

Human-Aware Robots

R. Chatila
LAAS-CNRS
Toulouse, France
Raja.Chatila@laas.fr

<http://www.laas.fr/~raja>
<http://www.cogniron.org>



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**A robot
Companion**



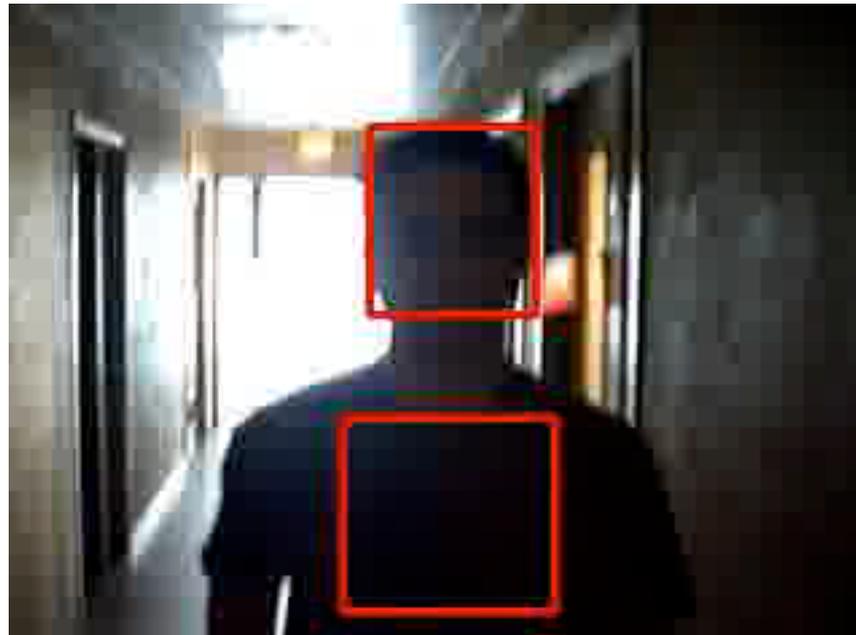
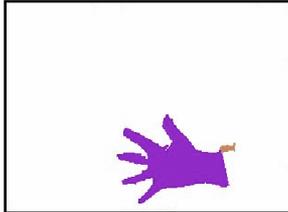
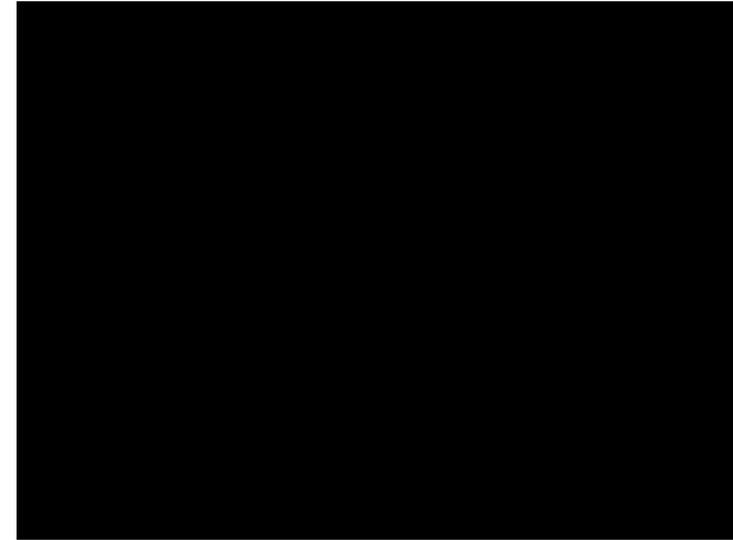
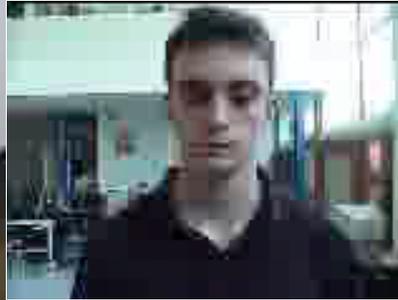
Robot companions interact closely with people

