

**PRESENTATION
ON
INTELLIGENT
AGENT PARADIGM**



Instructional Objective

- ⦿ Define an agent
- ⦿ Define an Intelligent agent
- ⦿ Define a Rational agent
- ⦿ Discuss different types of environment
- ⦿ Explain classes of intelligent agents
- ⦿ Applications of Intelligent agent

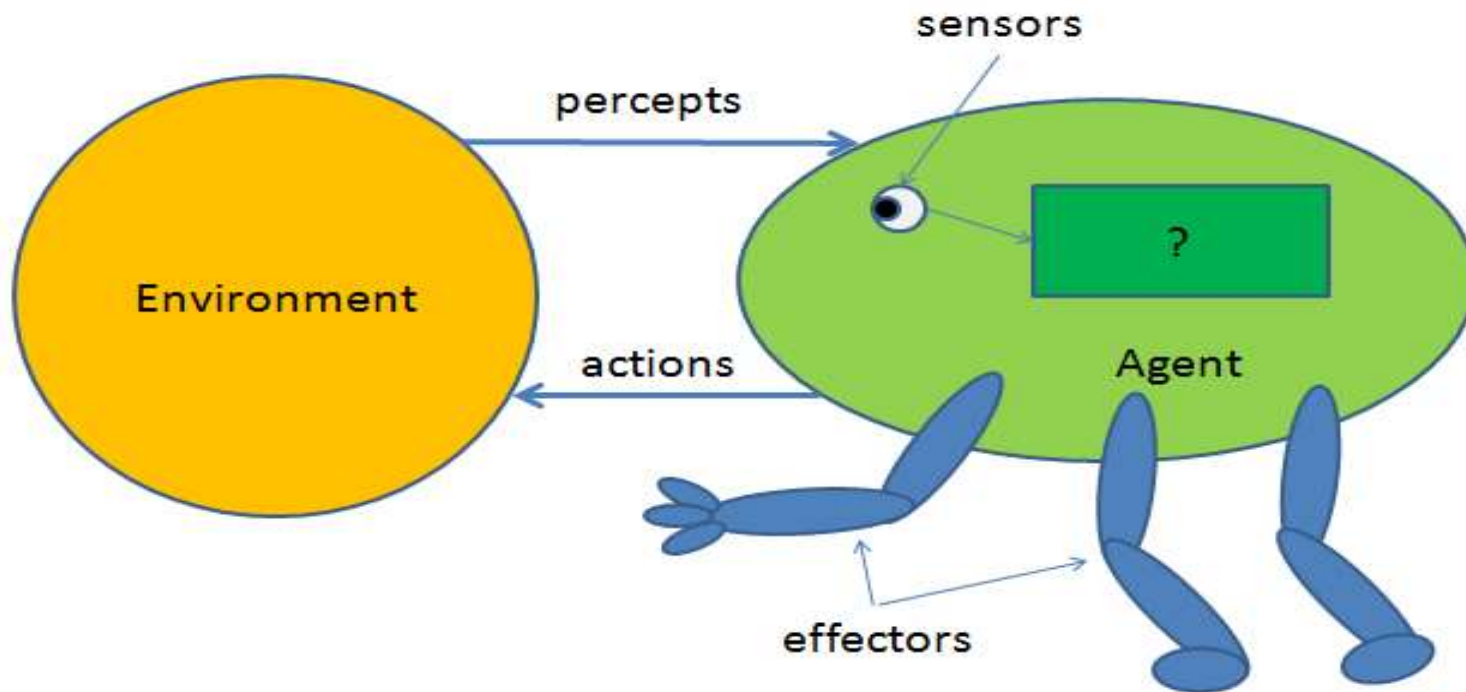


Agents

- ⦿ An **agent** is anything that can be viewed as **perceiving** its environment through **sensors** and **acting** upon that environment through **effectors**.
- ⦿ A human agent has eyes, ears, and other organs for sensors, and hands, legs, mouth, and other body parts for effectors.
- ⦿ A robotic agent substitutes cameras and infrared range finders for the sensors and various motors for the effectors.



Agent and Environment





Agents

- Operate in an environment.
- Perceives its environment through sensors.
- Acts upon its environment through actuators/effectors.
- Have goals.



