



Social robotics

Pierre Lison

University of Oslo, Dep. of Informatics

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Social robots?

Our long-term aim:



*Hi! I am C-3PO,
human-cyborg relations.*

Social robots?



Social robots?



*Hi! I am C-3PO,
human-cyborg relations.*

(and he speaks 6
million languages...)

- We are not quite there yet!
- But technology is steadily improving



Outline

- What is a robot?
- What is a *social* robot?
- Demonstration of Nao

What is a robot?

- A robot is a **physical artificial agent**
- It can *perceive* the world around him using sensors
- It can also perform *actions* via its actuators (motors)
- Some robots can also *interact* with other agents, humans or robots



What is a robot?

- Robot are built to accomplish specific *tasks*
- Most robots today are either remotely controlled or preprogrammed
- Research to develop more *autonomous* robots
 - Need to be able to **reason** and **learn** from experience

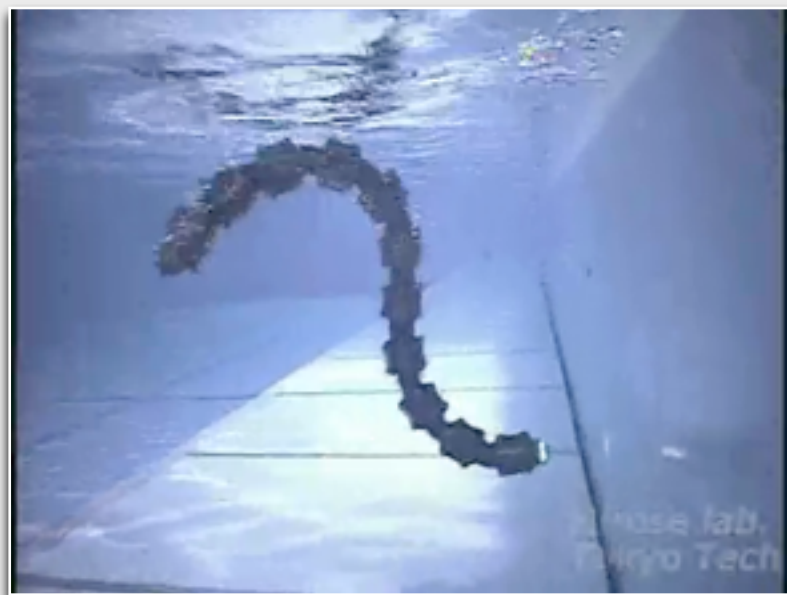


Type of robots

Mobile robots



“Big Dog” from Boston Dynamics



Underwater snake robot, H. Fukushima Lab

Static robots



Kuka robotic arm (LWR Leica T-Mac)

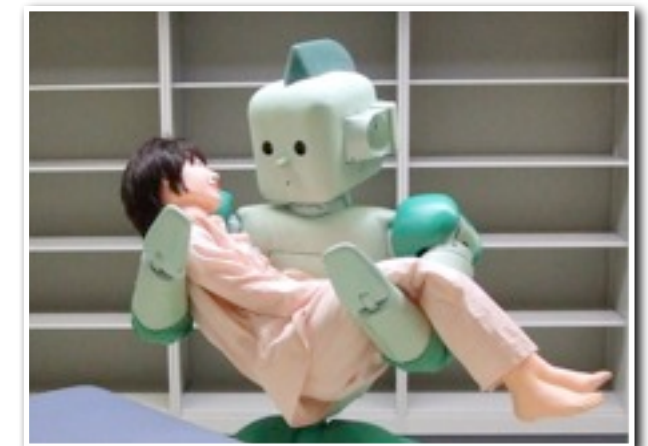
Hybrid robots



Asimo humanoid robot from Honda

What is a *social* robot?

- A *social* robot is a robot with communicative skills
 - Aware of its social context
 - Follows social conventions
- Why is it important?
 - Collaborative tasks between humans and robots
 - Service tasks in social environments



Application domains

- Take care of routine tasks, personal services
- Help the elderly, disabled or mentally impaired persons
- Exploration, search-and-rescue in dangerous areas
- Education, entertainment





Talking robots

- We need robots which can understand **natural language**
 - Especially *spoken* language
 - Most natural way to communicate for humans
 - But also highly complicated!

