KNOWLEDGEABLE
SERVICE ROBOTS
FOR AGING

KSERA: smart robots in care applications

Raymond H. Cuijpers
Human Technology Interaction
Eindhoven University of Technology
The Netherlands

Overview

- The KSERA approach
- The KSERA system
- Results from field trials
- Key Enablers

KSERA approach

Addressed Needs of COPD patients

- Improve self-management
- Support timely regulation of ventilation in home
- alarms in case of emergencies
- decrease/substitution of nurse visits in the home
- social inclusion

Method

- Field trials and user-centred design

Objectives

- Integrating smart homes, domotics & social robots
- Developing metrics for assessing QoL and well-being
- Ethical guidelines for SARs in AAL context
- Natural human-robot interaction

KSERA approach

Personas

- Catherine a senior single female (GOLD I stage: undiagnosed),
- Robert & Pauline a senior couple (GOLD 0),
- Mary a senior single female with moderate COPD (GOLD II: intermediate),
- Joseph a senior single male with severe COPD (GOLD III: severe), and
- Theo a senior married male with very severe COPD (entering GOLD IV stage).

KSERA Approach

Prototype 2 (COPD GOLD I,2)

- Scenario 1: Healthy through indoor exercise + Disease self-management
  - Need for motivation to do health exercise
  - Need for regular assessment of physical state
  - Easy to use system that comes to the user
- Scenario 2: Video communication + disease self-management
  - Need for Easy way to call for help & communication with medical authorities
- Scenario 3+4: Environmental measurements
  - Need for regular updates on air quality in/outdoors
- Scenario 5: Accept phone call while playing music