Sensors & Effectors

- ⦿ An agent Perceives its environment through sensors.
- ⦿ The complete set of inputs at a given time is called percept.
- ⦿ The current percept, or a sequence of percepts can influence the actions of an agent.



Sensors & Effectors

- ◎ It can change the environment through effectors.
- ◎ An operation involving an actuator is called an action.
- ◎ Actions can be grouped in to action sequences.
- ◎ So an agent program implement mapping from percept sequences to actions.



Agents

- ⦿ **Autonomous Agent:** Decide autonomously which action to take in the current situation to maximize progress towards its goals.
- ⦿ **Performance measure:** An objective criterion for success of an agent's behavior.
- ⦿ E.g., performance measure of a vacuum-cleaner agent could be amount of dirt cleaned up, amount of time taken, amount of electricity consumed, amount of noise generated, etc.



Examples of agents

- ◎ **Humans**

eyes, ears, skin, taste buds, etc. for Sensors.
hands, fingers, legs, mouth for effectors.

- ◎ **Robots**

camera, infrared, bumper, etc. for sensors.
grippers, wheels, lights, speakers, etc. for effectors.



Structure of agents

- ⊙ A simple agent program can be defined mathematically as an agent function which maps every possible precepts sequence to a possible action the agent can perform.
- ⊙ $F: p^* \rightarrow A$
- ⊙ the term percept is use to the agent's perceptual inputs at any given instant.



Intelligent agents

- ◉ Fundamental faculties of intelligence
 - Acting
 - Sensing
 - Understanding, Reasoning, learning
- ◉ In order to act you must sense. Blind actions is not a characterization of intelligence.
- ◉ Robotics: sensing and acting. Understanding not necessary.
- ◉ Sensing needs understanding to be useful.



Intelligent Agents

- ◎ **Intelligent Agent:**

 - must sense,

 - must act,

 - must be autonomous(to some extent)

 - must be rational.



Rational Agent

- ⦿ AI is about building rational agents.
- ⦿ An agent is something that perceives and acts.
- ⦿ A rational agent always does the right thing.

What are the functionalities(goals)?

What are the components?

How do we build them?



Rationality

- ◎ **Perfect Rationality:**

Assumes that the rational agent knows all and will take the action that maximize the utility.

Human beings do not satisfy this definition of rationality.



Agent Environment

- ⦿ Environments in which agents operate can be defined in different ways.
- ⦿ It is helpful to view the following definitions as referring to the way the environment appears from the point of view of the agent itself.



Environment: Observability

- ◎ **Fully Observable:** All of the environment relevant to the action being considered is observable.

Such environments are convenient, since the agent is freed from the task of keeping track of changes in the environment.

- ◎ **Partially Observable:** The relevant features of the environment are only partially observable.
- ◎ **Example:** Fully obs: Chess; Partially obs: Poker



Environment: Determinism

- ◎ **Deterministic:** The next state of the environment is completely described by the current state and the agent's action. **e.g.** Image Analysis
- ◎ **Stochastic:** If an element of interference or uncertainty occurs then the environment is stochastic. A partially observable environment will appear to be stochastic to the agent. **e.g.** ludo
- ◎ **Strategic:** Environment state wholly determined by the preceding state and the actions of multiple agents is called strategic. **e.g.** Chess



Environment: Episodicity

- ◎ **Episodic/Sequential:**

An **Episodic Environment** means that subsequent episodes do not depend on what actions occurred in previous episodes.

In a **Sequential Environment**, the agent engages in a series of connected episodes.



Environment: Dynamism

- ◎ **Static Environment:** does not change from one state to next while the agent is considering its course of action. The only changes to the environment as those caused by the agent itself.
- ◎ **Dynamic Environment:** Changes over time independent of the actions of the agent-and thus if an agent does not respond in a timely manner, this counts as a choice to do nothing.



Environment: Continuity

- **Discrete/Continuous:** If the number of distinct percepts and actions is limited, the environment is **discrete**, otherwise it is **continuous**.



