

## → Introduction to robotic agents

Autonomous agents: traditional definition

'Computational system, situated in a given environment that has the ability to perceive that environment using sensors and act in an autonomous way in that environment using its actuators to fulfil a given function.'

→ Requisites

Perceive environment, decide actions to execute, execute the actions using actuators, communicate (?) and perform a complex function (?).

Agent vs object: agents decide what to do, react to sensors and control actuators, object methods are called externally.

Robotics: science and tech. to build, program, program and use robots. Study of robotic agents.  
Increased complexity: environments, perception, action, architecture, navigation, interaction.

Robot: Humanoids + automata. Programmable, mechanically capable, flexible. Electromechanical device which can perform tasks on its own or with guidance.

Physical agent (with body) that generates intelligent / autonomous connection between perception and action.  
Autonomous system in physical world which may sense its environment and act on it to achieve goals.

## → Robotic architecture

An architecture provides a principled way of organizing a control system. Besides structure, it imposes constraints on the way the problem can be solved.

### ↳ Issues:

- Representation (unified, heterogeneous, multiple on one)
- Control and coordination (centralized or distributed)
- Learning
- Timely performance (real-time constraints)
- Biological and psychological inspiration
- Evaluation.

### ↳ Spectrum of architectures

- Deliberate control: 'think hard, then act'
- Reactive control: 'don't think, react'
- Hybrid control: think and act in parallel.

## Typical organizations:

- hierarchical / deliberative
- reactive
- behaviour based
- Hybrid

↳ Deliberative: action results from reasoning over the world model, perception is not directly tied to action. (internal world and external world).

↳ Reactive: The environment lacks temporal consistency and stability, the robot's immediate sensing is adequate for the task at hand. Difficult to localize robot. No value in symbolic world knowledge.

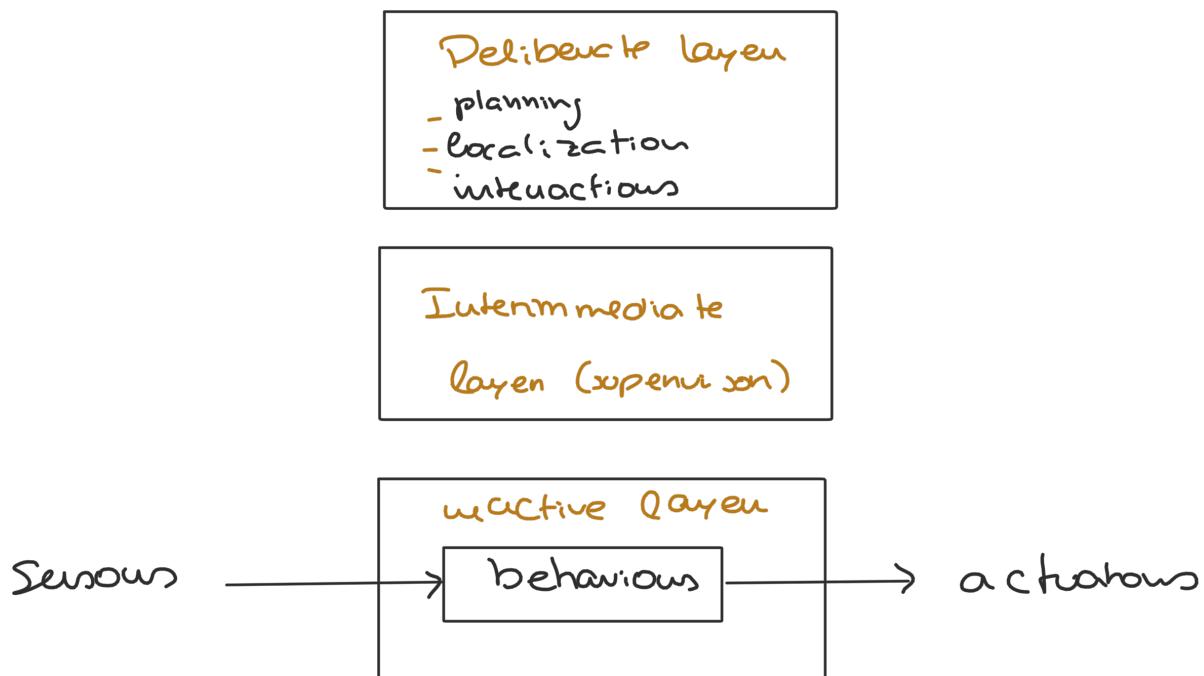
## Deliberate vs Reactive:

Thinking is slow, reaction must be fast, thinking allows looking ahead (planning), thinking too long is dangerous, accurate info to think.

↳ Behaviour: Behaviour implemented as control laws. Each behaviour receives inputs and sends outputs, many may receive input from the same sensors to same actuators. Behaviours are encoded to be simple and added incrementally.

↳ Hybrid: Combines the best of reactive and deliberate.

Part of the robot 'brain' plans, the other deals with immediate reaction. Challenge is to bring the two parts together. This requires the third part of the brain, often these are called "three-layer systems".



## → The BDI Model

- Three "mental attitudes":

- Beliefs are info the agent has about the world
- Desires are all the possible states of affairs the robot wants to accomplish
- Intentions are those states the robot has decided to work towards.