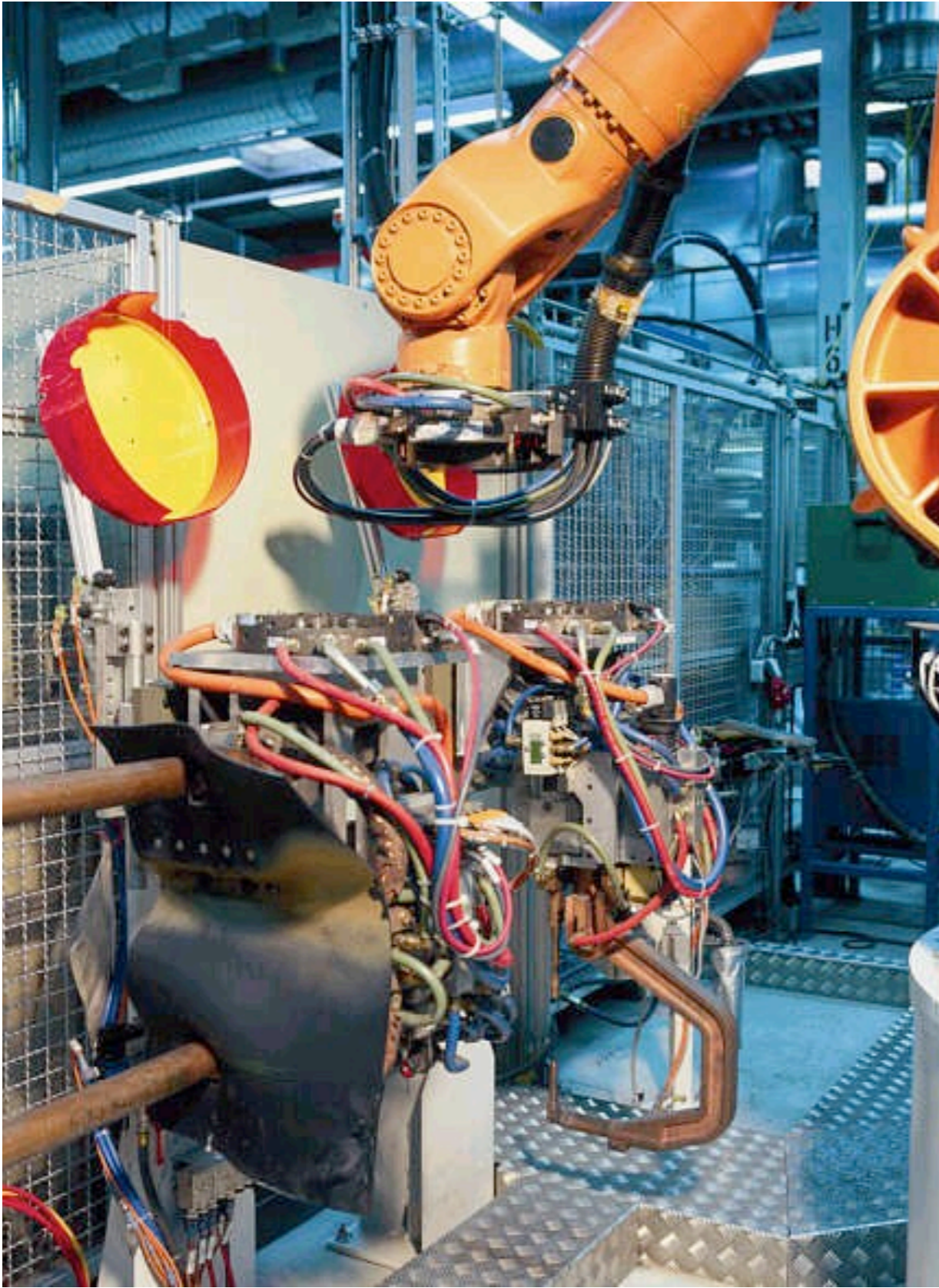


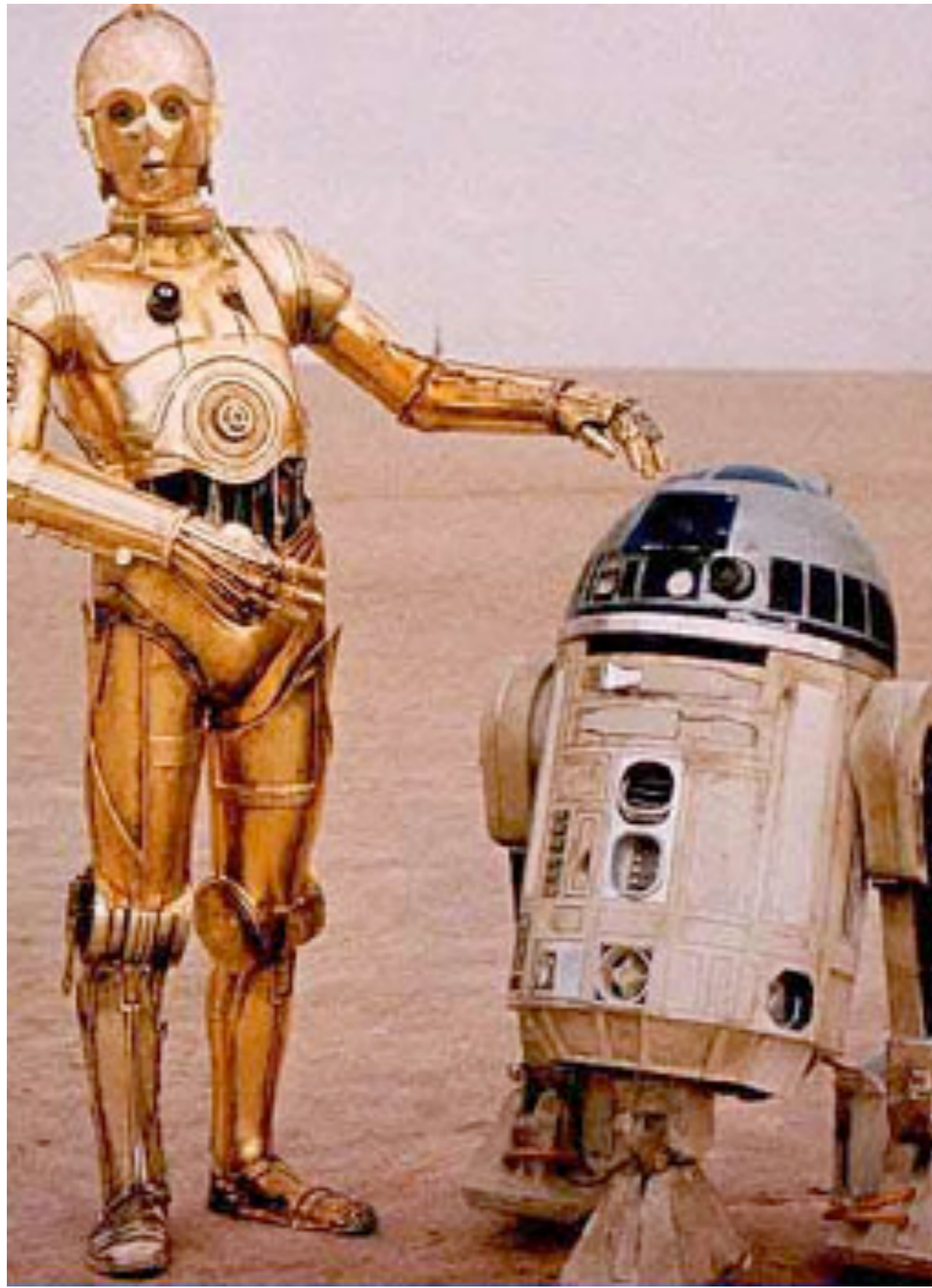
# Studying human-robot interaction (HRI)