Classes of Intelligent Agents

- ⦿ Intelligent agents are grouped in to five classes based on their degree of perceived intelligence and capability.
- ✓ Simple reflex agents
- ✓ Model based reflex agents
- ✓ Goal based agents
- ✓ Utility based agents
- ✓ Learning agents

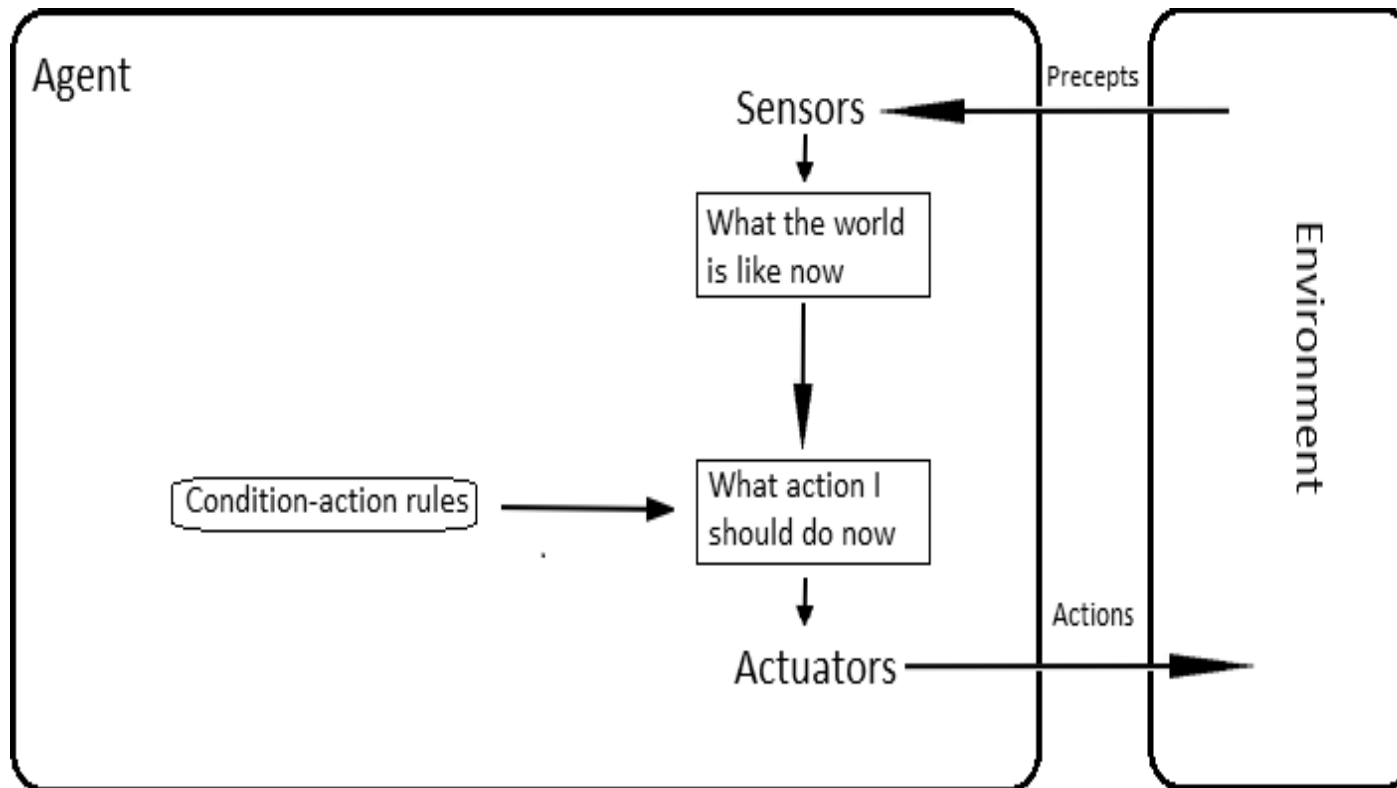


Simple reflex agents

- ⦿ Simple reflex agents act only on the basis of the current percept, ignoring the rest of the percept history. The agent function is based on the *condition-action rule*: if condition then action.
- ⦿ Succeeds when the environment is fully observable.
- ⦿ Some reflex agents can also contain information on their current state which allows them to disregard conditions.



