COMP111: Artificial Intelligence

Section 3. Intelligent Agents

Frank Wolter

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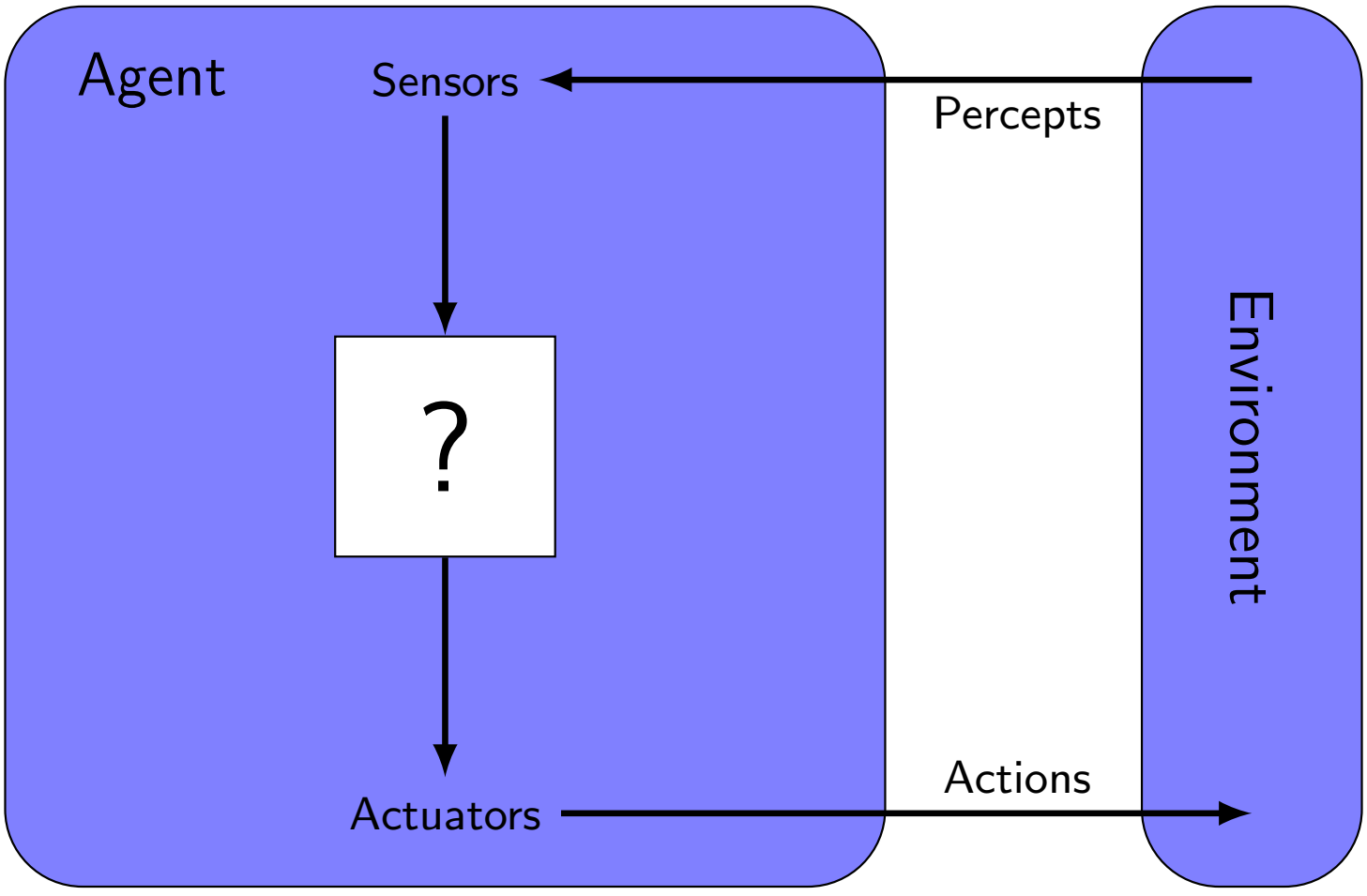
- It is reasonable to say that this module is about tools for designing and implementing rational agents.