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Dr. Selma Sabanovic  
Assistant Professor of Informatics

March 22, 2010  
I399

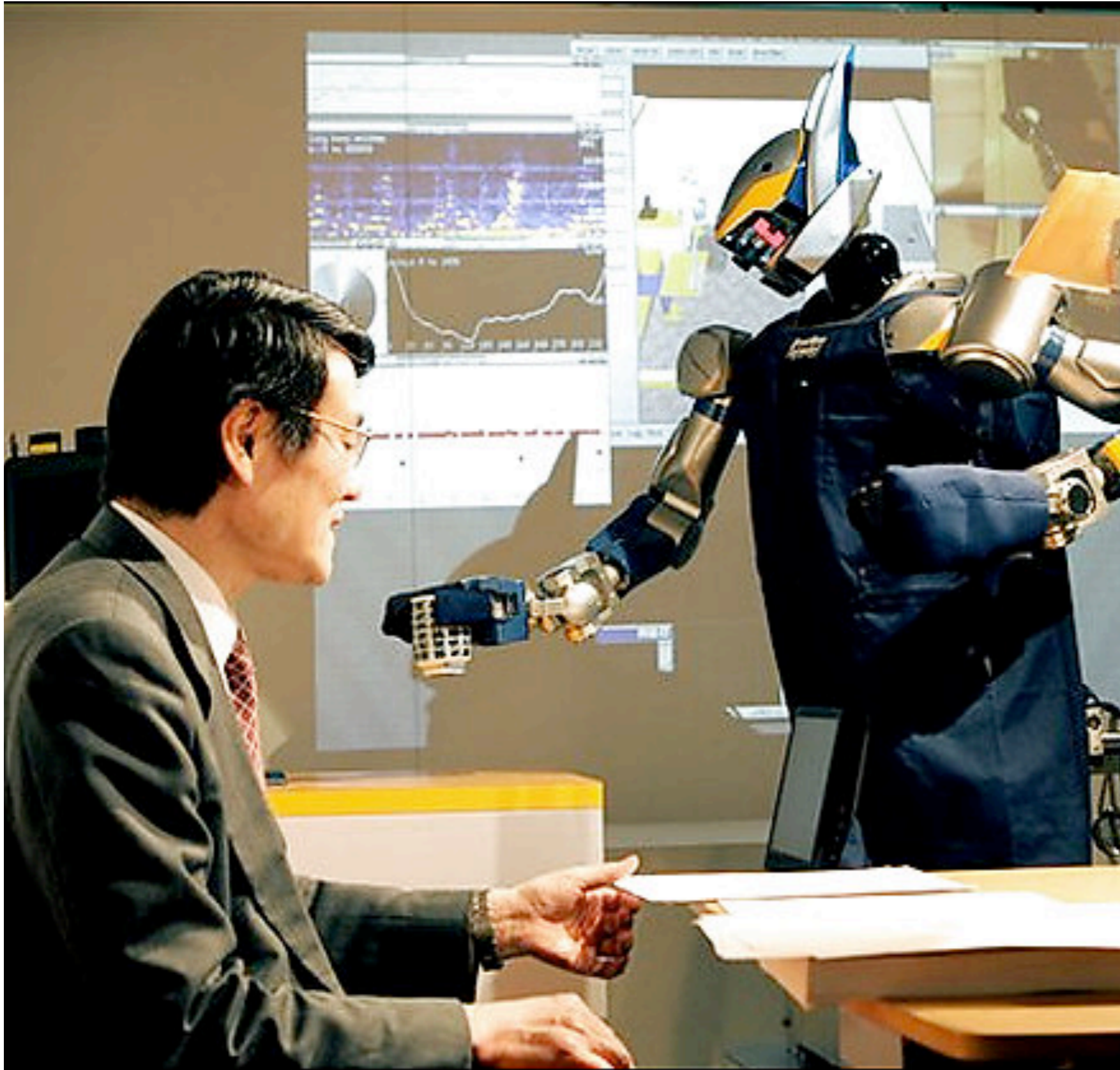




Robots as friends



“A robot in every home”  
(Gates 2007)



Robots as assistants & companions

# Social robots are part of society

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- People prefer to interact with robots like they do with other people.
- Robots should recognize and produce common human interactive behaviors.
- Robots as social actors can fulfill new roles as companions, caretakers, “natural” interaction partners, and mediating interfaces between humans and increasingly complex socio-technical environment we inhabit.