- Robots companions must be:
 - Safe
 - Legible
 - Predictable
 - Acceptable
 - Make people feel at ease
 - Able to adapt to human user
 - ...
- How to answers these requirements?
 - Code of conduct - ethics- deeply embedded in robot operation.
 - Robots must understand what humans expect and how they behave

Understanding Humans: human models

- Physiology
 - Geometrical model (shape, constraints)
 - Kinematic model (speed, acceleration)
 - Perceptual capacities, field of view
 - Workspace
- Activity
 - Postures
 - Gestures
 - Actions
- Psychology
 - Social spaces
 - Comfort
 - Acceptability
 - Expressions and emotions
- User-Specific

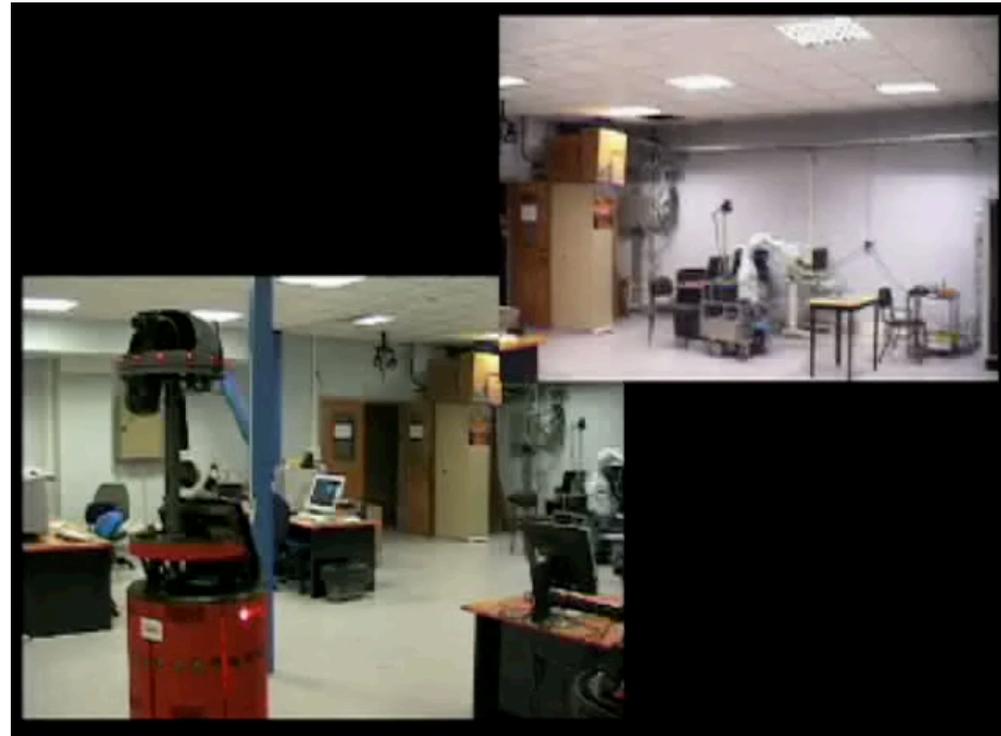
Detecting and tracking faces and gestures