Agent



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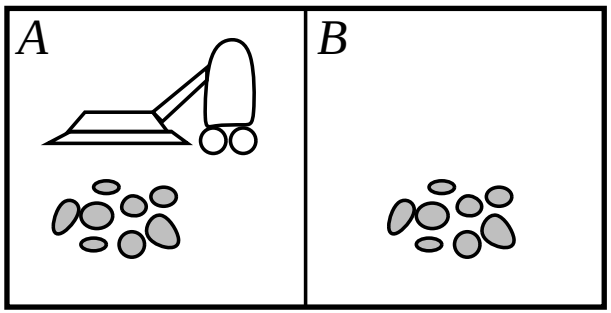
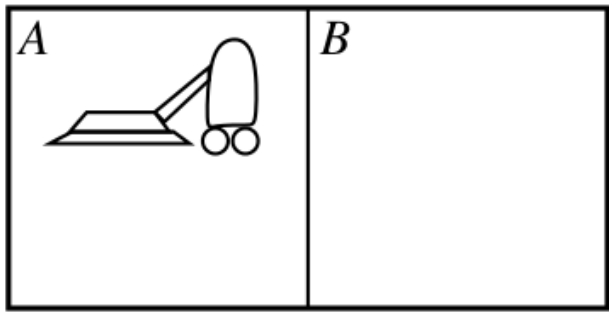
- Sensors: keyboard entry of patient's symptoms, responses to questions and findings.

Example 3: Vacuum cleaner world



Dirt in both rooms



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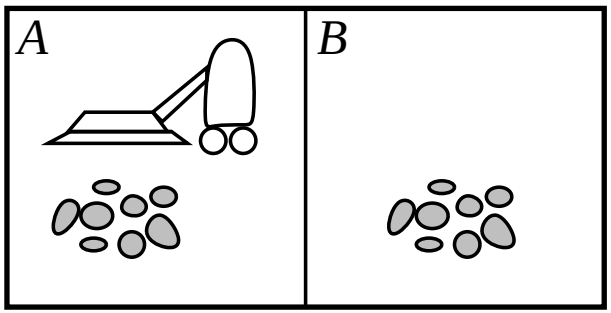

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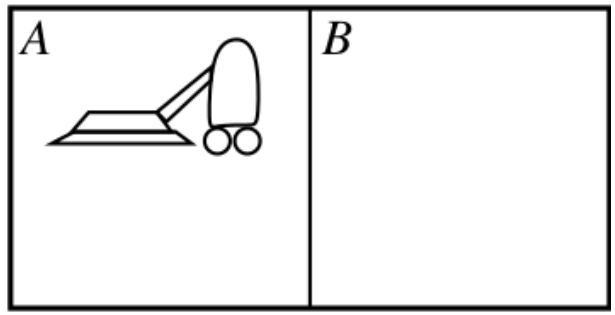

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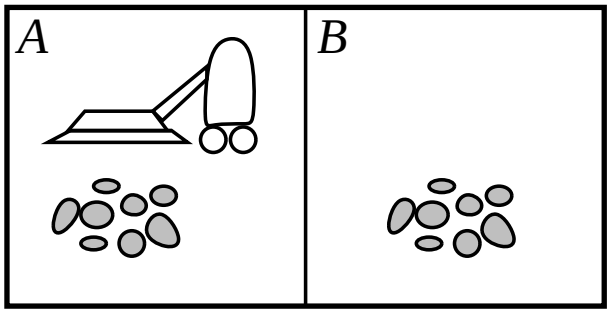

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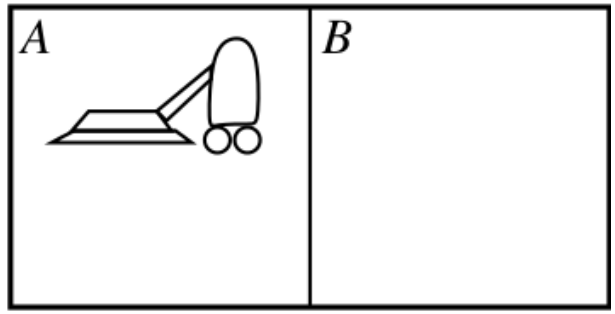