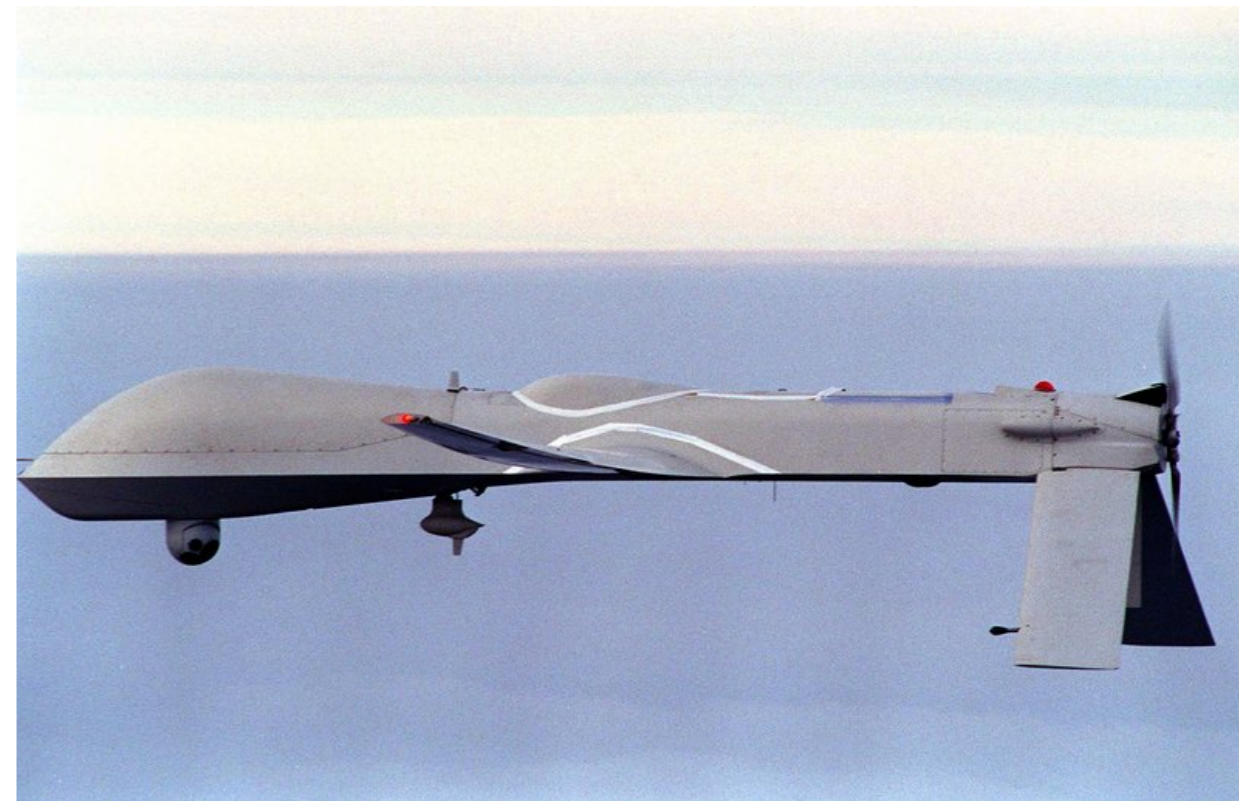


# HRI is a new theme in robotics

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- Technologies that can coexist and collaborate with humans in everyday environments
- Technologies that no longer function merely as tools, doing things *for* humans; they function as “relational” artifacts that do things *with* and *to* us (Turkle 2006)
- Technologies that have an intimate and personal impact on our lives





Teleoperation: being here and there





Robot as social interface



Robot as social actor



Robots as social  
mediators



Robots as persuasive machines

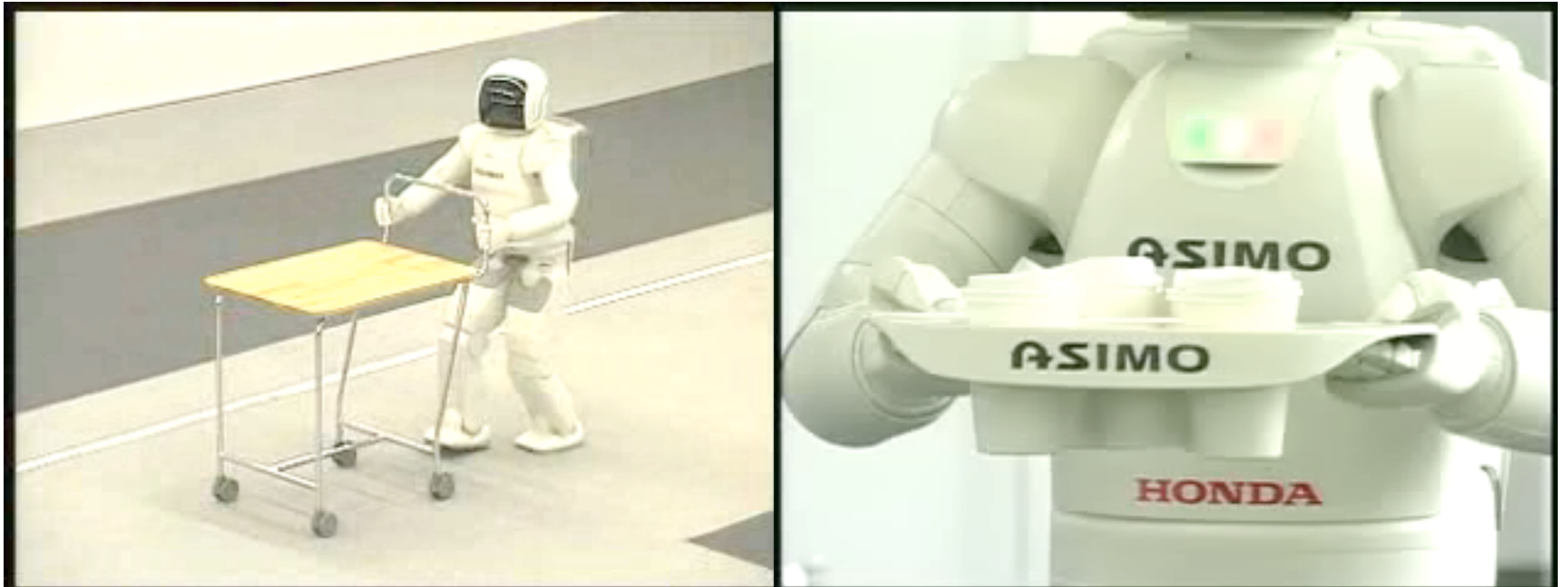
# From embodied action to embodied interaction

