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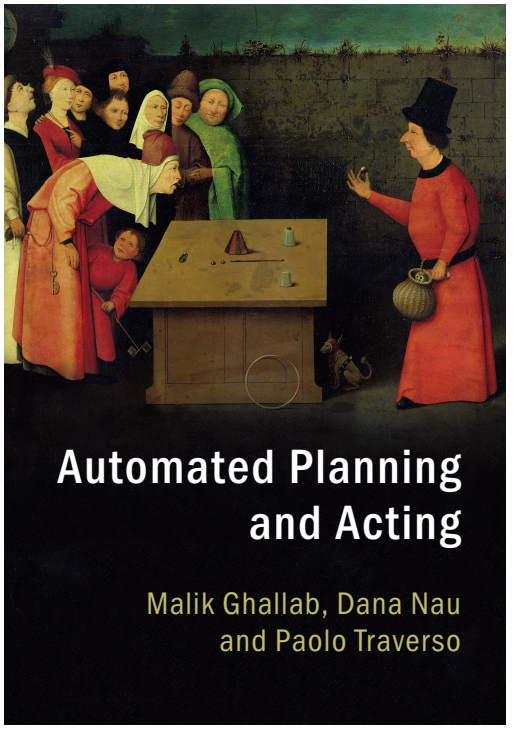
Deliberation in Planning and Acting

Part 1: Introduction



http://www.laas.fr/planning

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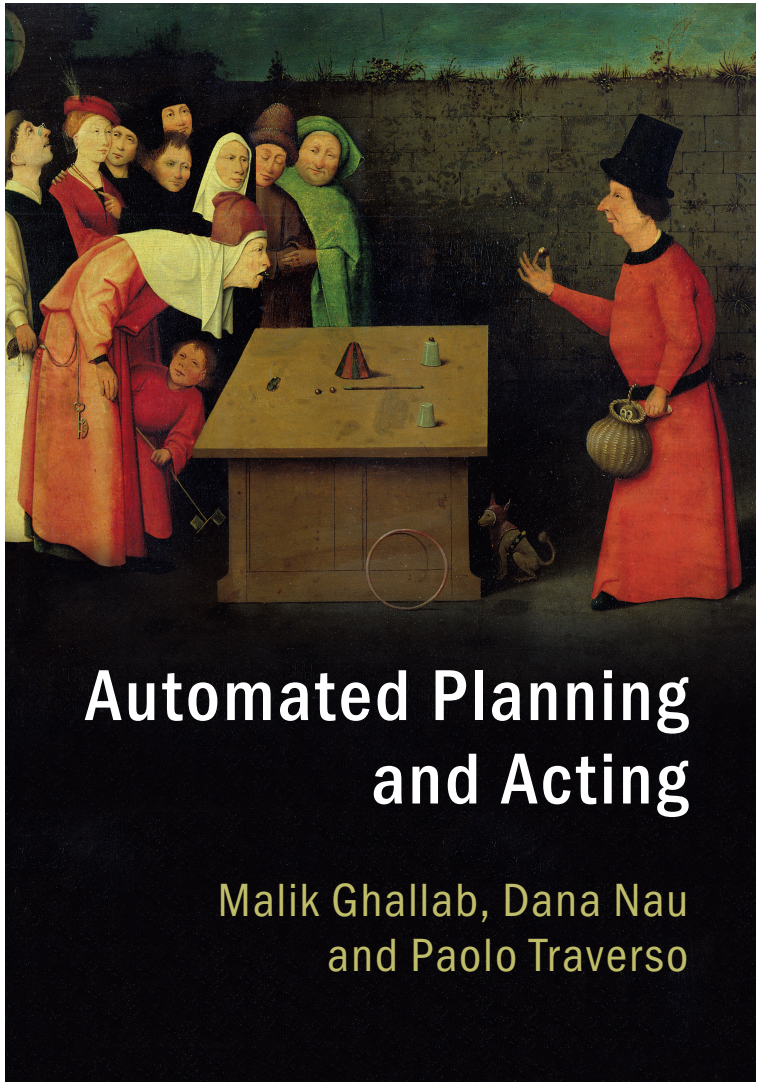
Source Materials

- Tutorial based on portions of a new book

  Ghallab, Nau, and Traverso (2016)
  Automated Planning and Acting
  Cambridge University Press

- Free downloads at
  http://www.laas.fr/planning
  - Final manuscript of the book
  - Lecture slides for the book
  - Lecture slides for this tutorial