KSERA system

Ceiling camera

Wearable projector

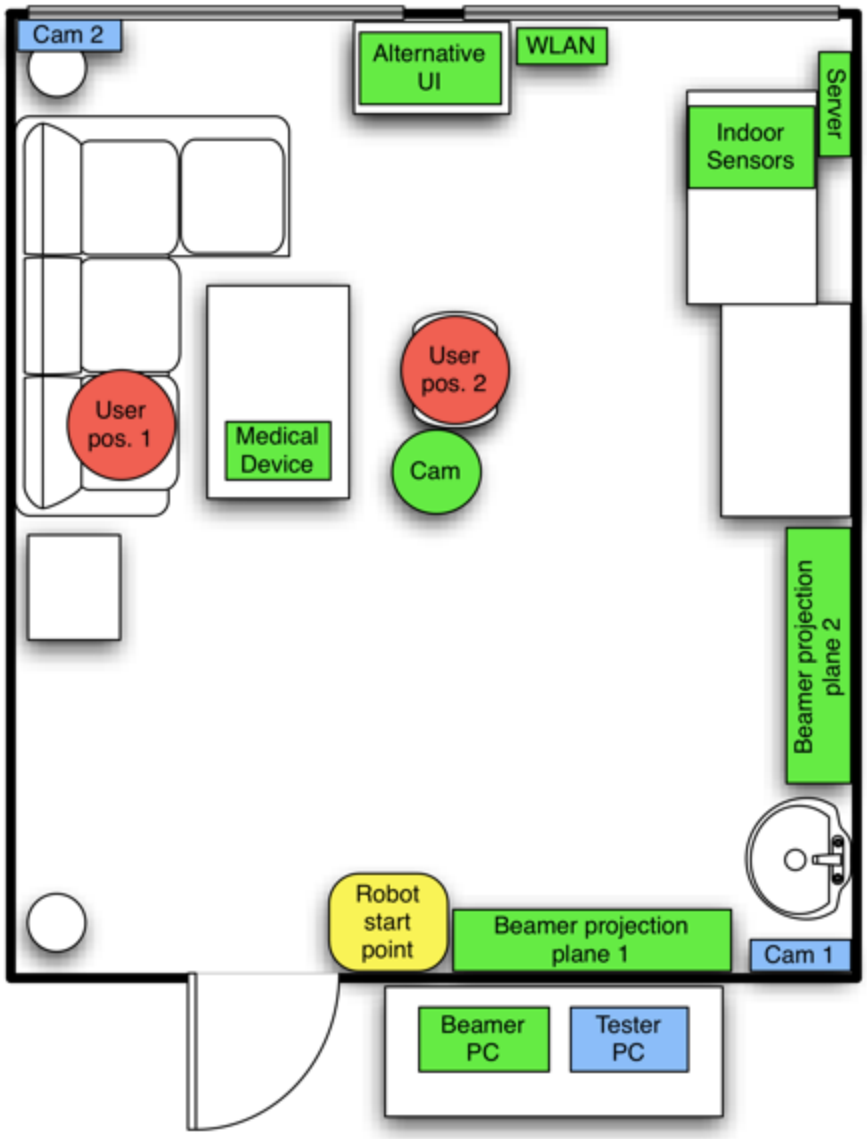
KSERA Intelligent Server

Medical Devices

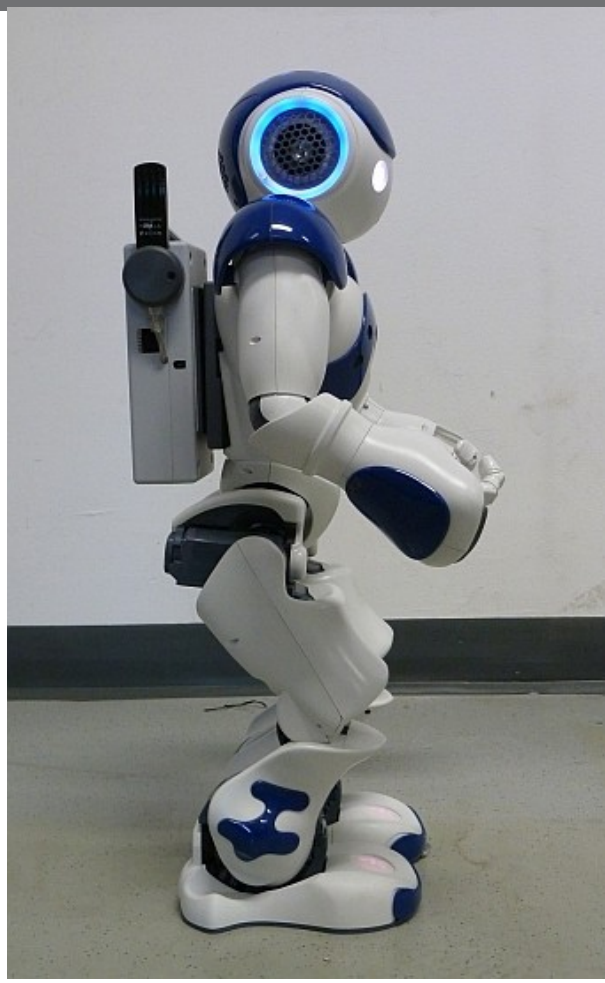
Domotic platform

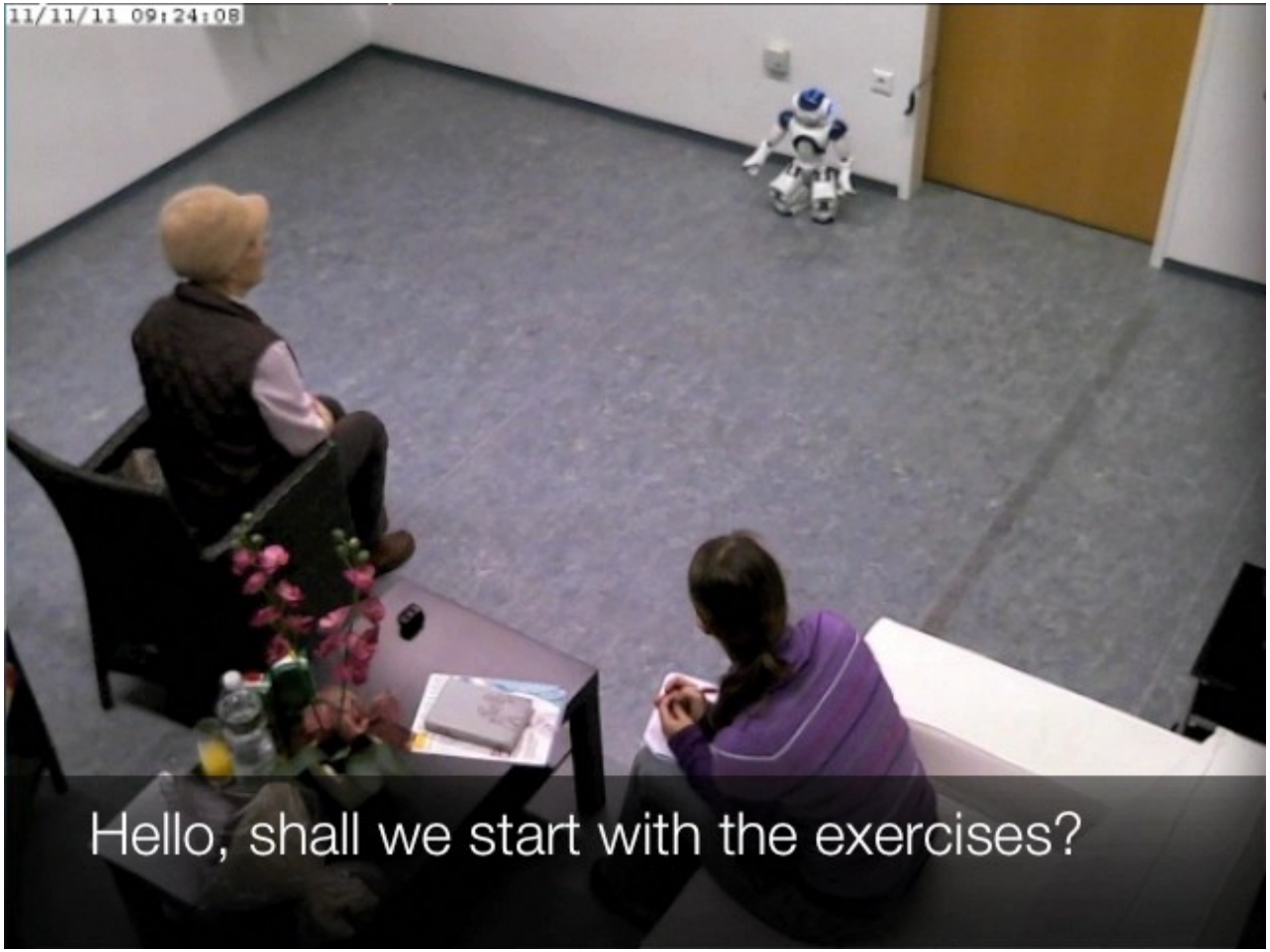
Technische Universiteit Eindhoven University of Technology

KSERA system



KSERA system




11/11/11 09:24:08
Hello, shall we start with the exercises?

