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Sheffield Centre for Robotics

Do Robots Need Cognition? Does Cognition Need Robots?

(*a response to Matthias Scheutz's talk*)

Prof. Roger K. Moore

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Robots in Cognition and Cognition in Robots:

The Dual Role of Robots in Cognitive Science

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Overall Response

- Matt's question:
  - "*What do robots and cognition <u>both</u> need?*"
- Matt's answer:
  - "*DIARC/ADE*"
- The outcome:
  - impressive demonstrations of HRI
- A more general answer (*to Matt's question*):
  - a sound theoretical basis
  - a computationally tractable architecture
  - a quantitative experimental methodology

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Some Superficial Reactions

- We seem to have a multiplicity of computational paradigms at our disposal, so how can we choose between them?
- The situated/embodied view of cognition doesn't always mean physical robots – so how can we know when to deploy them?
- Are we impressed with what a robot does, or simply with the fact that it does anything?
- Selecting a particular robot raises so many questions about the appropriateness of its visual, vocal and behavioural affordances - how are they characterised, and how does that impact on outcomes?
- A lot of what was discussed seemed to be uniquely relevant to HRI – what about other configurations?
- Like Matt, people often say "*language is a mess, but people are very good at it*" – maybe our view of real language is quite wrong?
- Just how much autonomy/adaptability is real? – e.g. how did the robot recognise/synthesis the word "*follow*" in the first place?

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Didn't really address the exam question!

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The Exam Question(s)

- Do robots need cognition?
- Does cognition need robots?
- Raises two core issues …
  - what theories of cognition have been refuted by experiments with robots?
  - what robot behaviours are impossible without cognition?
- All this assumes that we know what a 'robot' is and what 'cognition' is!

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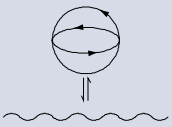
Cognition



- Cognition …
  - "*the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses*"
- Mental process …
  - "*the performance of some composite cognitive activity*" !
- Q: is cognition sufficiently well defined that we can determine whether it is present or absent? *(does a slug have cognition, does a tree?*)
- A: if not, then we need such definitions

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Does Cognition Need Robots?

"You have everything to learn from us, and we have nothing to learn from you!"

- Q: do practitioners in the field of cognition need a physical experimental platform like a robot?
- A: probably, if their scientific questions cannot be answered by simulation
- Q: if cognition does need robots, which one(s)?
- A: robots with quantifiable capabilities in appropriate dimensions

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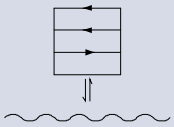
Do Robots Need Cognition?

- Q: is there such a thing as a robot
- A: no, so maybe some robots need cognition, and others don't

- Q: if a robot needs cognition, how much?
- A: need to define the dimensions with which cognition can be characterised, and establish capabilities and requirements



- Q: do robots needs an understanding of how living organisms behave
- A: yes, if they are to interact with them

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Some Common Themes

- We seem to require a richer description of both 'cognition' and 'robot'

- We need to be able to characterise both along key dimensions that permit controlled experimentation

- We need to be able to quantify performance and requirements along such dimensions

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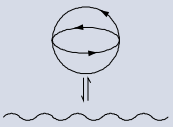
Cognitive Systems



EUCog definition (*of the behaviours*) …

- interaction with the environment, including communication with other agents
- information processing, such as knowledge or reasoning
- adaptation, learning, flexibility
- goal directed autonomous behaviour
- (*see the wiki*)

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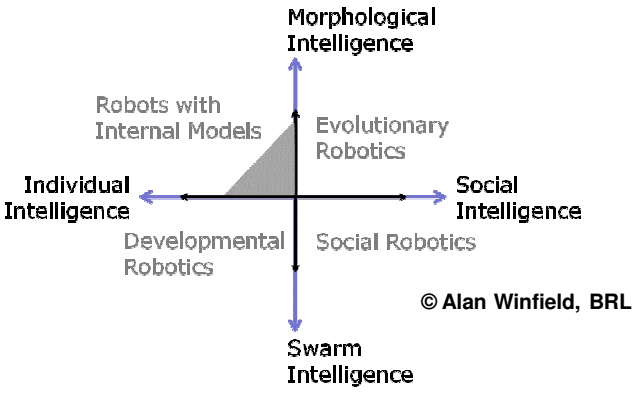
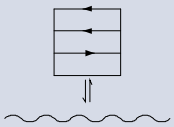
Robotics





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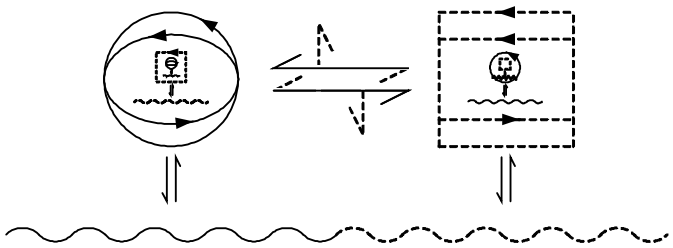
Human-Robot Interaction



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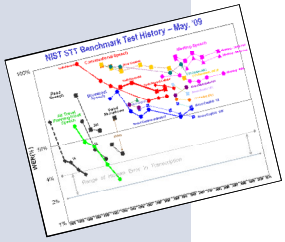
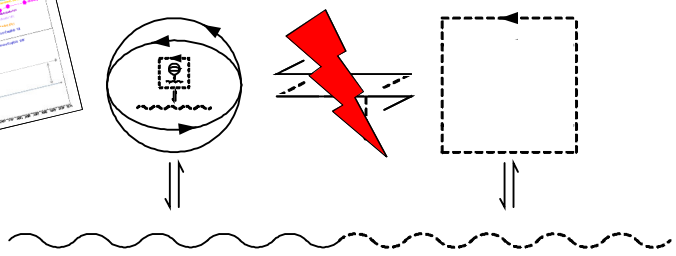
Human-Robot Interaction





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