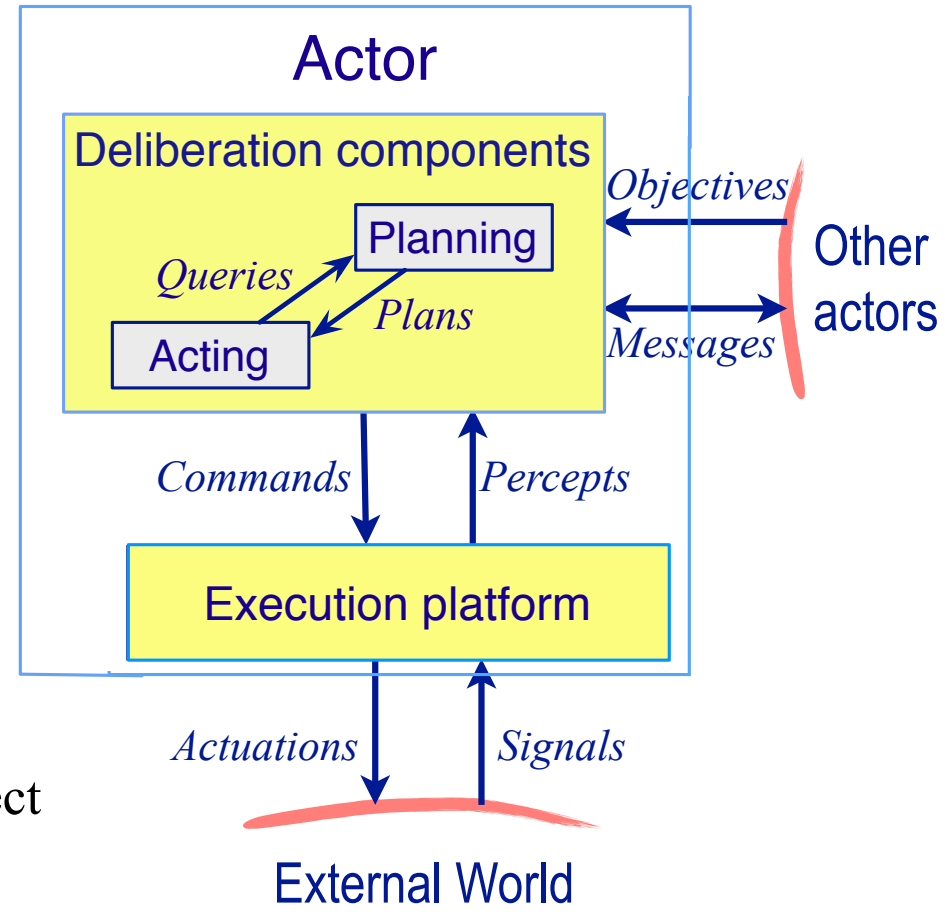


Motivation

- *Actor*: agent that performs actions
  - Deliberation functions
    - Planning

      What actions to perform
    - Acting

      How to perform them



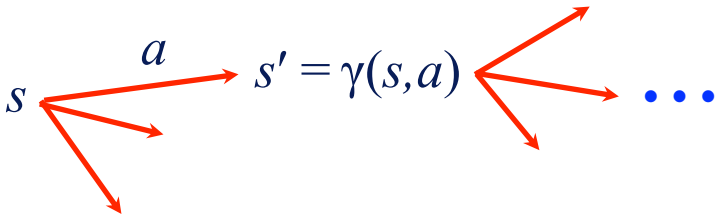
- Traditional "AI planning" view
  - Acting = execution
  - No deliberation about *how*
- Sometimes correct, but often incorrect

Acting as Execution

Deliberative Acting

Planning

- Relies on *prediction* + *search*
  - Prediction uses models that predict *what* the actions will do
    - *Descriptive* models
  - Search
    - Search over *predicted states* and possible organizations of feasible actions