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(Videos from Honda website: <http://www.hondanews.com/categories/1085/videos/>)

# From embodied action to embodied interaction

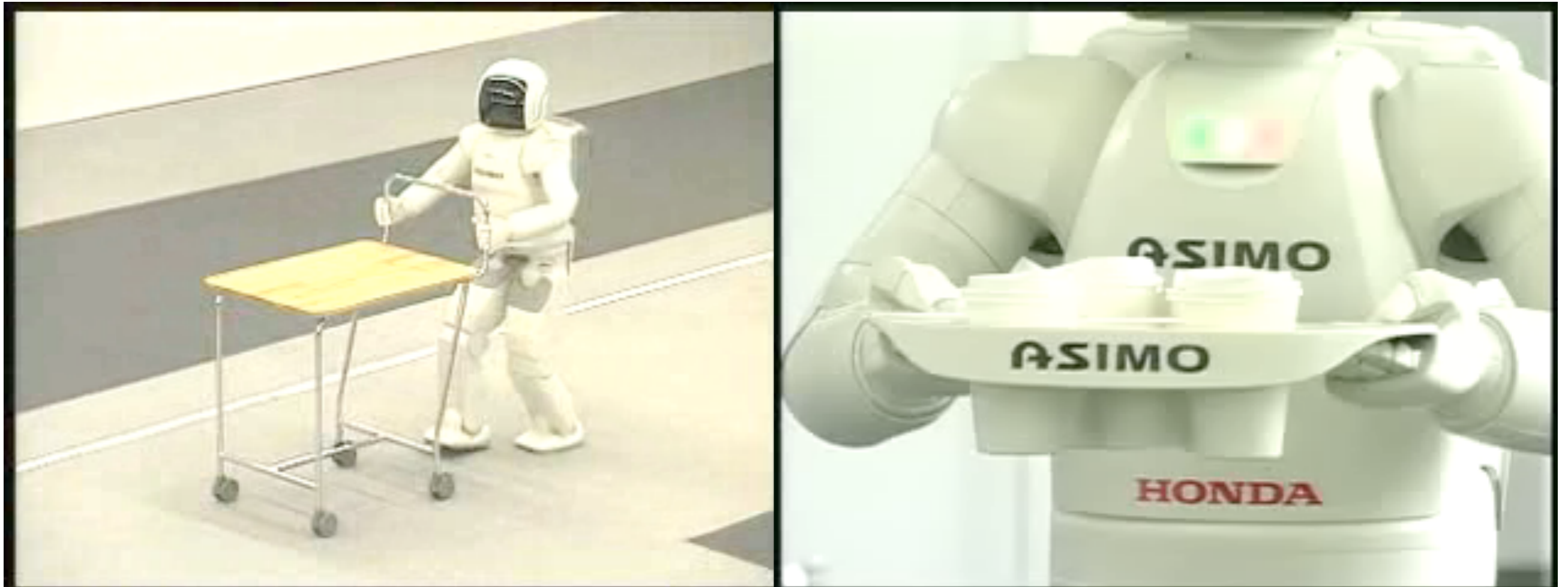
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# From embodied action to embodied interaction