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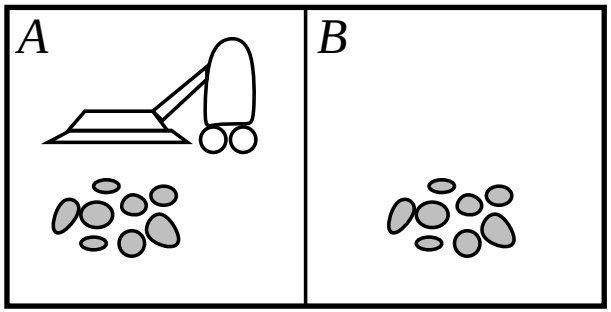

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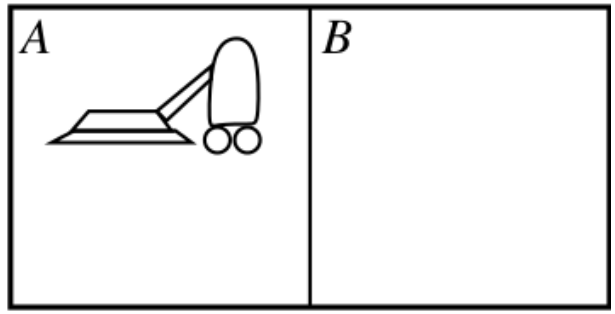

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- Sensors: in which room is the vacuum cleaner? Is there dirt in that room?

Task Environments

The properties of the task environment that the agent inhabits may differ greatly, depending upon the particular application area. Russell and Norvig have given a classification of the different types of properties of agent environments:

- Fully observable vs partially observable
- Deterministic vs stochastic
- Episodic vs sequential
- Static vs dynamic
- Discrete vs continuous

Fully Observable vs partially observable

Fully observable environment: one in which the agent can fully obtain complete, up-to-date info about the environment's state. Many moderately complex environments are only partially observable.

- Fully observable environments are more convenient as the agent does not need to maintain any internal state (including memory) to keep track of the environment.
- Fully observable environment examples: a crossword puzzle, the game of chess.
- Partially observable environment examples: the everyday physical world (driving a car, playing football), the card game poker.

Deterministic vs Stochastic

Deterministic environment: one in which any action has a single guaranteed effect - there is no uncertainty about the state that will result from performing an action. In stochastic environment, the effect is not guaranteed.
This definition applies from the point of view of the agent.

- If the environment is deterministic except for the actions of other agents, the environment is said to be strategic.
- Deterministic environment examples: a crossword puzzle, the game of chess.
- Stochastic environment examples: medical diagnosis, the card game poker, driving a car (the physical world).

Episodic vs Sequential

Episodic environment: one where the performance of an agent is dependent on a number of discrete episodes with no link between its performance in different episodes. In sequential environments different episodes are linked.

- In episodic environments the agent can decide what action to perform based only on the current episode without having to reason about the interactions between this and future episodes.
- In sequential environments the current decision could affect all future decisions.
- Episodic environment examples: a mail sorting system, defect detection on an assembly line.
- Sequential environment examples: a crossword puzzle, the card game poker, driving a car.

Static vs dynamic

Static environment: one that can be assumed to remain unchanged whilst the agent is deliberating.
Dynamic environment: one that has other processes operating on it, and hence changes whilst the agent is deliberating.
Static environments are easier to deal with. The agent does not need to keep observing the environment whilst deciding how act, nor need it worry about time elapsing.

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- Dynamic environment examples: medical diagnosis, the physical world.

Discrete vs Continuous

Discrete environment: one that contains a fixed, finite number of distinct states.
The distinction applies to the state of the environment, the way in which time is handled, the percepts and actions of the agent.
Continuous environments provide greater challenges for agent designers.
Discrete environment examples: a crossword puzzle, the game of chess.
Continuous environment exmples: medical diagnosis, driving a car.