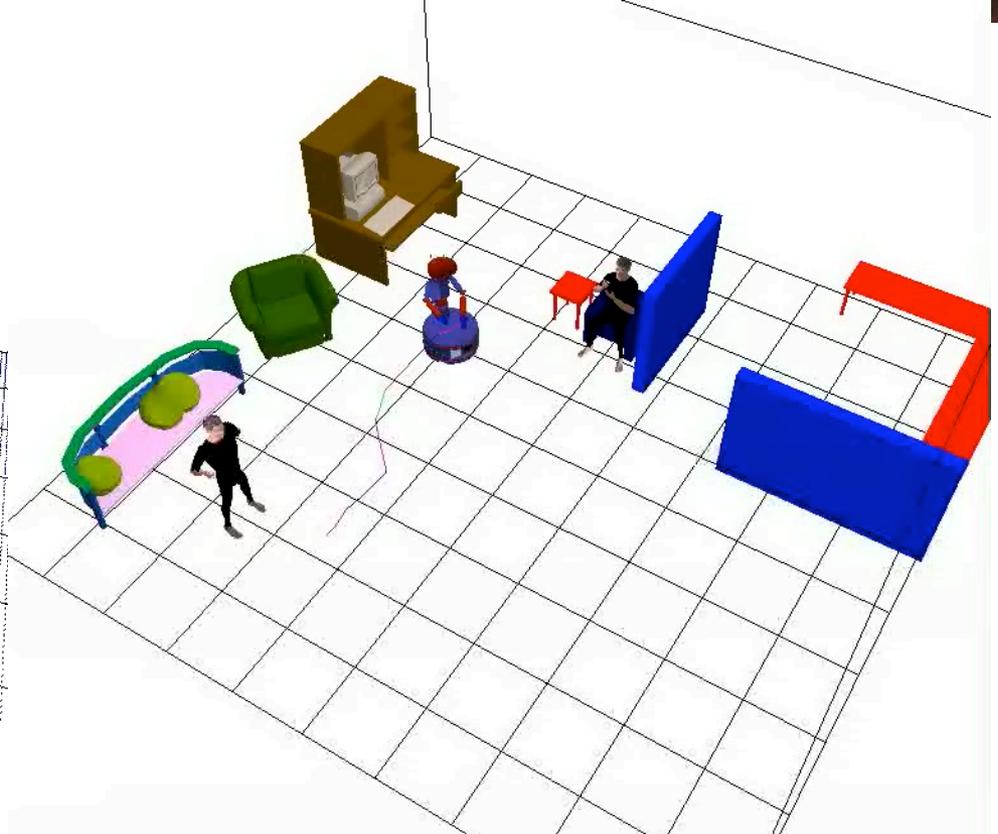
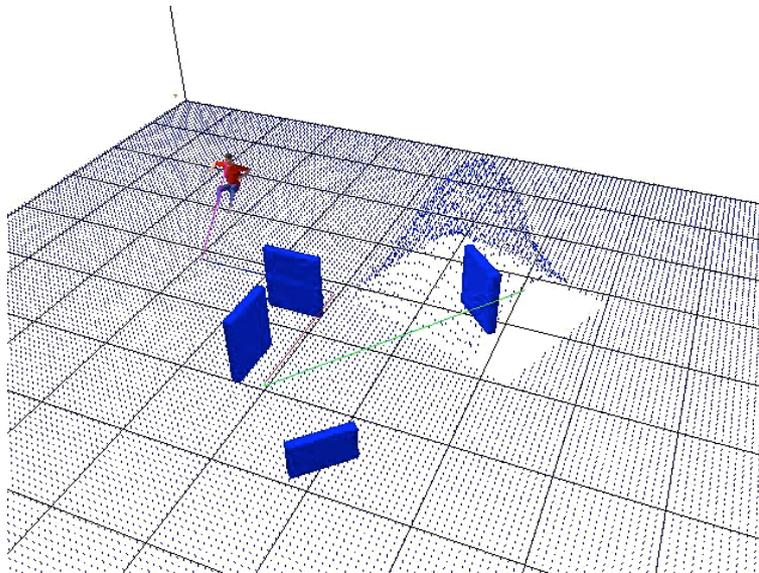
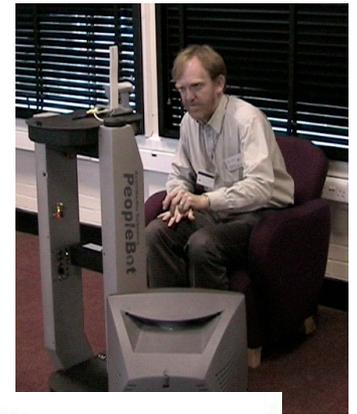
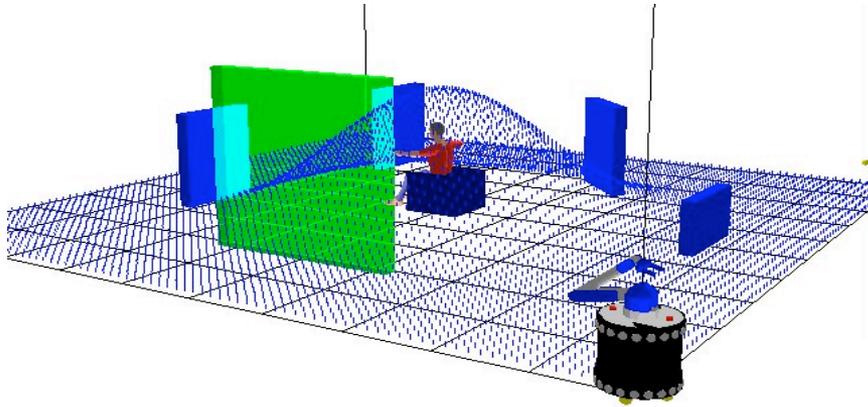
Understanding human actions