Simple reflex agents



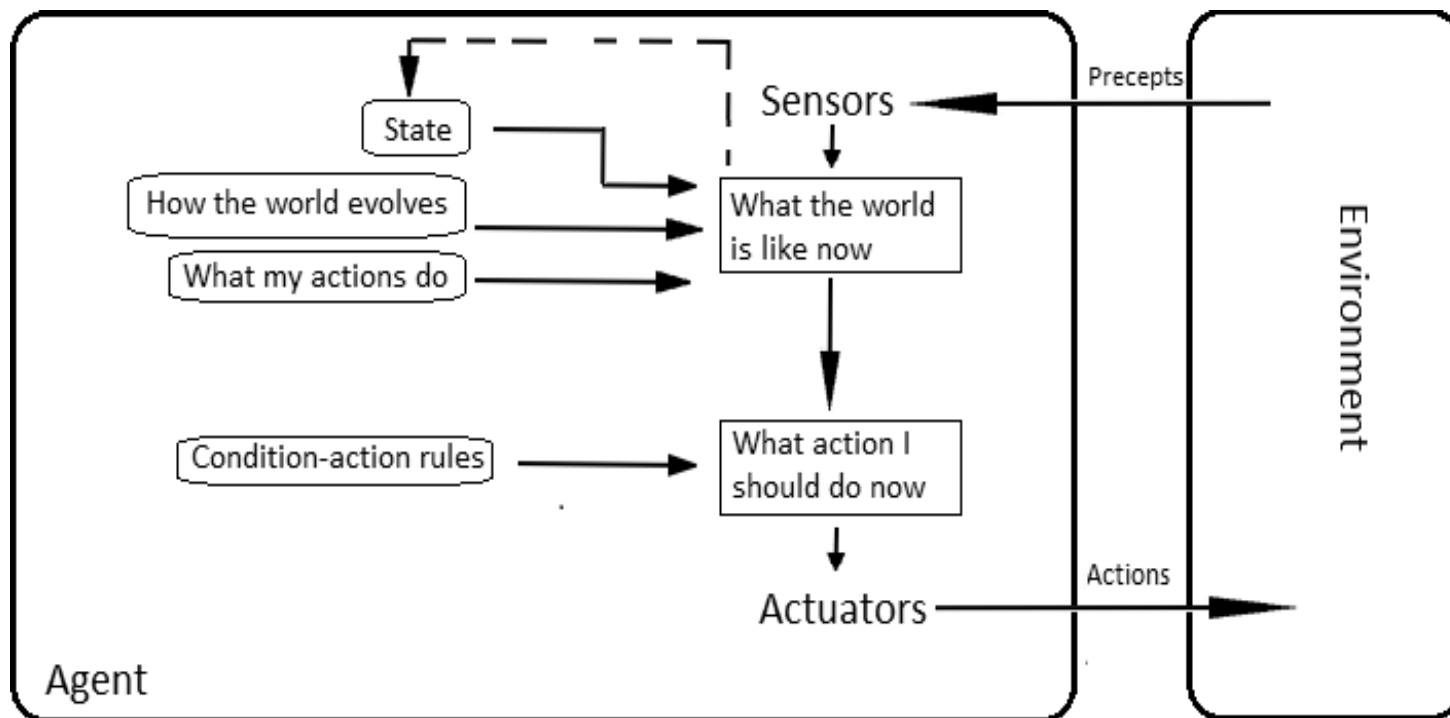


Model based reflex agents

- ⦿ A model-based agent can handle a partially observable environment.
- ⦿ Its current state is stored inside the agent maintaining some kind of structure which describes the part of the world which cannot be seen.
- ⦿ This knowledge about "how the world evolves" is called a model of the world, hence the name "model-based agent".