«Instead of requiring humans to be more *computer-literate*, we should try to build machines which are more *human-literate*»

Human-robot interaction

- Goal: «understand, design and evaluate robotic systems for use by or with humans»
- Fast growing research area!
- Multidisciplinary expertise:
 - Robotics, Artificial Intelligence
 - Cognitive Science, Psychology
 - Computational Linguistics



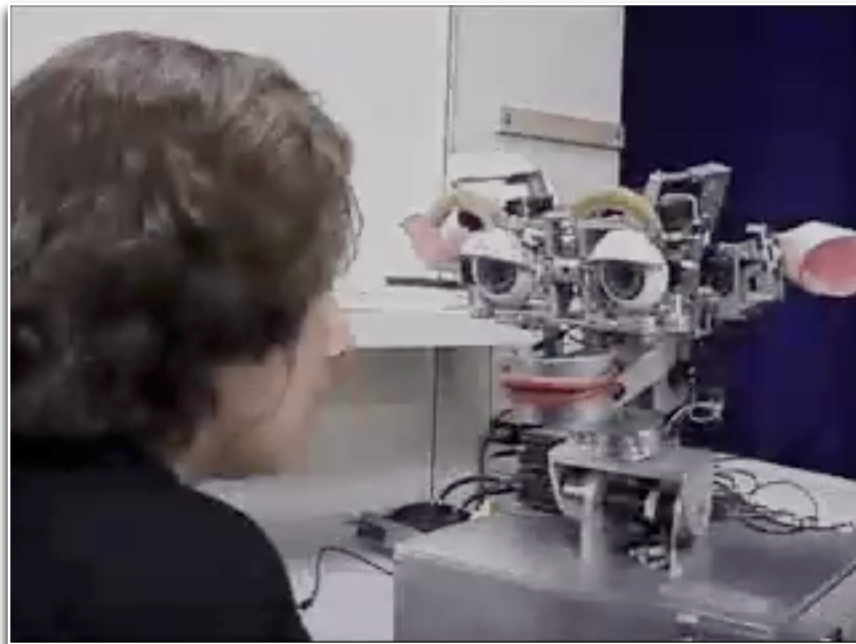
Challenges in HRI

- Need to address many technical problems:
 - Noise, uncertainty in speech recognition and vision
 - *Complex, unstructured* environment
 - Need to adapt to new situations
 - Must react in real time!
- Understanding natural dialogue is difficult!

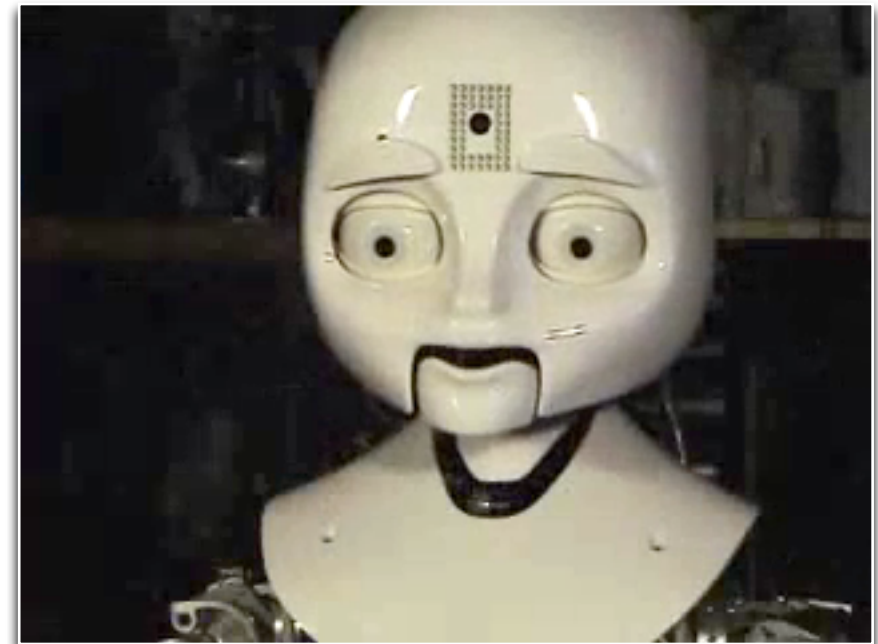


Non-verbal interaction

- Communication is not only verbal
 - Role of gestures, posture, facial display
 - Body language to convey emotions!
- Both understanding & production