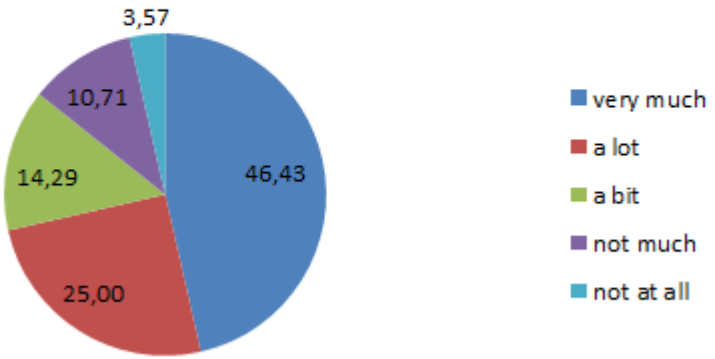
KSERA Results

Metrics & Ethical guidelines

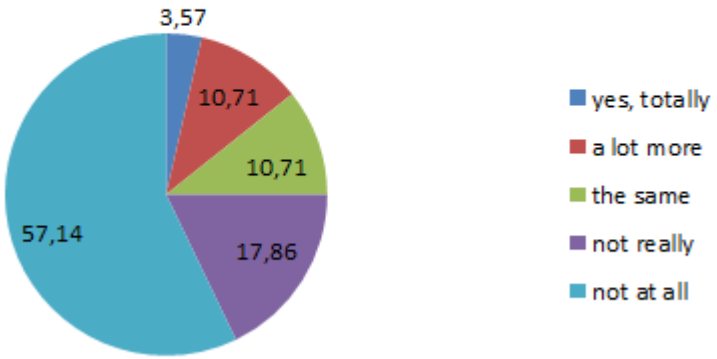
- KSERA extends existing metrics (Raltec, Austria)
  - WHO QoL, PANAS, CCQ COPD questionnaire
  - User related System performance
  - Social acceptance and social impact
  - Human Robot Interaction
    - Attitude towards robots (Godspeed questionnaire, Bartneck et al. 2009)
    - Psychophysical performance measures
- Ethical guidelines (Marjo Rauhalla, TUW, Austria)
  - Support for project partners working with real people
  - Policy of data collection
  - Safety of a robot for the person, Liability
- Ethical Advisory Board
  - Ofra Golan, Martin Peterson, Heidrun Mollenkopf

Results from field trials

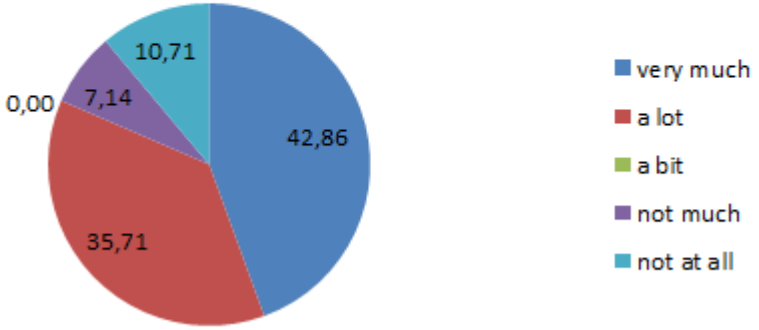
NAO motivates me to do the excercise...



NAO motivates me more than a human trainer...



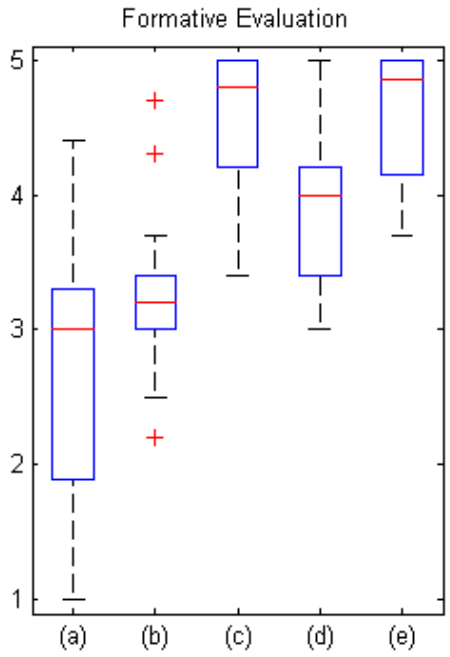
NAO motivates me more than a standard trainings plan...