Model based reflex agents



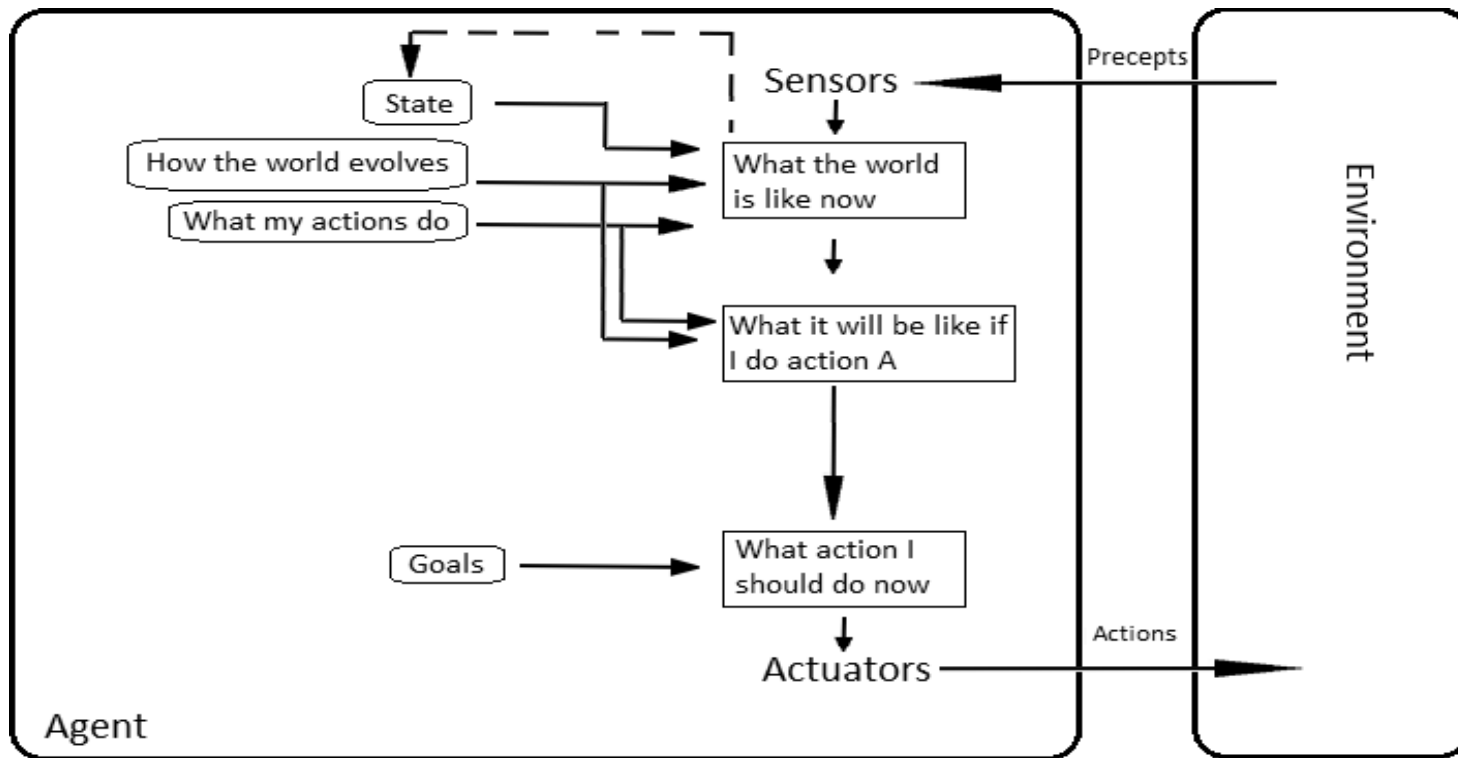


Goal based agents

- Goal-based agents further expand on the capabilities of the model-based agents, by using "goal" information.
- Goal information describes situations that are desirable. This allows the agent a way to choose among multiple possibilities, selecting the one which reaches a goal state.
- Search and planning are the subfields of artificial intelligence devoted to finding action sequences that achieve the agent's goals.



