

CSC 445 - Intro to Intelligent Robotics, Spring 2018

Overview

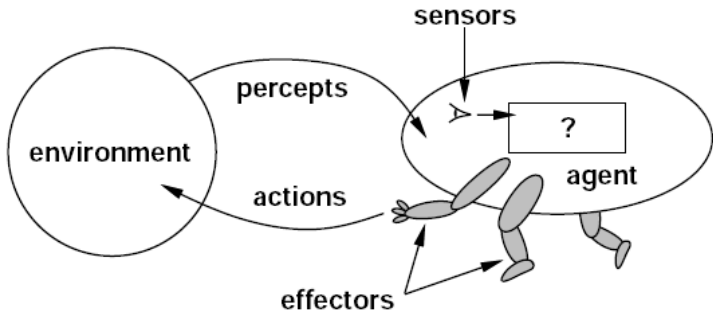
Robot

- The word *robot* was coined by Czech novelist Karel Capek in a 1920 play titled “Rassum’s Universal Robots”.
- *Robot* in Czech means worker or servant.

Autonomous Agents

“Autonomous agents are computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realise a set of goals or tasks for which they are designed.”

– Pattie Maes, MIT Media Lab



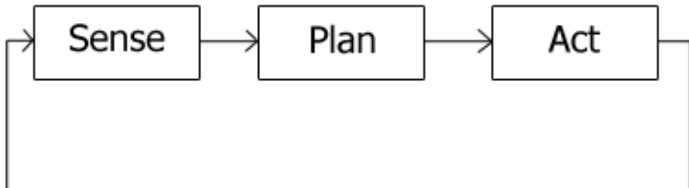
Characteristics of Environments

- Fully observable vs. partially observable
- Deterministic vs. stochastic
- Episodic vs. sequential
- Static vs. dynamic
- Discrete vs. continuous
- Single agent vs. multiagent

Example Robotic Tasks

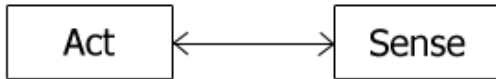
- Navigation
- Perception
- Learning
- Cooperation
- Manipulation
- Planning
- Reasoning
- ...

Classic / Hierarchical Control Paradigm



- Focus on automated reasoning and knowledge representation.
- Stanford Research Institute Problem Solver (STRIPS): Perfect world model, closed world assumption.

Reactive Control Paradigm



- No models: “The world is its own, best model”
- Behaviors are a direct mapping of sensory inputs to a pattern of actuator actions.

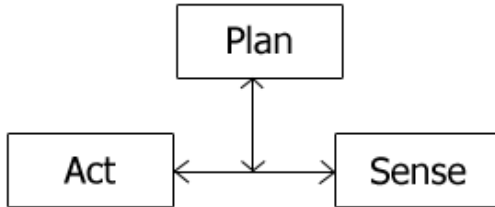
Characteristics of the Reactive Paradigm

- Situated agent – the robot is integral part of its environment.
- No memory – controlled by what is happening in the world.
- Tight coupling between perception and action via behaviors.
- Ego-centric representation – only local, behavior-specific sensing is permitted.

Subsumption Architecture

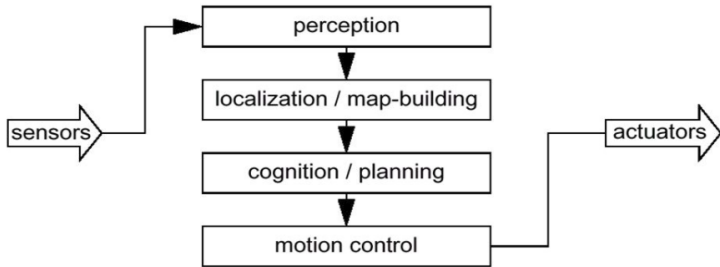
- Introduced by Rodney Brooks in 1986.
- Behaviors are networks of sensing and acting modules (augmented finite state machines).
- Modules are grouped into layers of competence.
- Layers can subsume lower layers.
- No internal state.

Hybrid



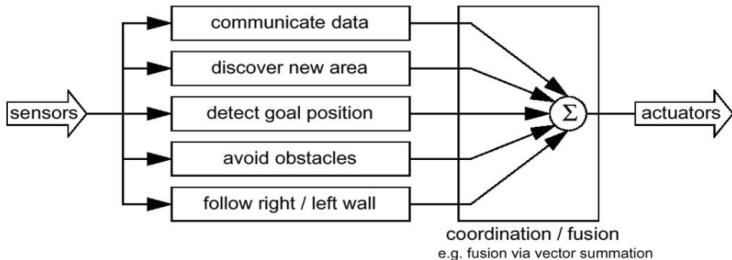
- Combines advantages of previous paradigms:
 - World model used for planning.
 - Closed loop, reactive control.

Model Based Navigation



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Behavior Based Navigation



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Control Scheme Outline

