simulations
- domains: problem types and instances for input to algorithms

(Often run algorithms on domains rather than agents in environments.)

```
(setq joe (make-agent :name 'joe :body (make-agent-body)
                     :program (make-dumb-agent-program)))
```

```
(defun make-dumb-agent-program ()
  (let ((memory nil))
    #'(lambda (percept)
        (push percept memory)
        'no-op))))
```