Kismet, MIT Media Lab



Dexter, MIT Media Lab

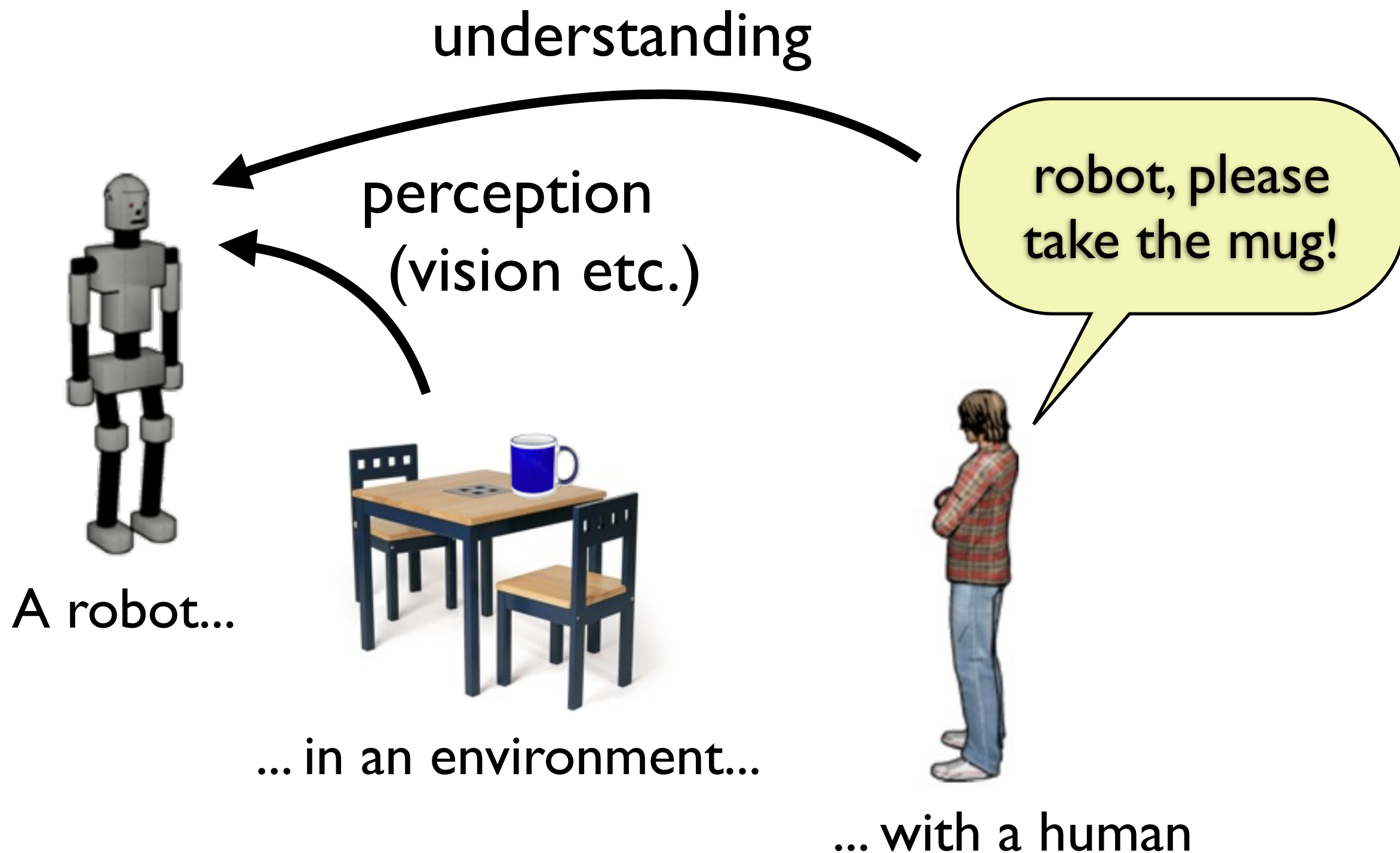
Situated dialogue

- Dialogue with robots is *situated*
 - Shared environment
 - References to entities or events
 - Small-scale or large-scale
 - Past, present or future
- Understanding the context crucial for the interaction