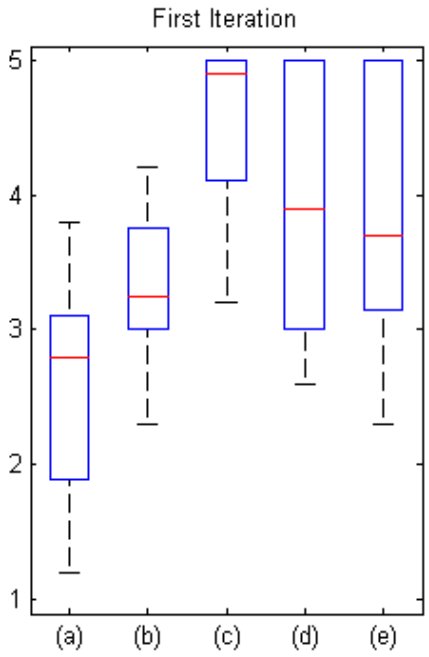


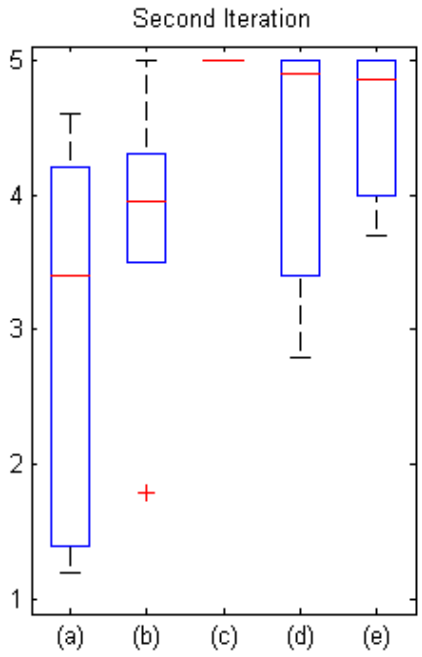
Technische Universiteit Eindhoven University of Technology

Gopdspeed HRI scale

- (a) – Antropomorphism
- (b) – Animacy
  (c) – Likability
- (d) – Perceived Intelligence
- (e) – Perceived Safety