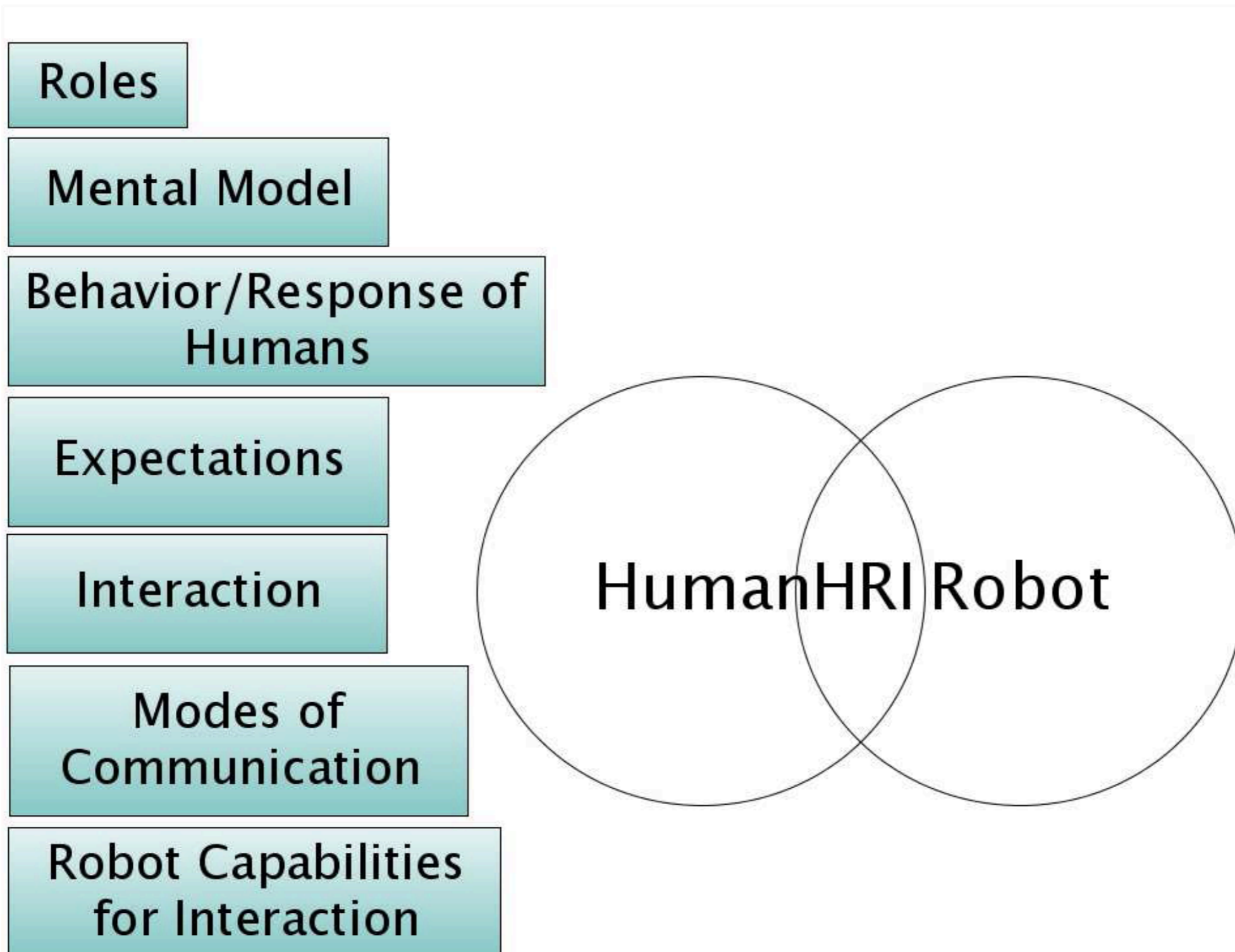
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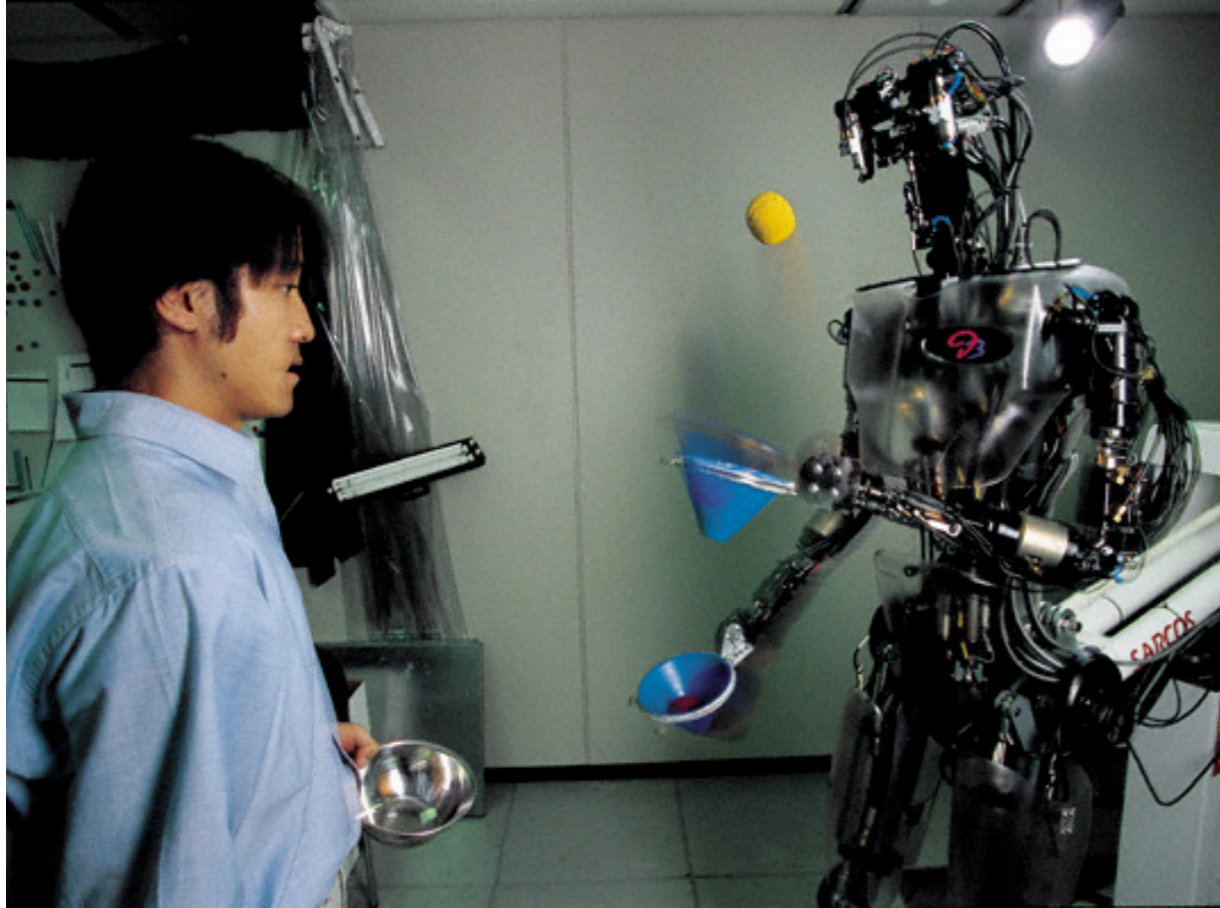
(Videos from Honda website: <http://www.hondanews.com/categories/1085/videos/>)

# Looking at humans and robots as part of an interactive system

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Learning about human behavior & cognition