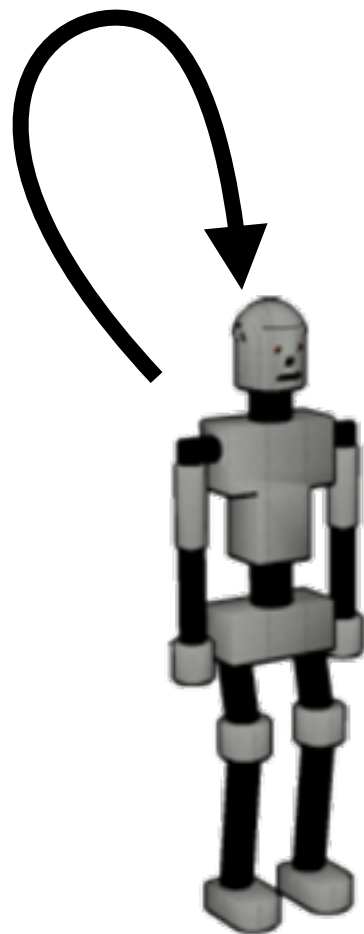
Leonardo: a sociable robot
MIT Media Lab

How it works



How it works

decision/planning



A robot...



... in an environment...



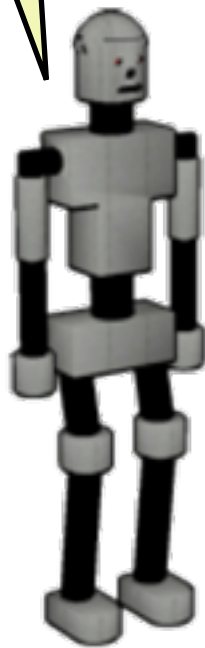
robot, please
take the mug!

... with a human

How it works

sure, I'll do it
right away!

communication



A robot...