Intelligent Agents: a classification

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- Such agents are simple to implement, but of very limited intelligence.

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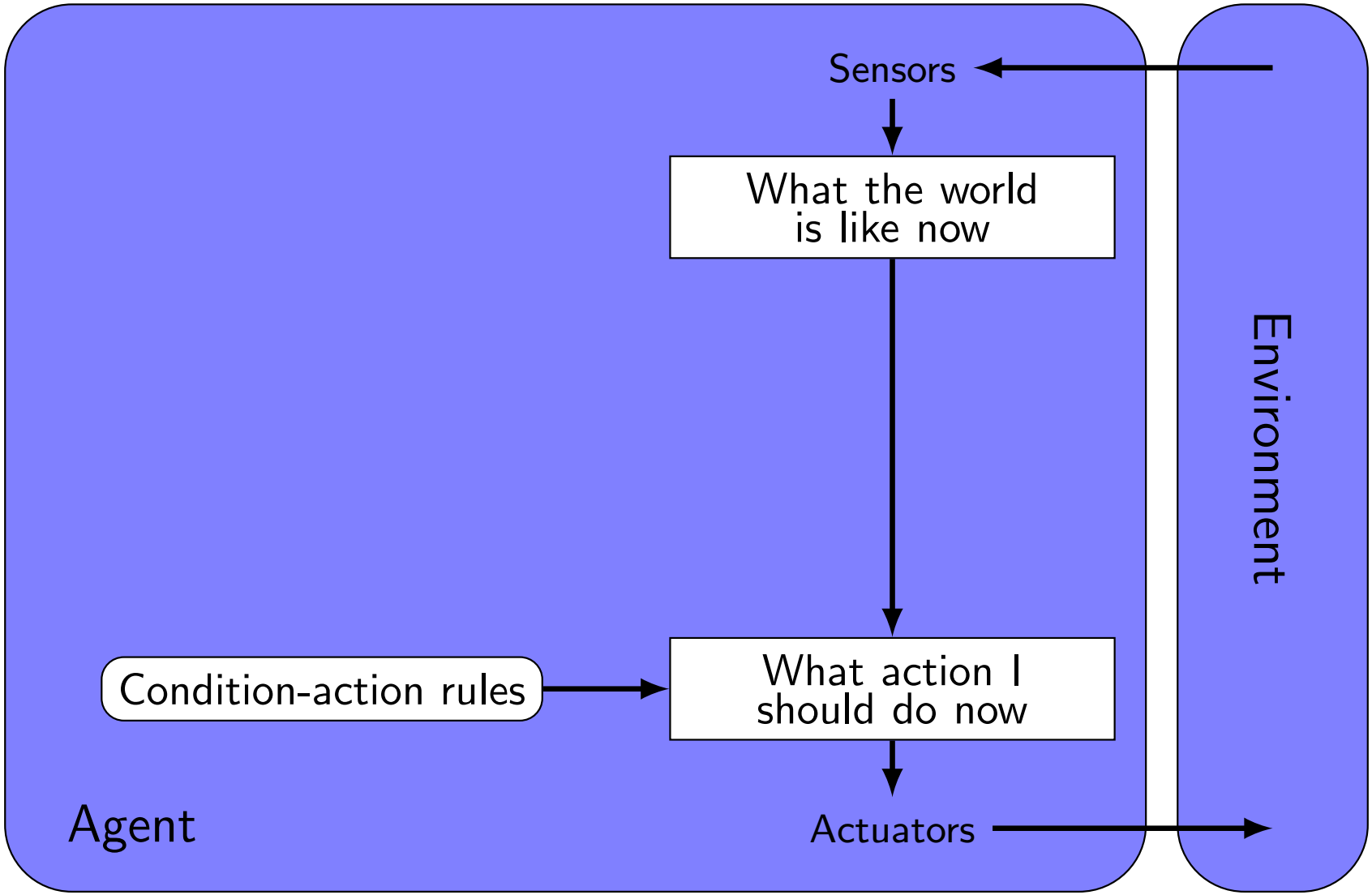

