

Outline LUND

- Reflections
- Lessons to learn
- Where to go from here
 - Specification, software engineering
 - Embedded system design
 - Adaptive Control
 - Formal methods
 - Agent specification

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Reflections to make after the contest:

- What went wrong?
- What was the reason?
 - external explanation vs. design-centered
 - half-empty-bottle effect
- How could we have changed the outcome?
 - Morphology?
 - Feedback?
 - Algorithms?

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Lessons to learn

- About the design process itself:
 - Design is a tedious, repetitive process: very seldom the first idea is (completely) right
 - Design is a process requiring possibility of testing/verifying the ideas
 - Successful design requires deep reflection over its outcomes
- About complexity:
 - It is defined by possible interactions between the robot and its environment
 - Needs to be taken into account
- One should attack a problem in a principled way.

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Where to go from here?

- Specification, software engineering
- Embedded system design
- Formal methods
- Agent specification
- **Robotics**
- Control theory, adaptive control



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Robot applications

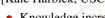
- Search and rescue
- Fire fighting
- De-mining
- Medical technology
- Production technology
- Exploration: ocean, space
- Colonisation: ocean, space
- Entertainment
- Defence

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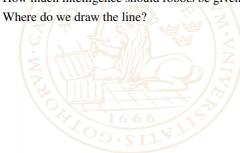
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Ethics

[Kale Harbick, USC]



- Knowledge increasing faster than wisdom
- How much intelligence should robots be given?



A rational agent

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[Wooldridge, 2000]



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An agent is said to be rational if it chooses to perform actions that are in its own best interests, given the beliefs it has about the world.

Properties of rational agents:

- autonomy (they decide);
- proactiveness (they try to achieve their goals);
- reactivity (they react to changes in the environment);
- social ability (they negotiate and cooperate with other agents).

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Logical characterisation of agents

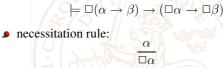
- How can we characterize rationality?
 - crucial terms: beliefs and best interests;
 - decision theory, game theory;
 - logic:
 - epistemic logics;
 - temporal logics, dynamic logics;
 - BDI logics.
- How can we build rational agents?
 - software architectures;
 - executable specifications;
 - logic;
 - BDI logics.

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The omniscience problem

All normal modal logics obey the following:

K axiom:





- infinite set of beliefs
- consistency of beliefs
- equivalence of beliefs



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Ways of dealing with omniscience

We need to model:

- 1. bounded resources of agents;
- 2. incomplete reasoning mechanisms.
- Weakening the system non-standard semantics
- Distinguishing explicit and implicit knowledge The two ways above suffer from partial logical omniscience!
- Removing closure properties
- Syntactification