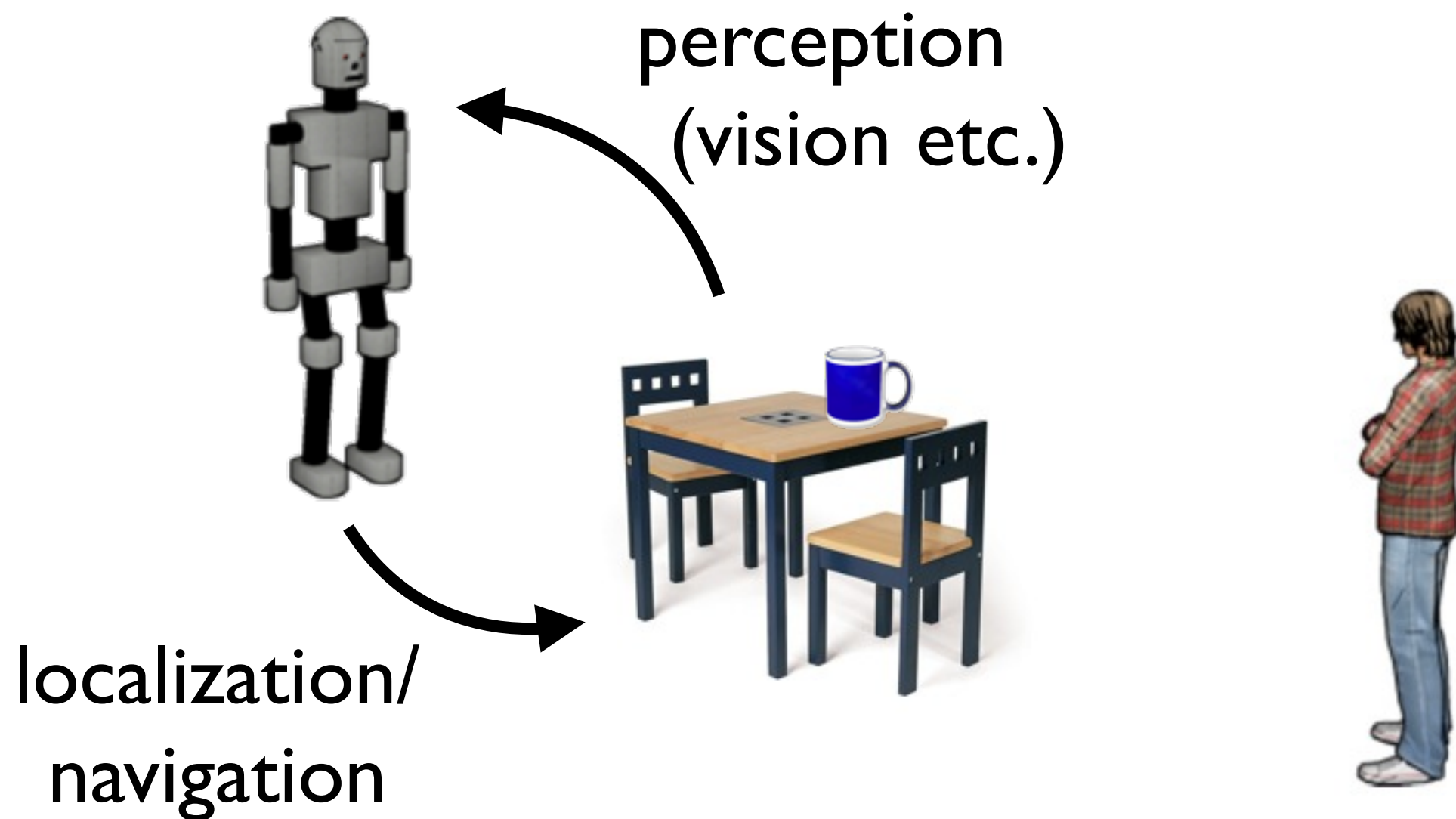


... in an environment...

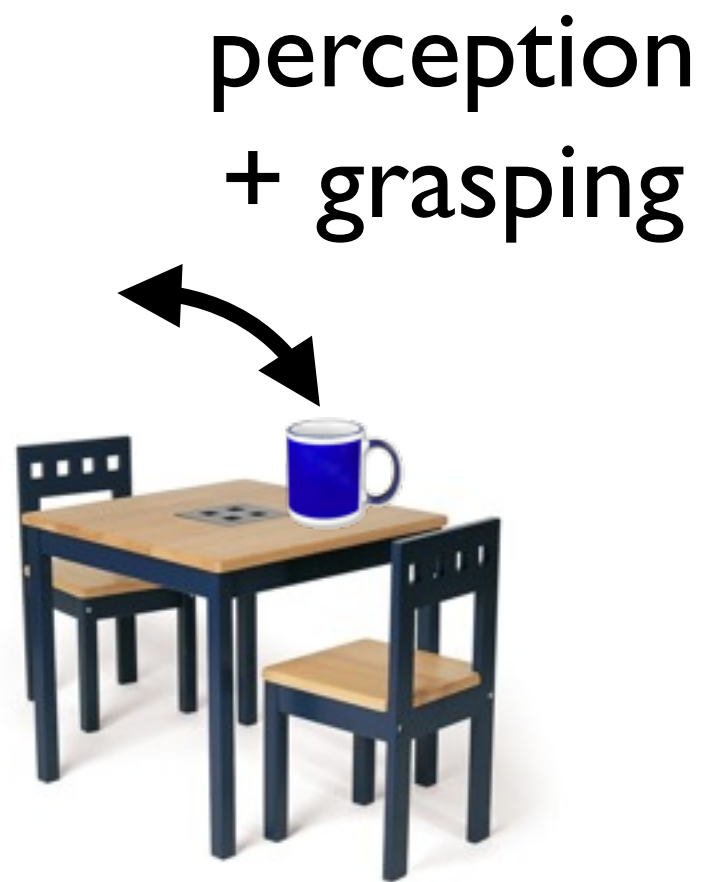
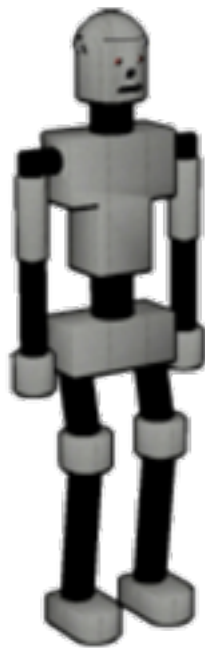