Detecting, Recognizing and Understanding People



Human safety and Preferences



Humans are not
"yet another obstacle"

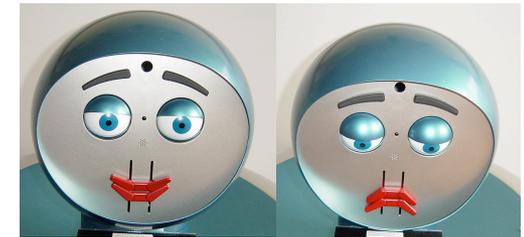
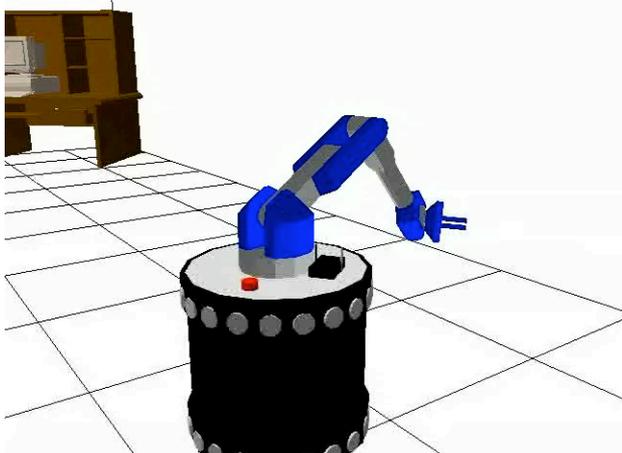
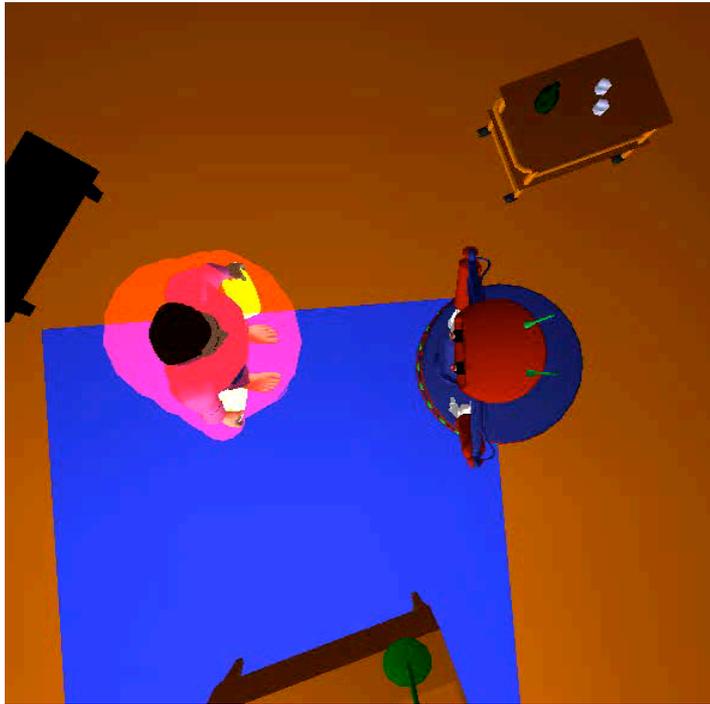