Goal based agents



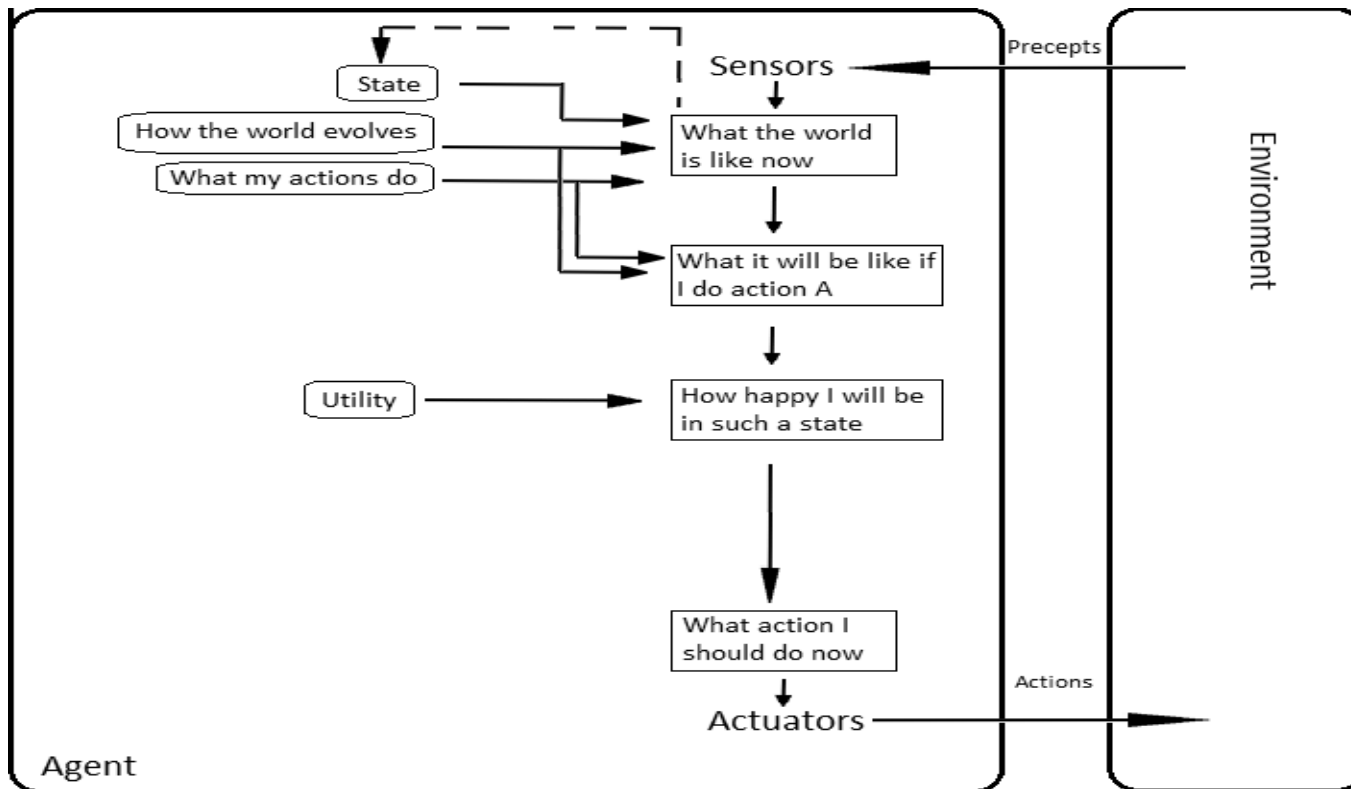


Utility based agents

- ⦿ Goal-based agents only distinguish between goal states and non-goal states.
- ⦿ It is possible to define a measure of how desirable a particular state is. This measure can be obtained through the use of a *utility function* which maps a state to a measure of the utility of the state.
- ⦿ A more general performance measure should allow a comparison of different world states according to exactly how happy they would make the agent. The term utility, can be used to describe how "happy" the agent is.



Utility based agents





Learning agents

- ⦿ Learning has an advantage that it allows the agents to initially operate in unknown environments and to become more competent than its initial knowledge alone might allow.
- ⦿ The most important distinction is between the "learning element", which is responsible for making improvements, and the "performance element", which is responsible for selecting external actions.
- ⦿ The learning element uses feedback from the "critic" on how the agent is doing and determines how the performance element should be modified to do better in the future.