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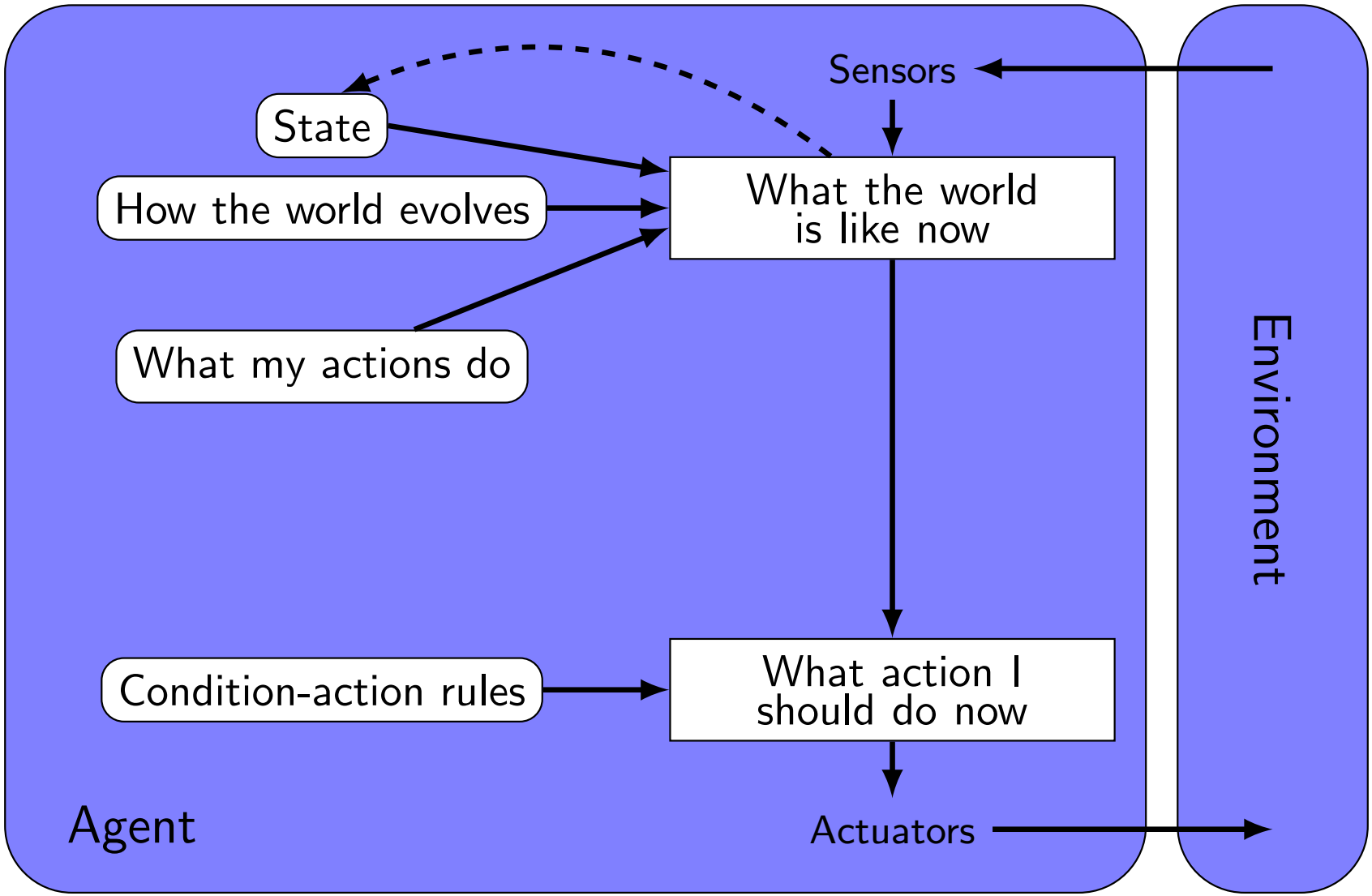

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- Decision making may become complicated when dealing with long sequences of actions to achieve a goal. Search and planning may be required.