Standard obstacle avoidance

Human Aware Navigation



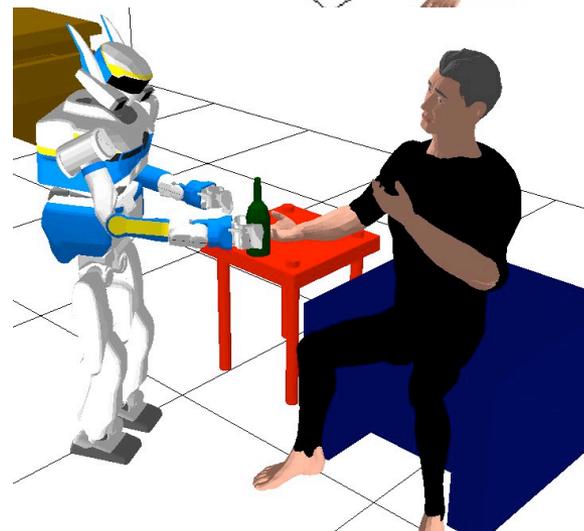
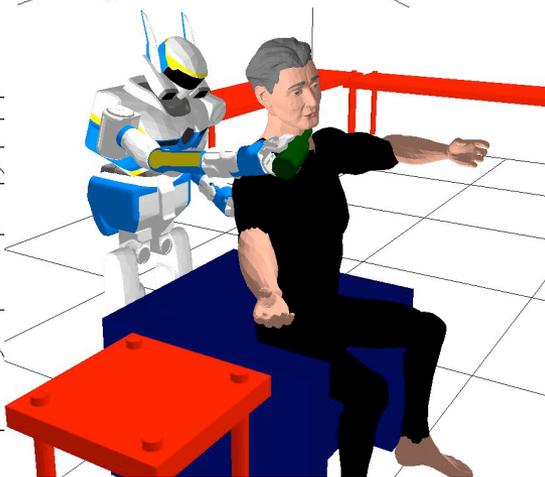
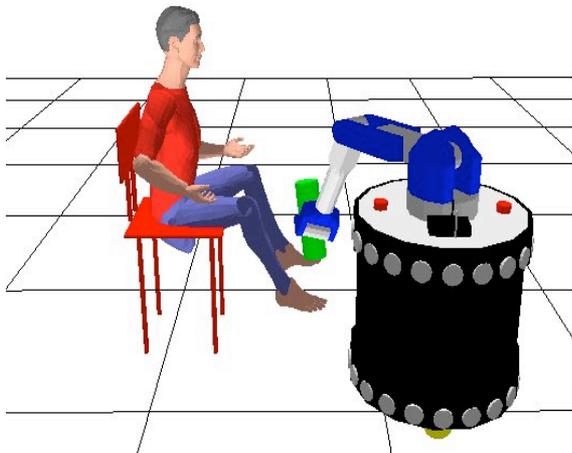
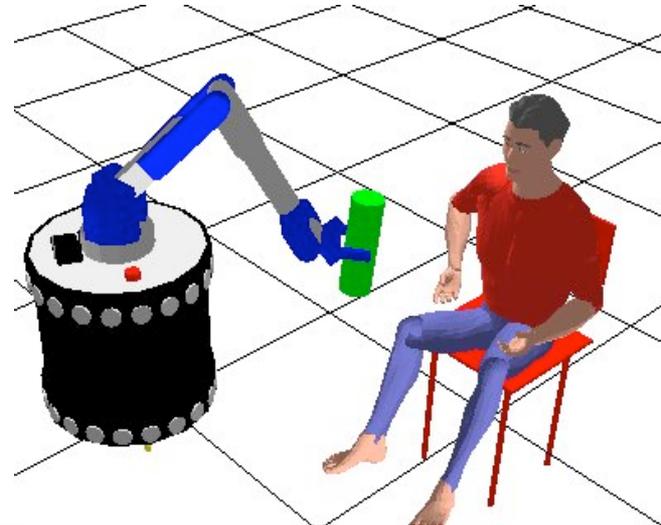
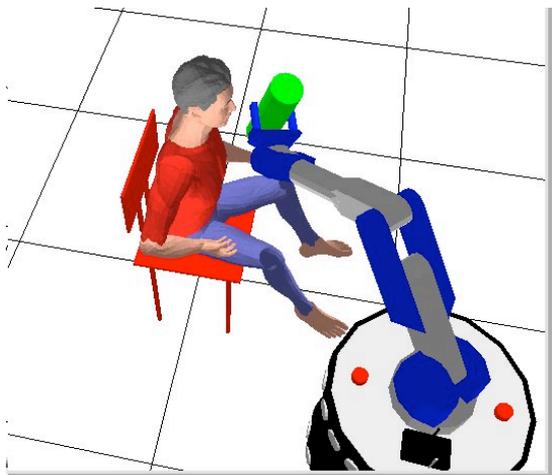
Interacting closely with People