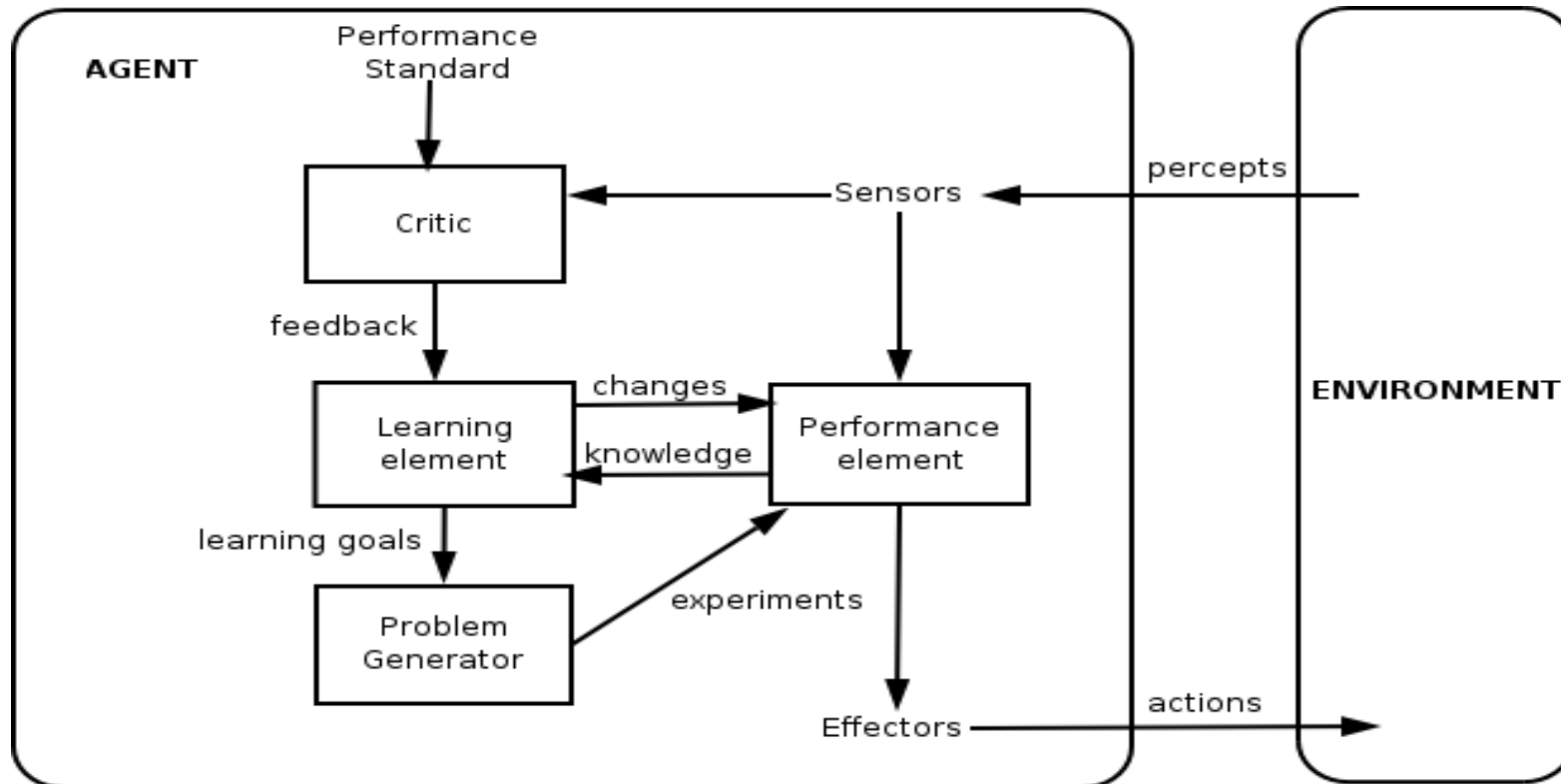


Learning agents

- ⦿ The last component of the learning agent is the "problem generator". It is responsible for suggesting actions that will lead to new and informative experiences.



Learning agents





Applications of Intelligent Agents

- ◎ Intelligent agents are applied as **automated online assistants**, where they function to perceive the needs of customers in order to perform individualized **customer service**.
- ◎ Use in smart phones in future.

Thank you!