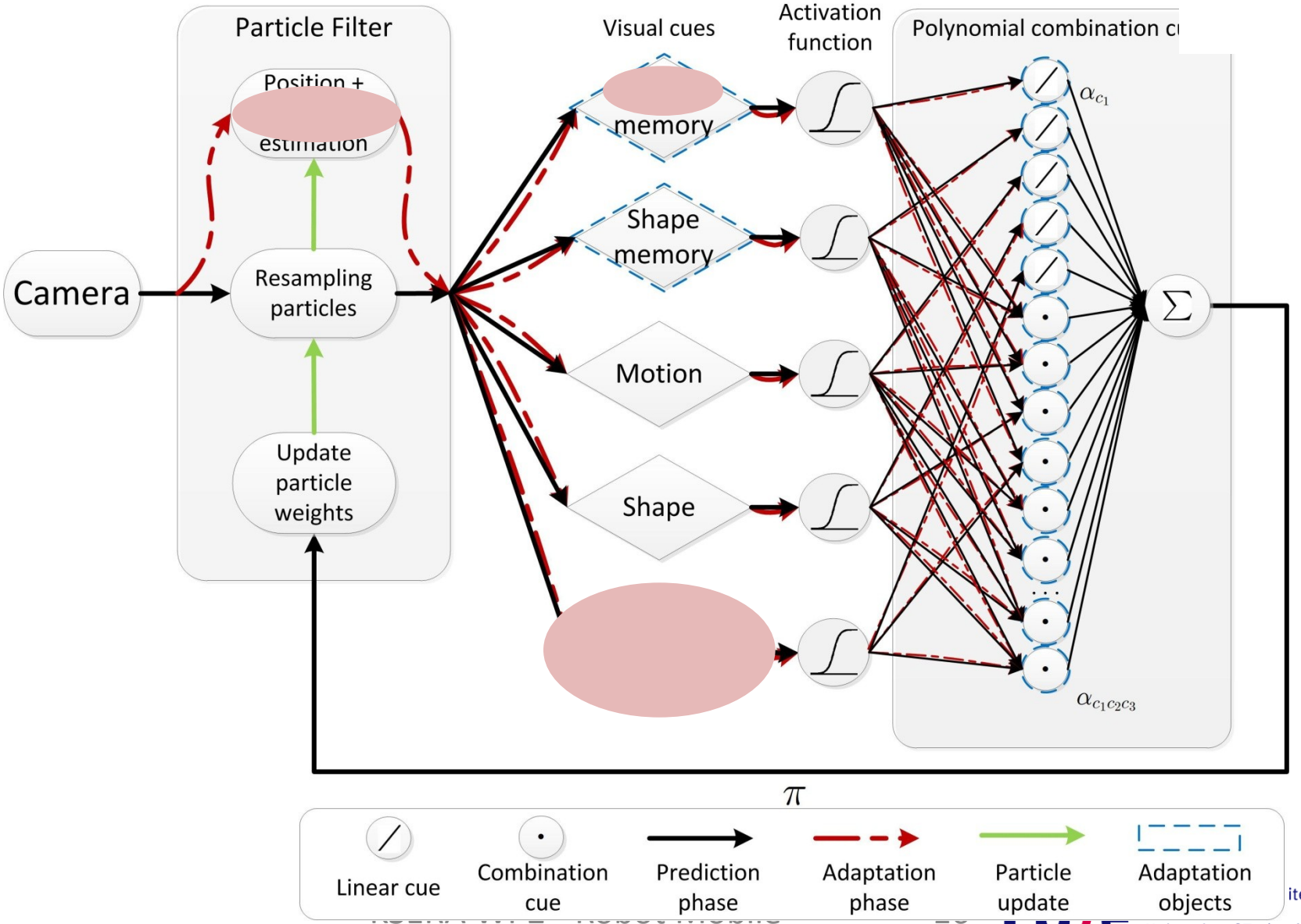




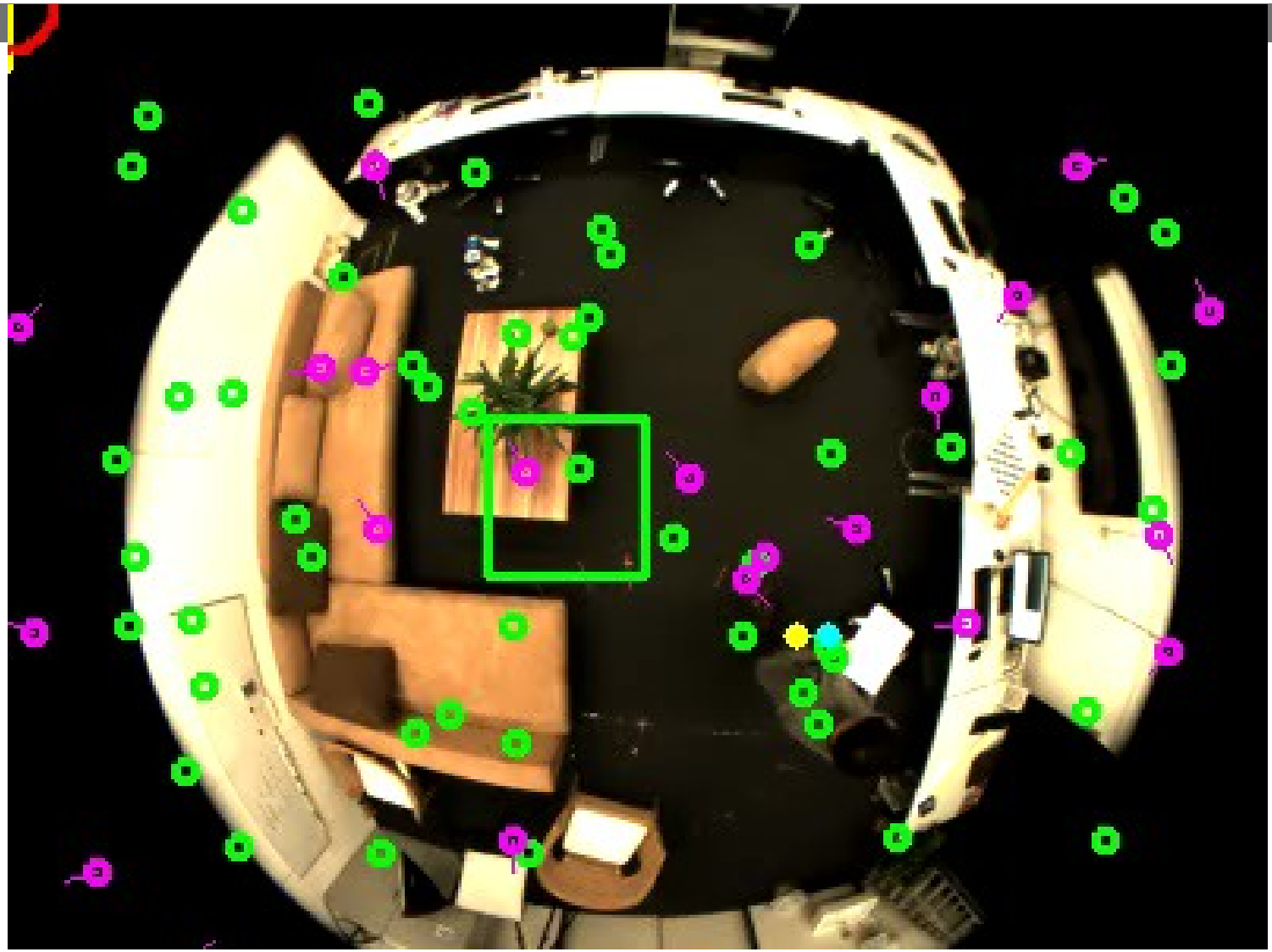
Key Enablers

- Natural Human Robot Interaction
  - Locating a person
  - Model for personal space for approaching
  - Head pose estimation for eye contact
  - Combining speech with gestures and facial leds
  - Mobile video communication
- Advanced Care System (Hadas Lewy, Maccabi, IL)
- Novel ICT solutions (Mikhail Simonov, ISMB, IT)