User studies (U. Hertfordshire)

Expressiveness
(Lino - Philips)

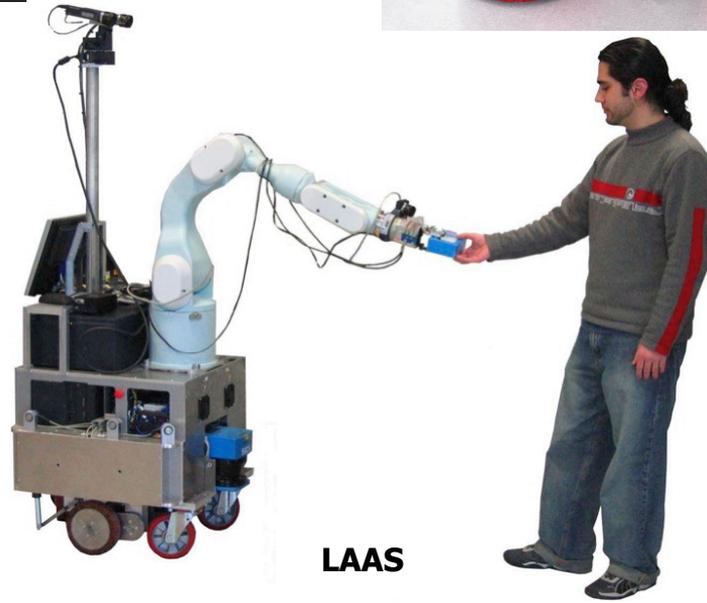
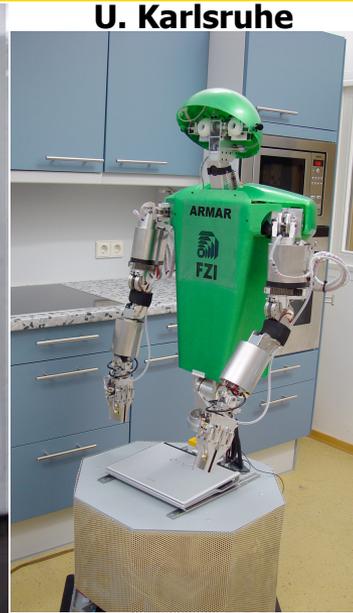
How to hand an object to a person?



Not acceptable placements and Movements

Acceptable placements and Movements

Acceptability: Does shape matter?



How much have robots to know about humans?

- Improved quality of interaction and service
 - Recognizing human state
 - Reasoning on human abilities
 - Keeping to expectations
 - ...

- But...
 - ... Is it acceptable that they know too much?