... with a human

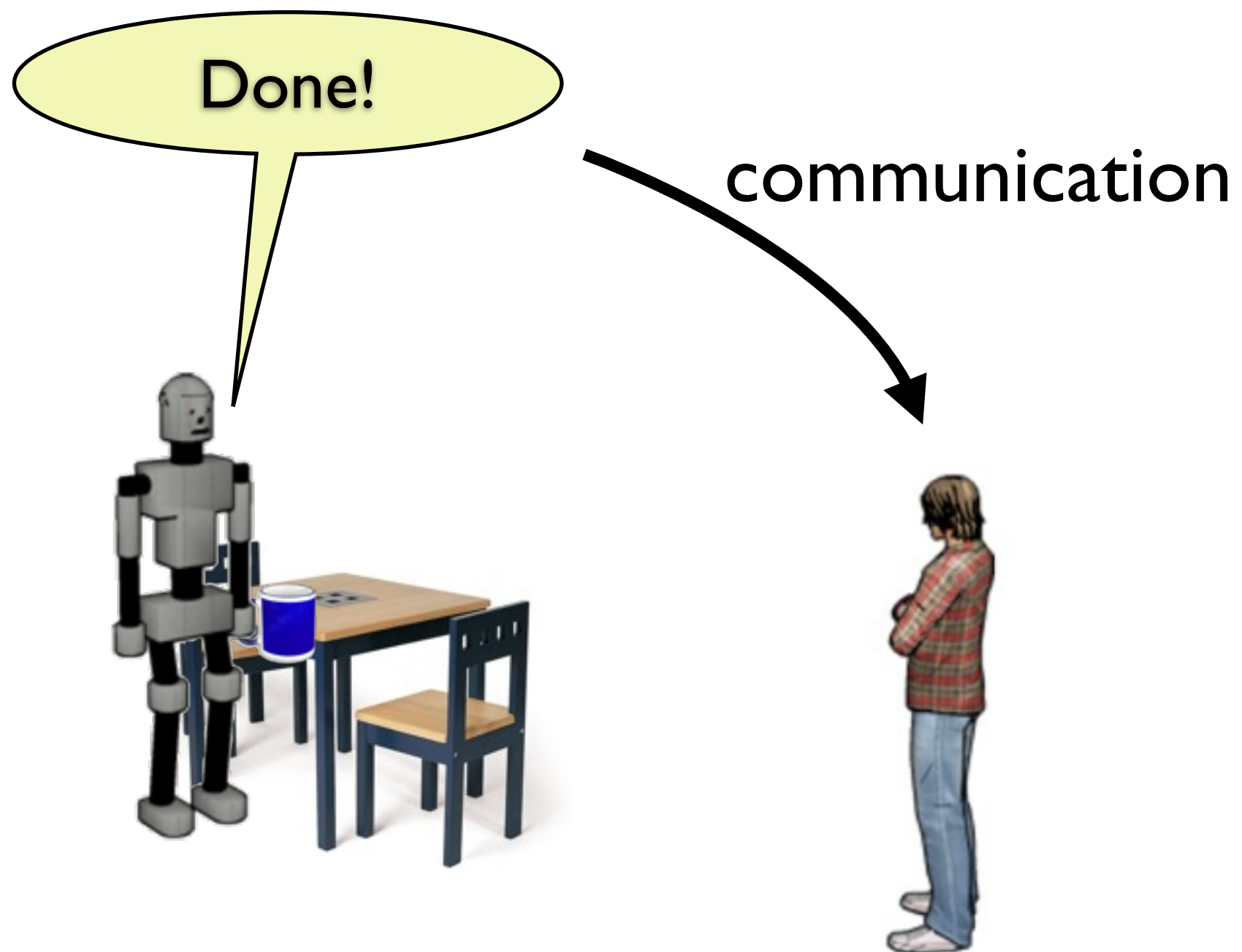
How it works



How it works



How it works



Nao demonstration



- Nao is small humanoid robot
- Fully programmable
- Many sensors & motors
- Used for our research in human-robot interaction