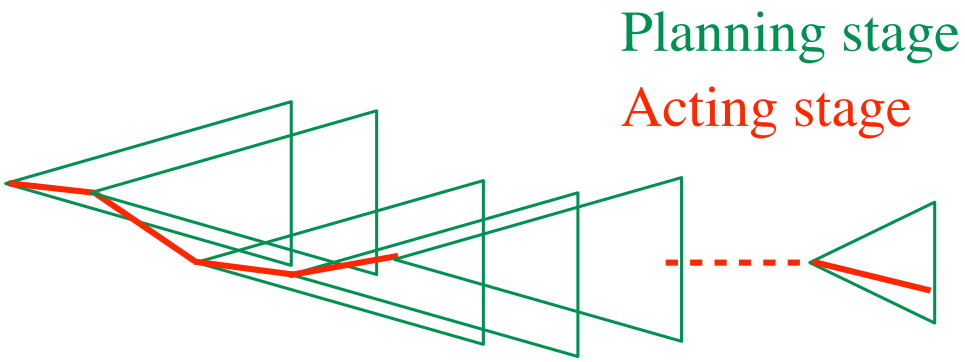
- Different types of actions ⇒
  - Different predictive models
  - Different planning problems and techniques

- Motion and manipulation planning
- Perception planning
- Navigation planning
- Communication planning
- Task planning

Most AI planning

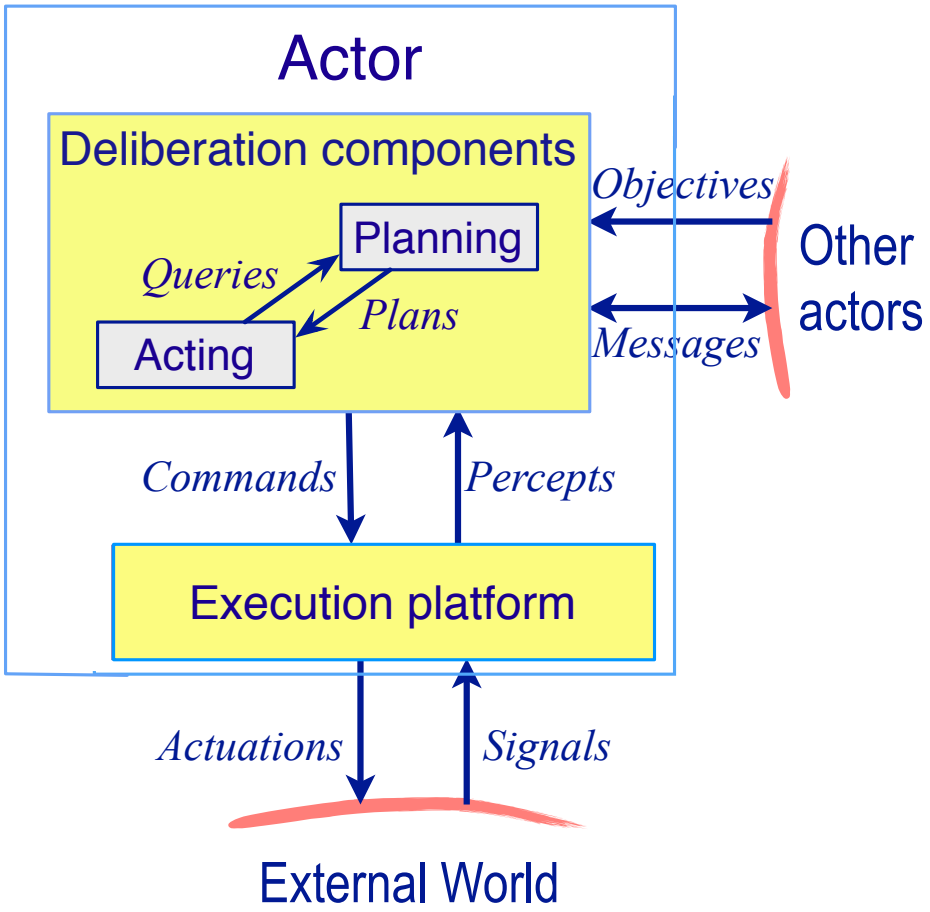
Acting

- Actor is situated in a dynamic unpredictable environment
  - Adapt actions to current context
  - React to events
- Relies on
  - *Operational models* of actions
    - Tell *how* to perform the actions
  - Observations of *current state*