Person Localisation

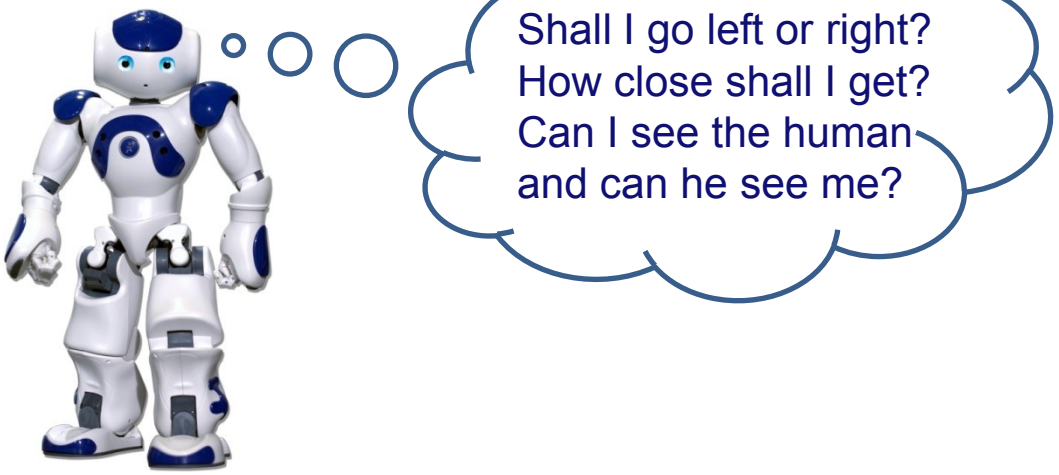


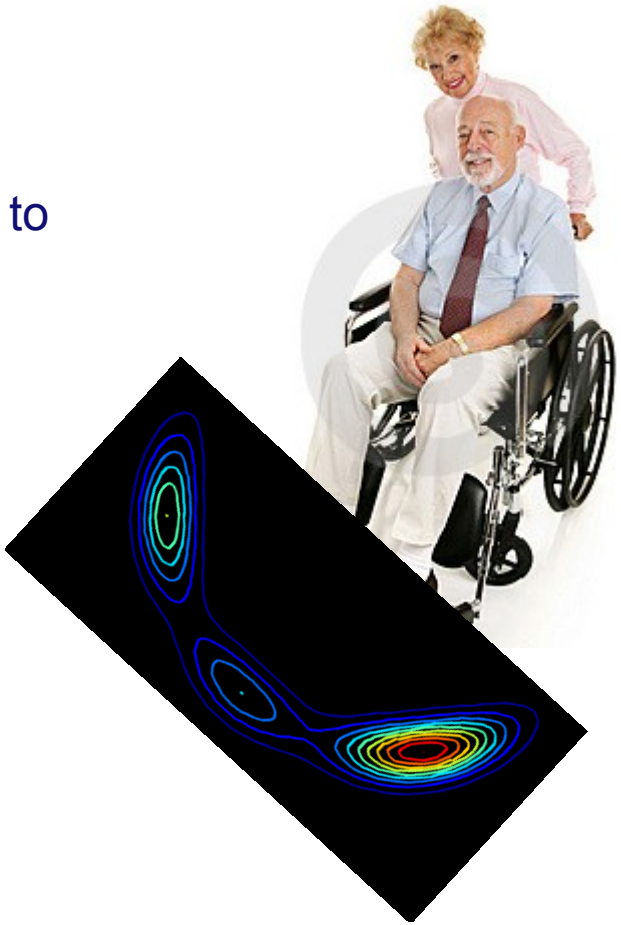
Person Localisation



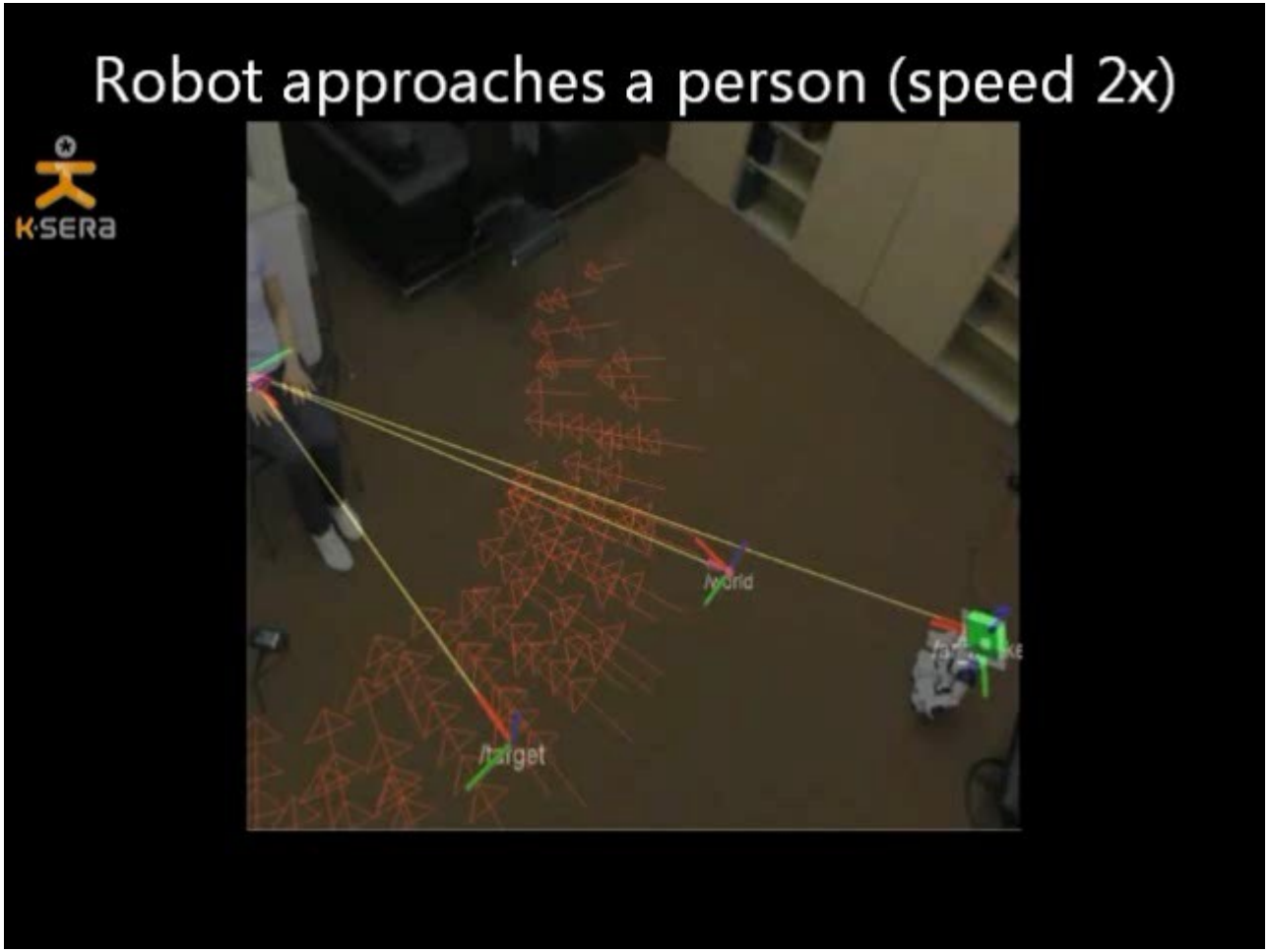
Personal Space

- **Personal Space**
  A social convention that defines a region of space around individuals as personal
- **Direction of Encounter**