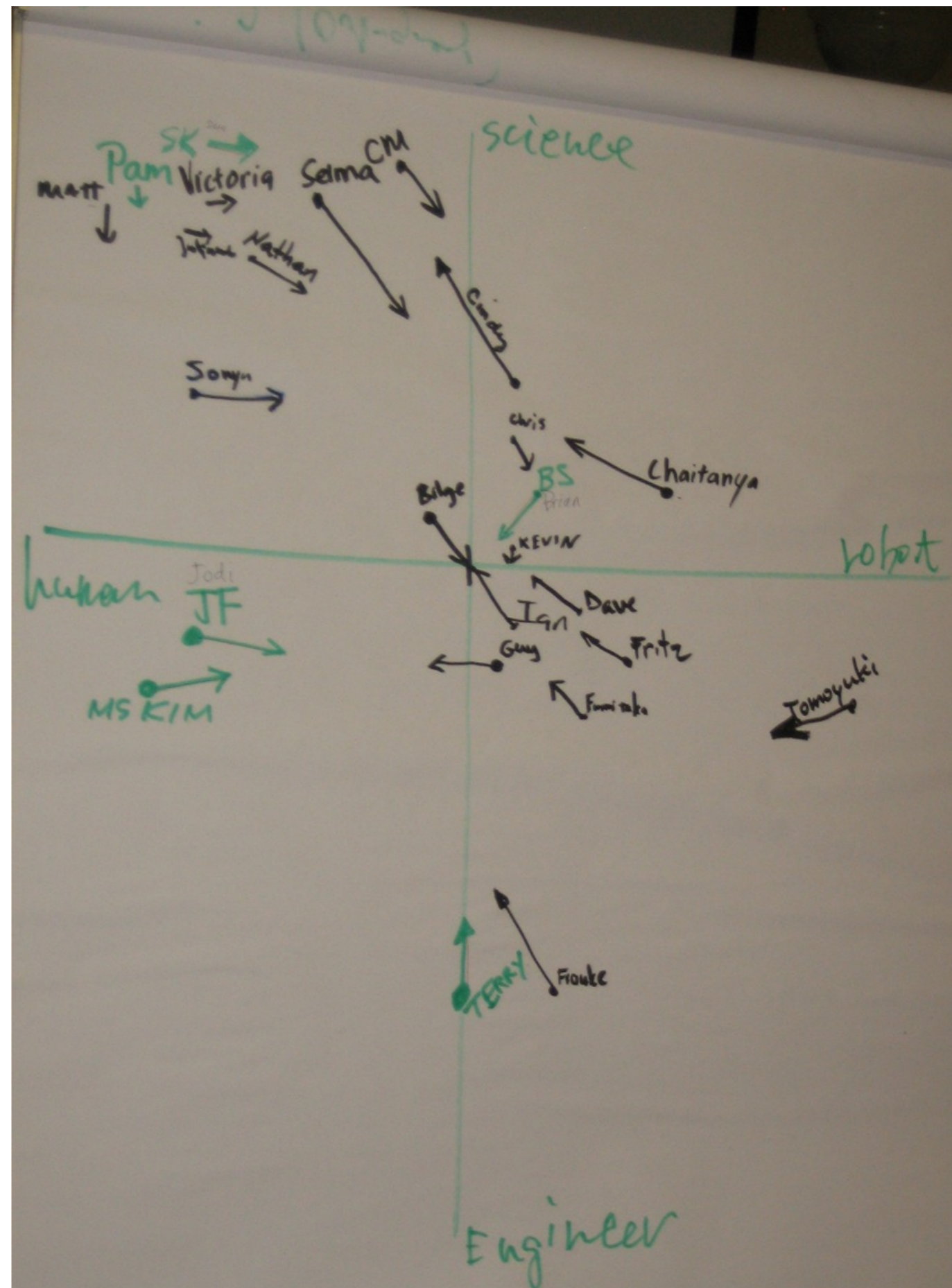
Understanding how people make sense of technology

Designing socially assistive technologies

Subjects of inquiry in social HRI

# “Hybrid science”

Problem-based inquiry that traverses disciplinary boundaries; deals with social as well as technical questions.