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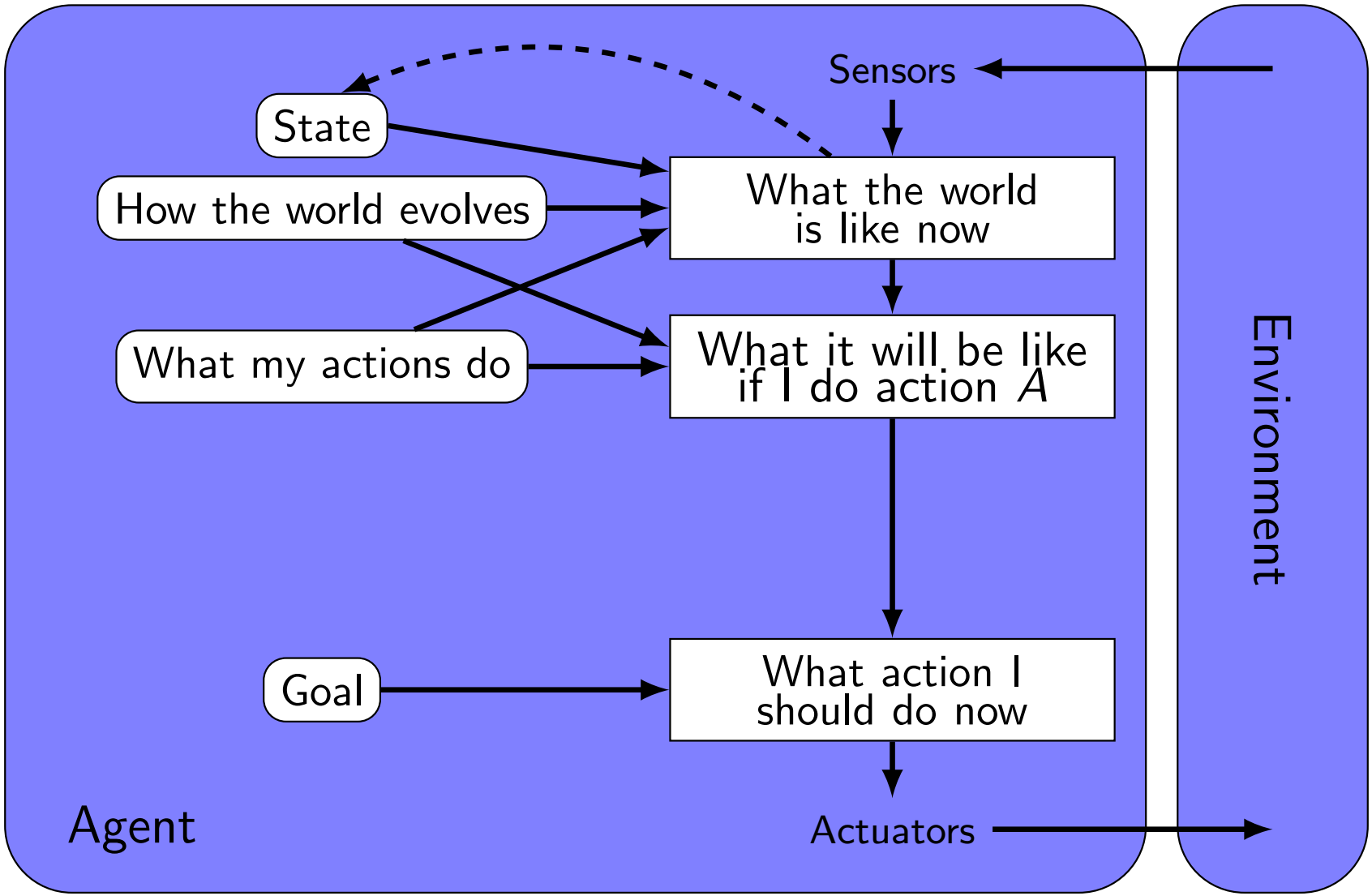

