



UNIVERSITY OF  
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# CSCE274 Robotic Applications and Design

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## Control Architectures Overview

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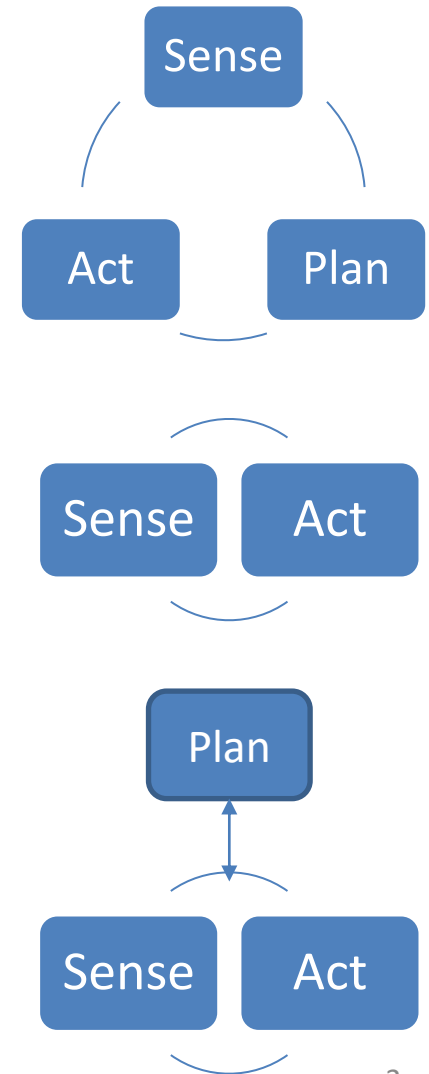
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# Control architecture

- A robot control architecture (or paradigm) is the set of principles, building blocks, and tools for designing robots
- It provides guiding principles and constraints for organizing robot's control system

# Control architectures

- Deliberative control
  - Top-down approach: sense-plan-act
  - Starts with high level goals that are decomposed in subtasks
- Reactive control
  - Bottom-up approach
  - Independent modules run concurrently monitoring sensor data and triggering actions accordingly
- Hybrid control
  - Deliberative at high level, reactive at low level



# Control architectures

- Behavior-based control is usually considered in literature a type of reactive control architecture
  - Different behaviors to achieve a goal

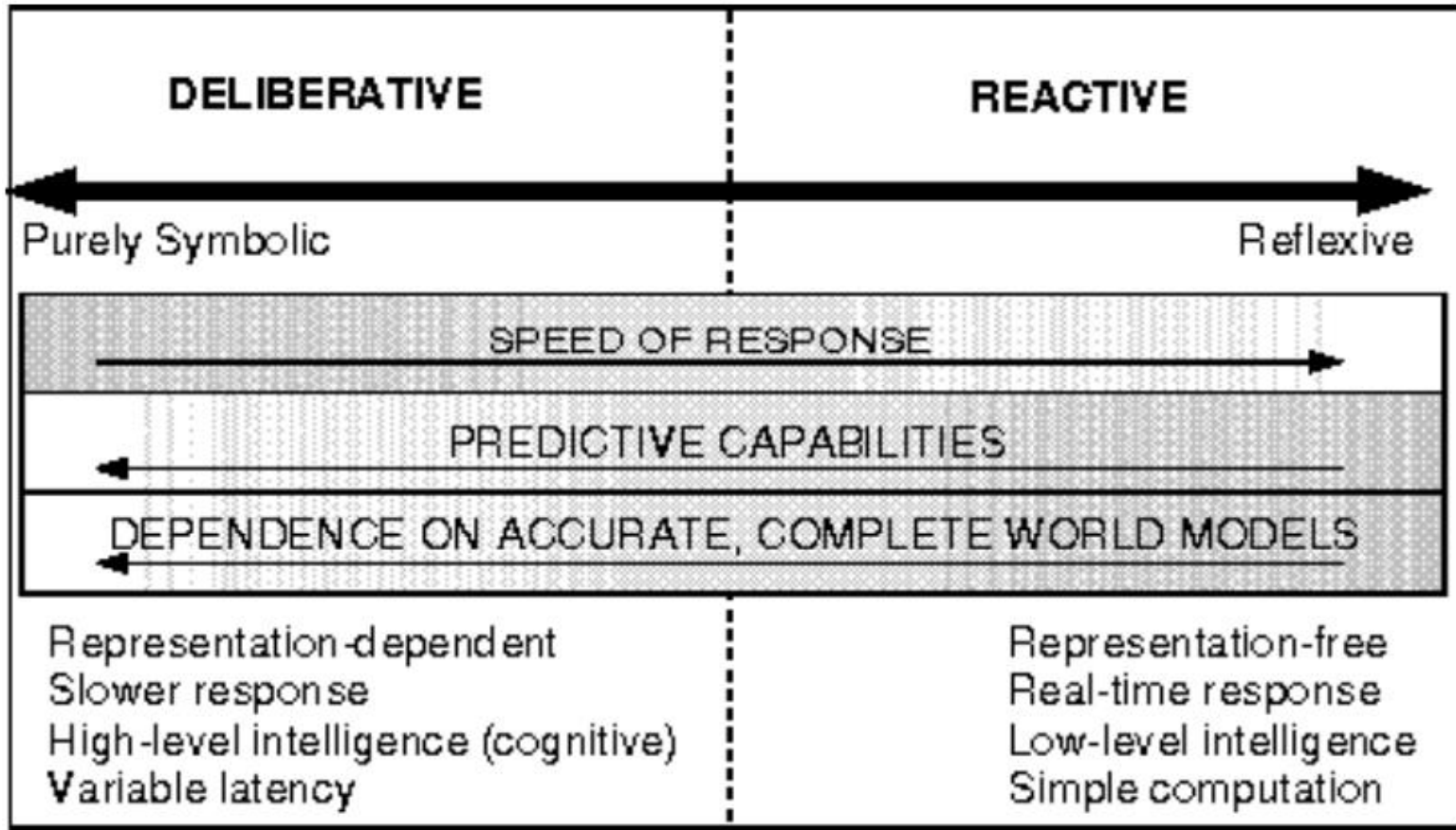
# Dimensions

- Each architecture differs in how they consider different dimensions
  - Time-scale: long time-scale vs. real-time
  - Modularity: sequential vs. parallel
  - Representation of the world
    - Consider past or discard information
    - Discrete vs. continuous

# Levels of control problem

- According to the different dimensions, each architecture solves control problems at different levels
  - High level: discrete problem, long time scale
    - E.g., pick bottle of water from the fridge
  - Intermediate level: continuous or discrete problem, time scale of few seconds
    - E.g., navigate to the fridge
  - Low level: continuous-valued problems, short time scale
    - E.g., where the robot should place the leg at the next step

# Spectrum of control



Source: [Arkin, 1998, MIT Press]