# 日本ロボット学会誌



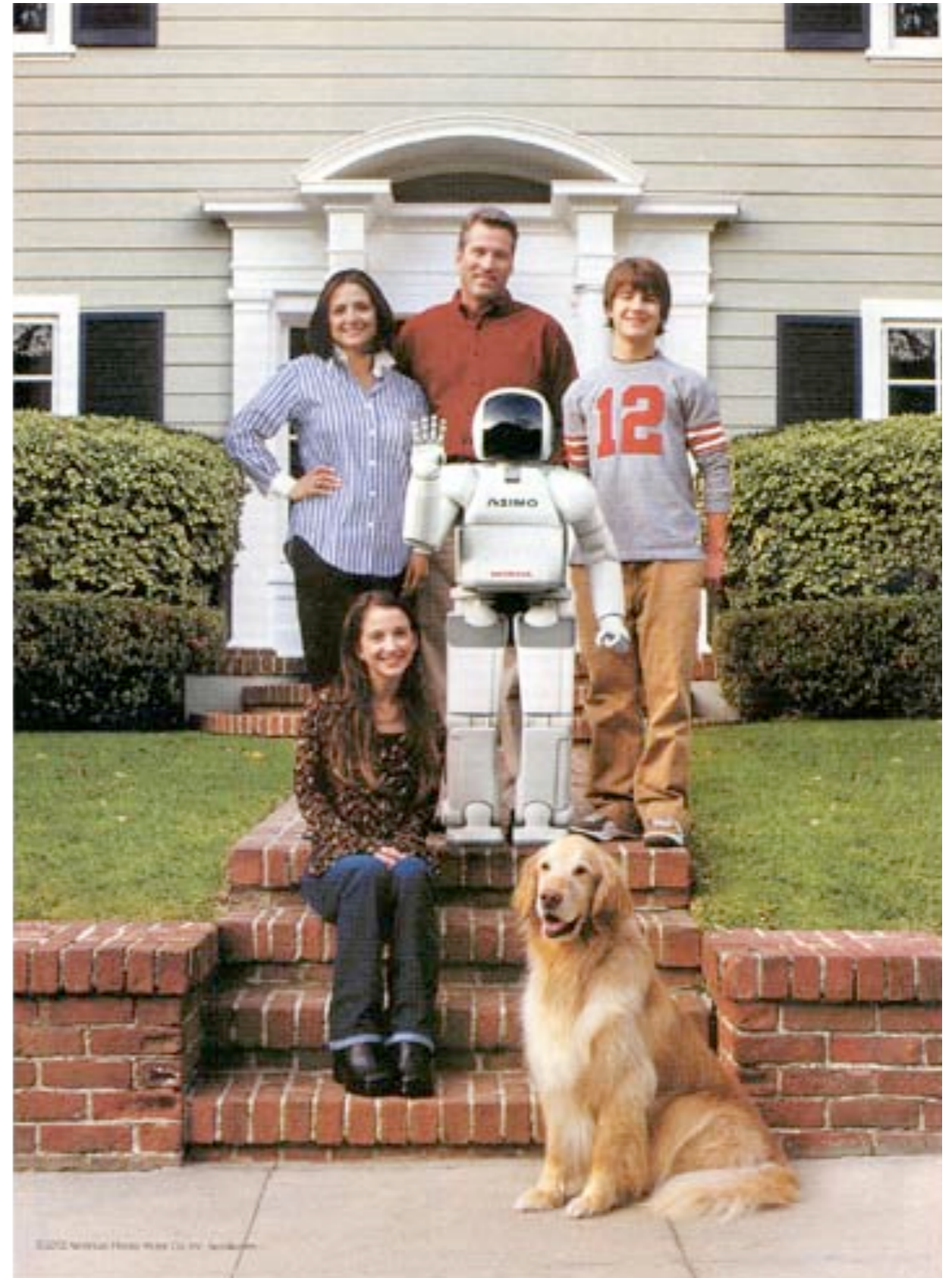
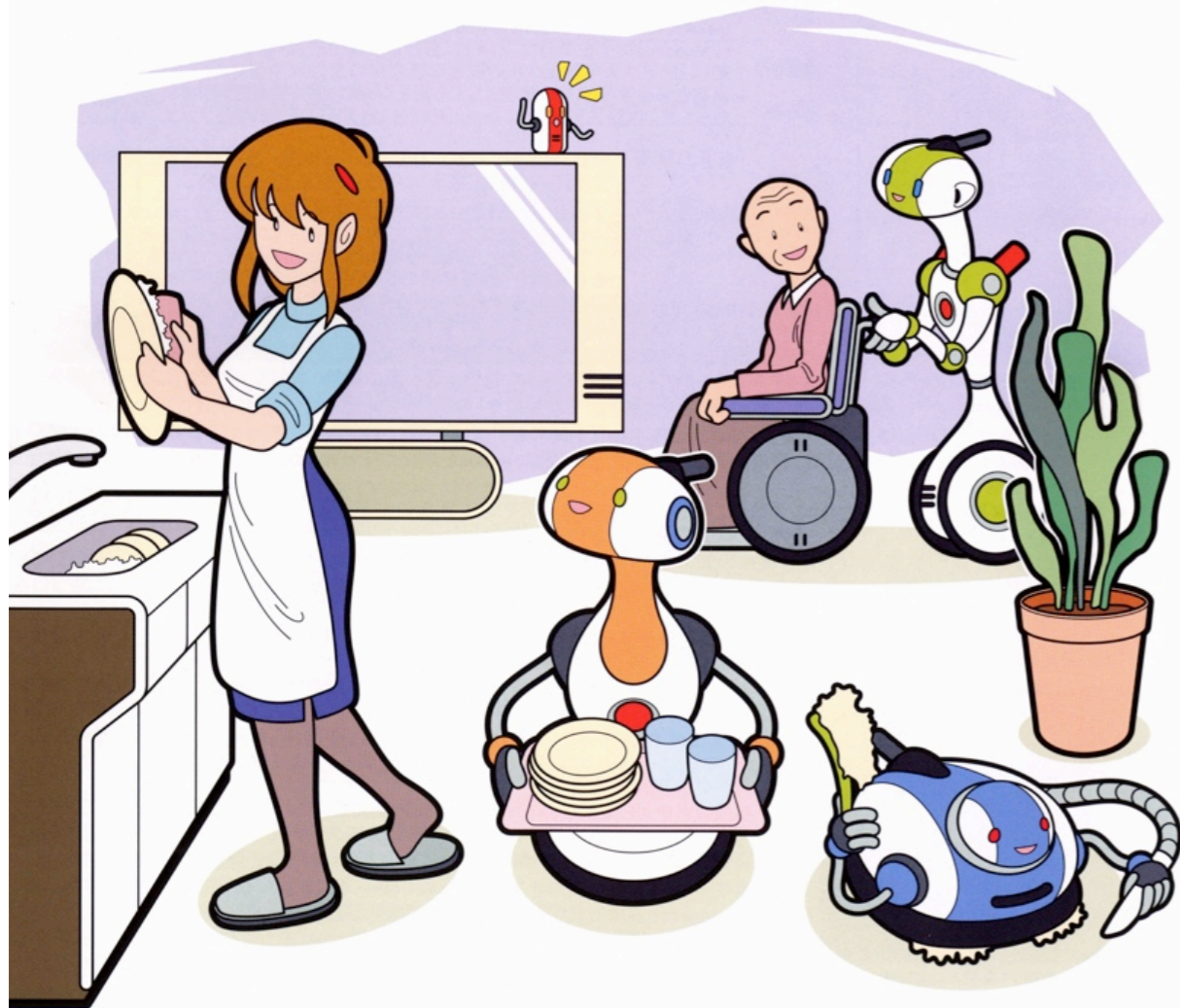
RSJ

November 2008

Vol.26 No.8

特集]

ロボットのいる生活



What roles should robots play in our lives?



How should robots look? (And what should they do?)