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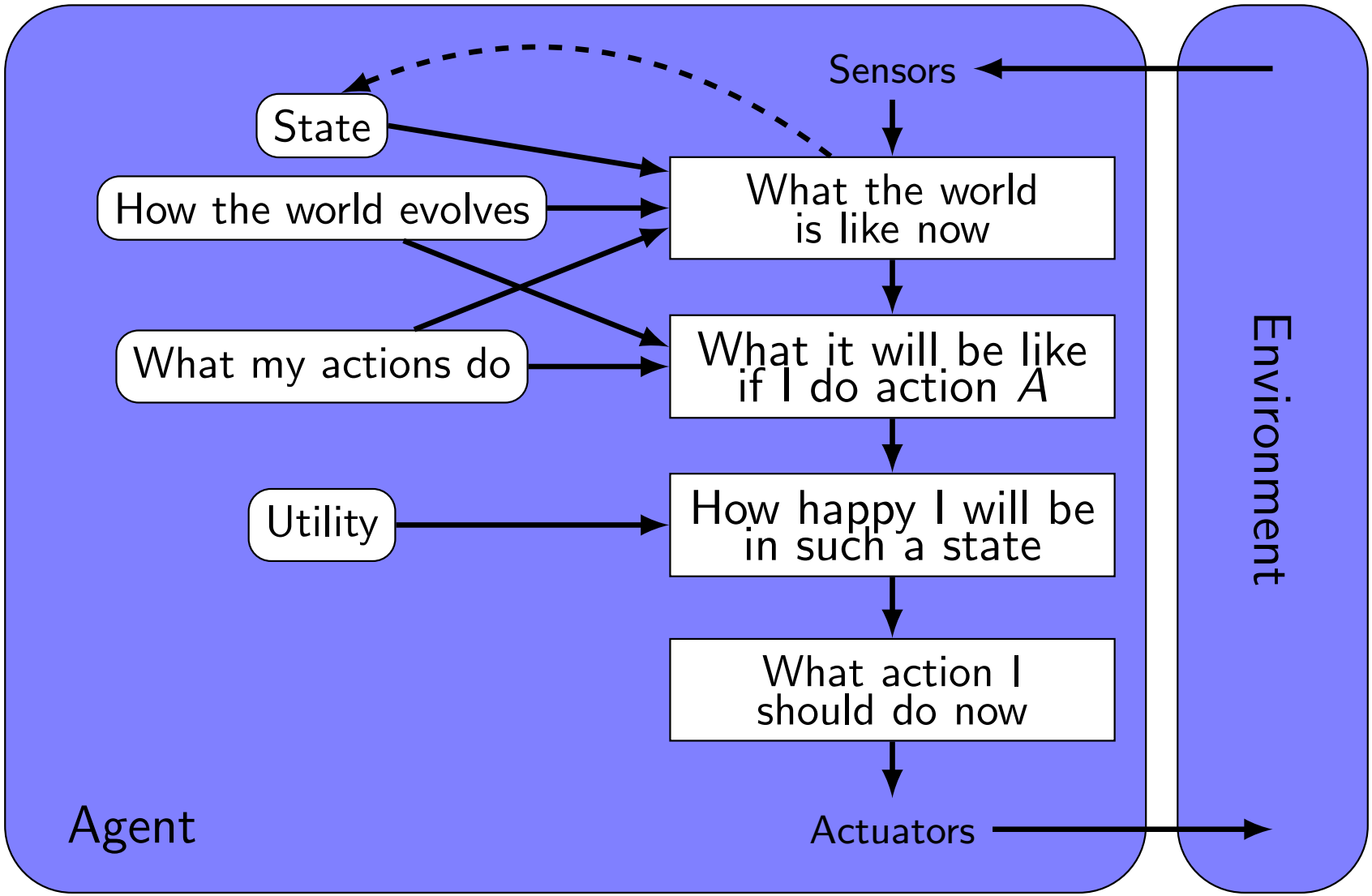

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- Use knowledge about the effects of previous actions to inform the action selection procedure from agent models introduced earlier.
- Possibly generate new problems that can be used to learn better action selection procedures.