  The preferred direction from which a person would like to be addressed
- **Feasibility of interaction**
  The region of space where interaction is feasible





Personal Space



Head pose estimation

- **Eye contact**

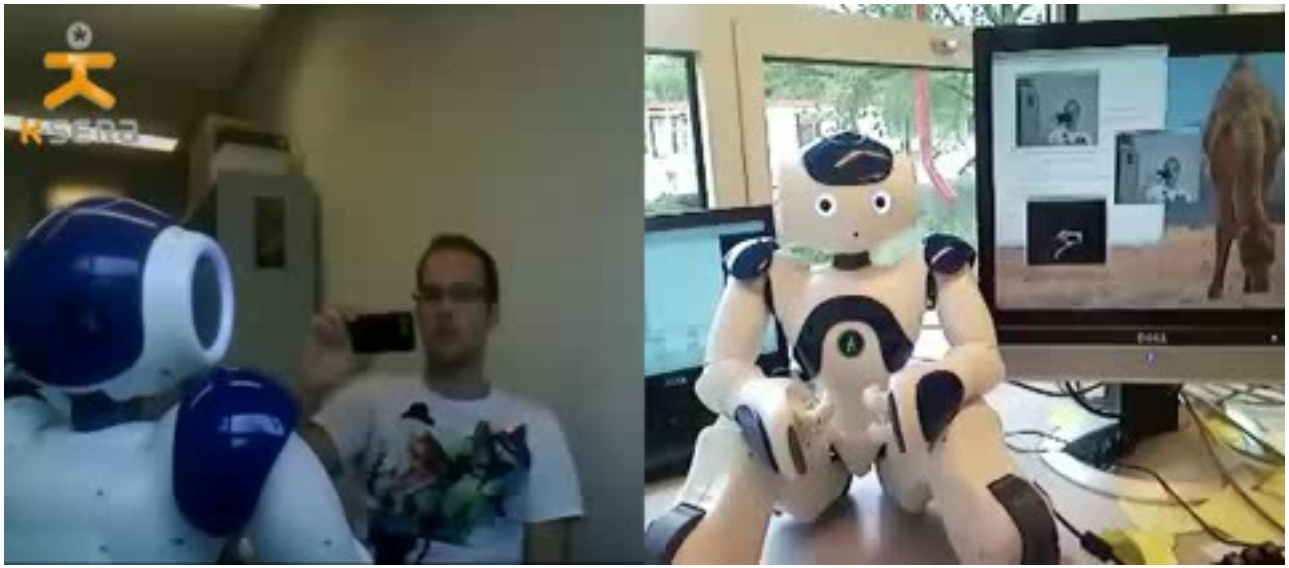
A social convention that shows when someone is paying attention