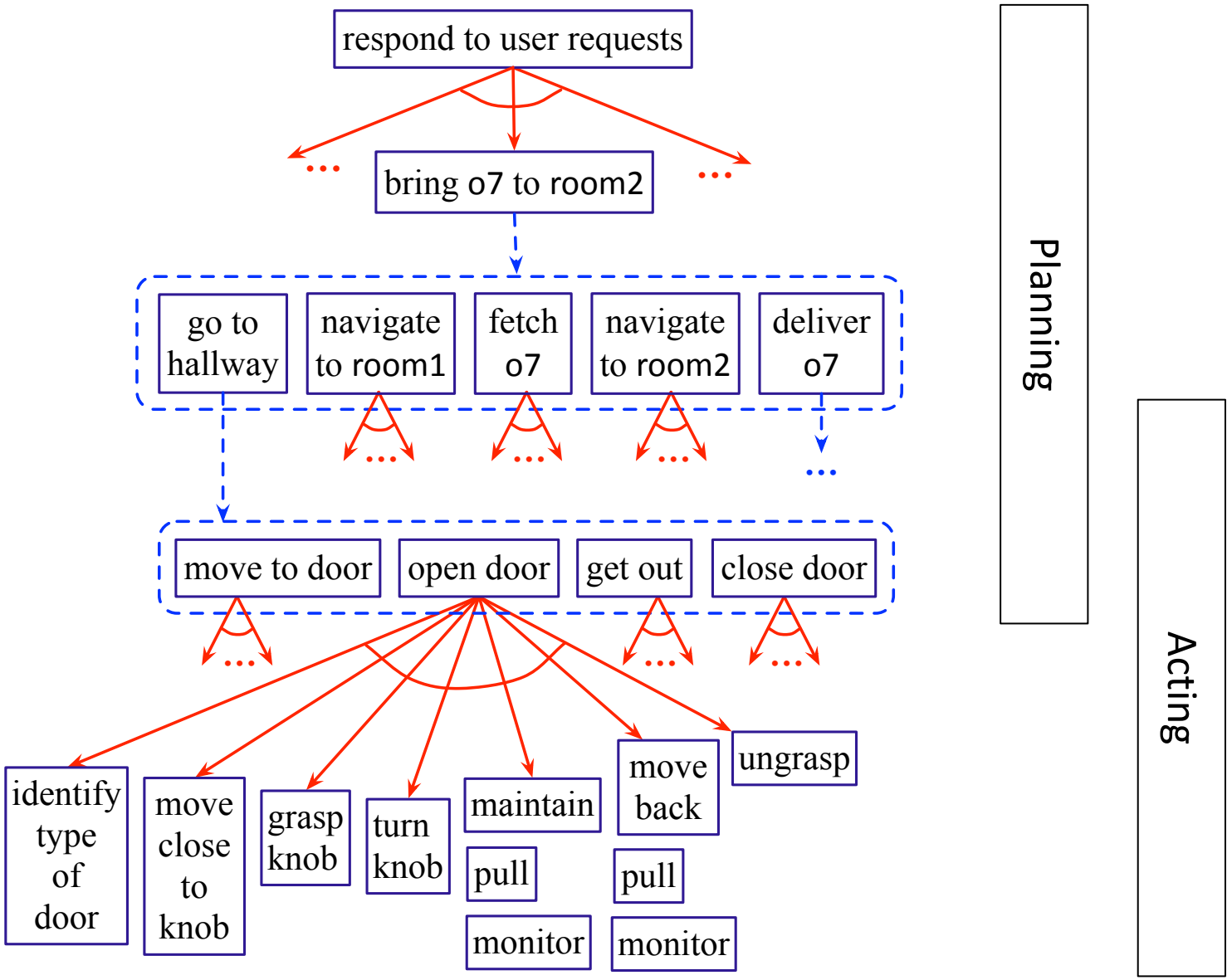


General Characteristics

- *Multiple levels of abstraction*
  - Actors are organized into physical subsystems
  - Deliberation reflects this
- *Heterogeneous reasoning*
  - Different techniques
    - at different levels
    - in different subsystems at same level
- *Continual online planning*
  - Can't plan everything in advance
  - Plans are abstract and partial until more detail is needed



Levels of Abstraction



Outline

1. **Introduction**
2. **Deterministic models**
   - Refinement methods for acting
   - Refinement methods for planning
3. **Temporal models**
   - Timelines and temporal refinement methods
   - Chronicles for planning and acting
4. **Nondeterministic models**
   - Offline and online nondeterministic planning
   - I/O automata and refinement methods for planning and acting
5. **Conclusion**

Download the tutorial slides at http://www.laas.fr/planning

Relation to the Book

- Ghallab, Nau, and Traverso (2016). *Automated Planning and Acting.* Cambridge University Press

- Free downloads:
  - Lecture slides, final manuscript
  - http://www.laas.fr/planning

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Cover image: *The Conjuror.*
Hieronymus Bosch (c.1450–1516)