- **Feasability/Timing of interaction**

Delivering a message is only useful when person is attending

- **Natural behaviour**

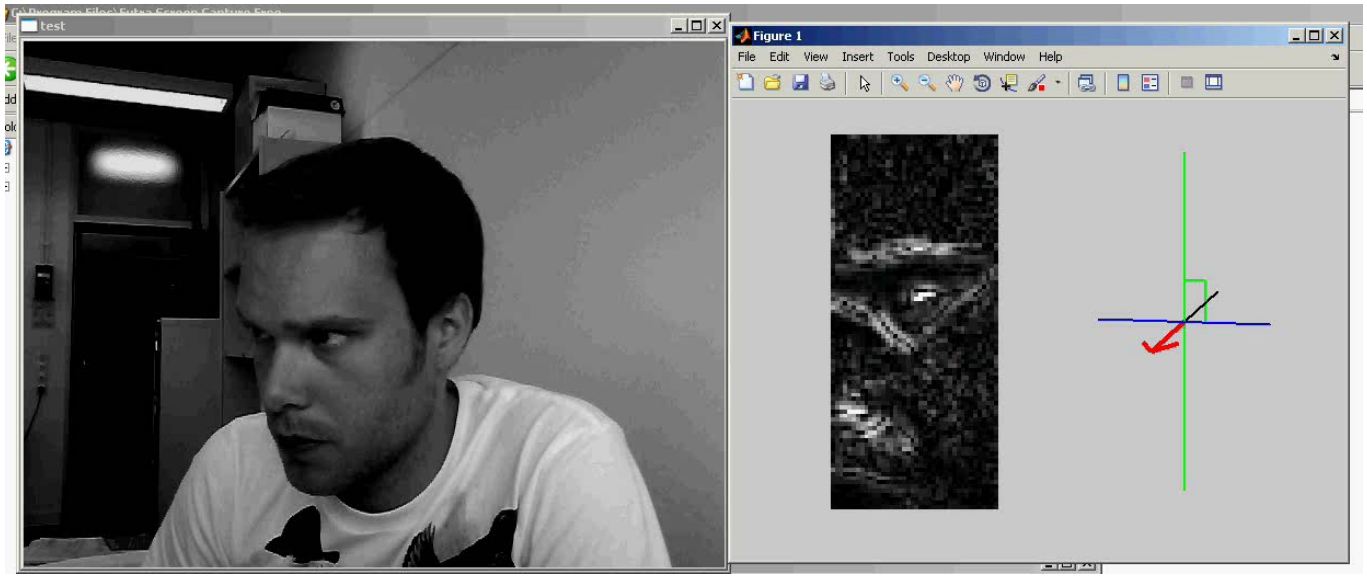
Facilitates understanding and improves user acceptance



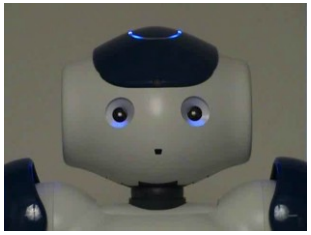
Head Pose Estimation

- Head pose estimation allows the robot to judge whether a person is looking at it

Camera stream | **Transformed frame (input)** | **Pose (output)**

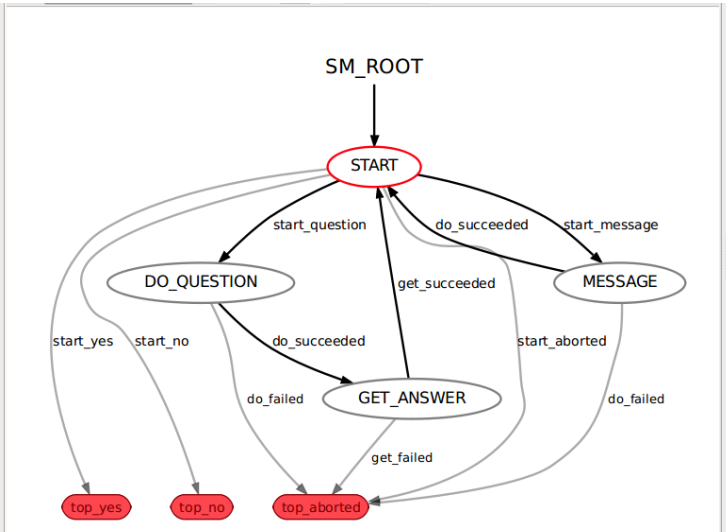


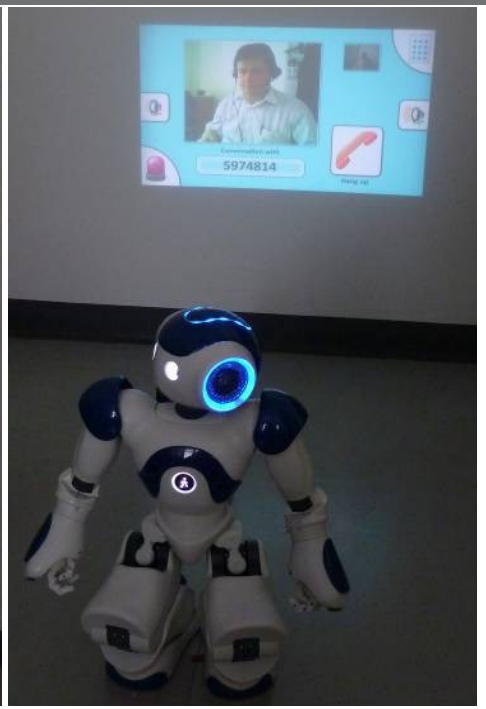
Dialog Management system



Sad

Annoyed




5974814


sip26


Conversation with
sip26
Hang up

Summary

- People like the robot
- Personal space model works very well
- Eye contact is a very powerful cue enabling natural robot behaviour
- Embodied systems are liked more, but people are not faster
- Attracting attention works best with non-visual/auditory cues. Gesturing is preferred, eye contact is least preferred

Conclusions

- There is a growing need for socially assistive technology
- Robotic assistence has a huge potential, …
- … but there are still many issues
  - A thorough understanding of human-human interaction
  - Capabilities that are natural for a human being, are absent in machines like Nao.
- KSERA provided first steps on the way toward intelligent and effective care solutions performed by robots

Thank you for your attention!

Videos:

www.ksera-project.eu

www.youtube.com/user/kseraproject

The KSERA project has received funding from the European Commission under the 7th Framework Programme (FP7 ICT-2009.7.1 ICT & Ageing) for Research and Technological Development under grant agreement n°2010-248085.

Technische Universiteit Eindhoven University of Technology