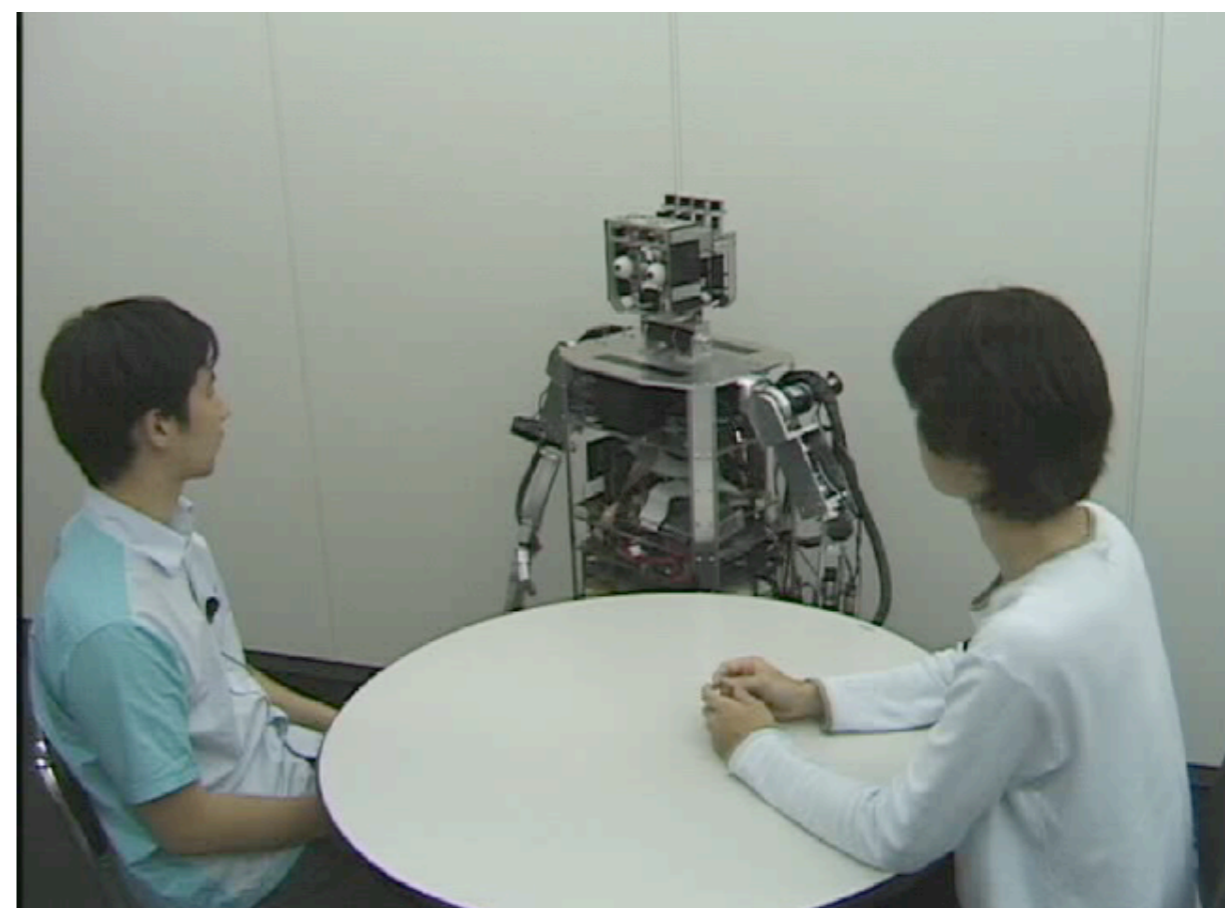
Hideki Kozima's research  
with Keepon at ATR.

Waseda University's humanoid

How should robots act?

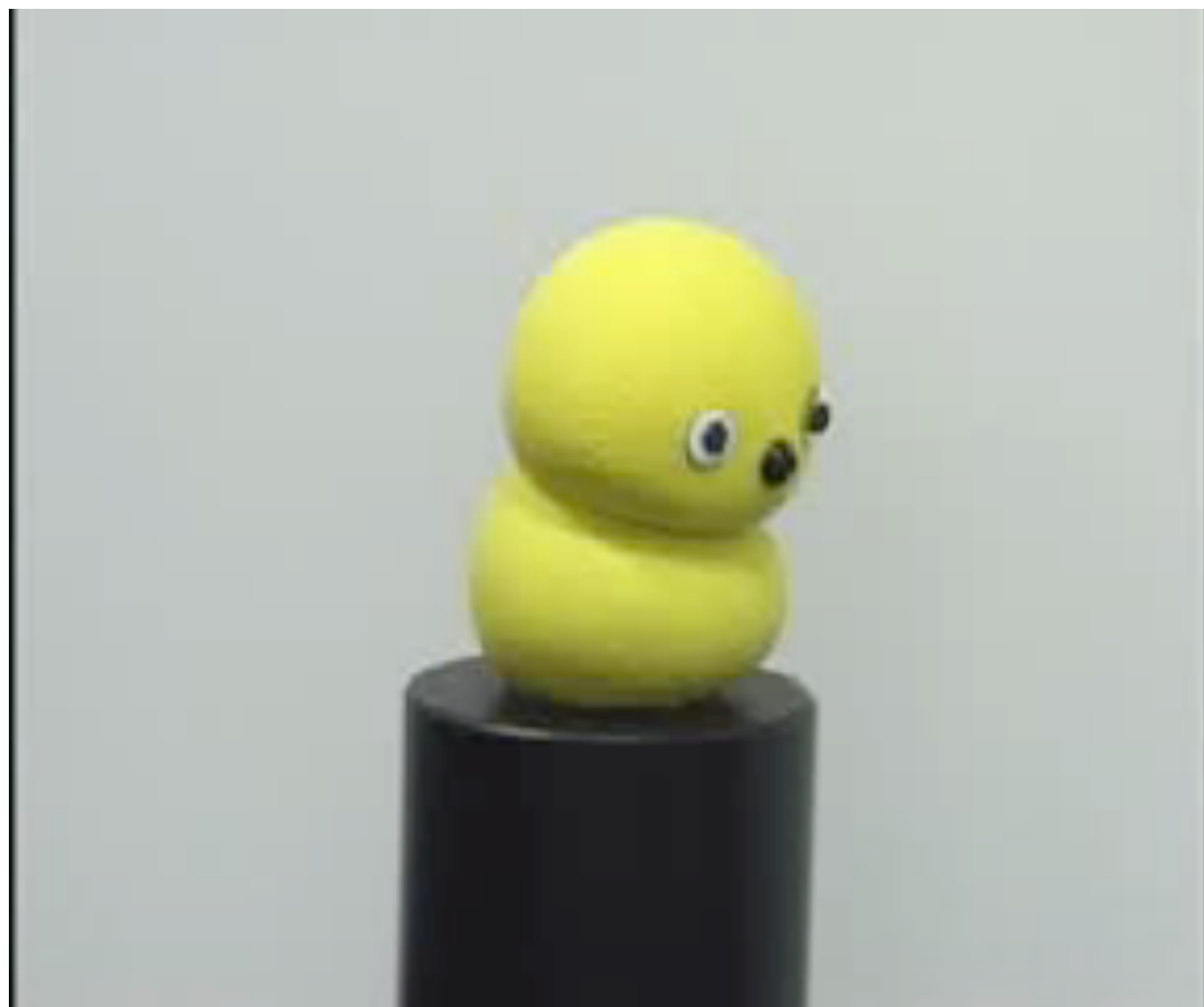


Hideki Kozima's research  
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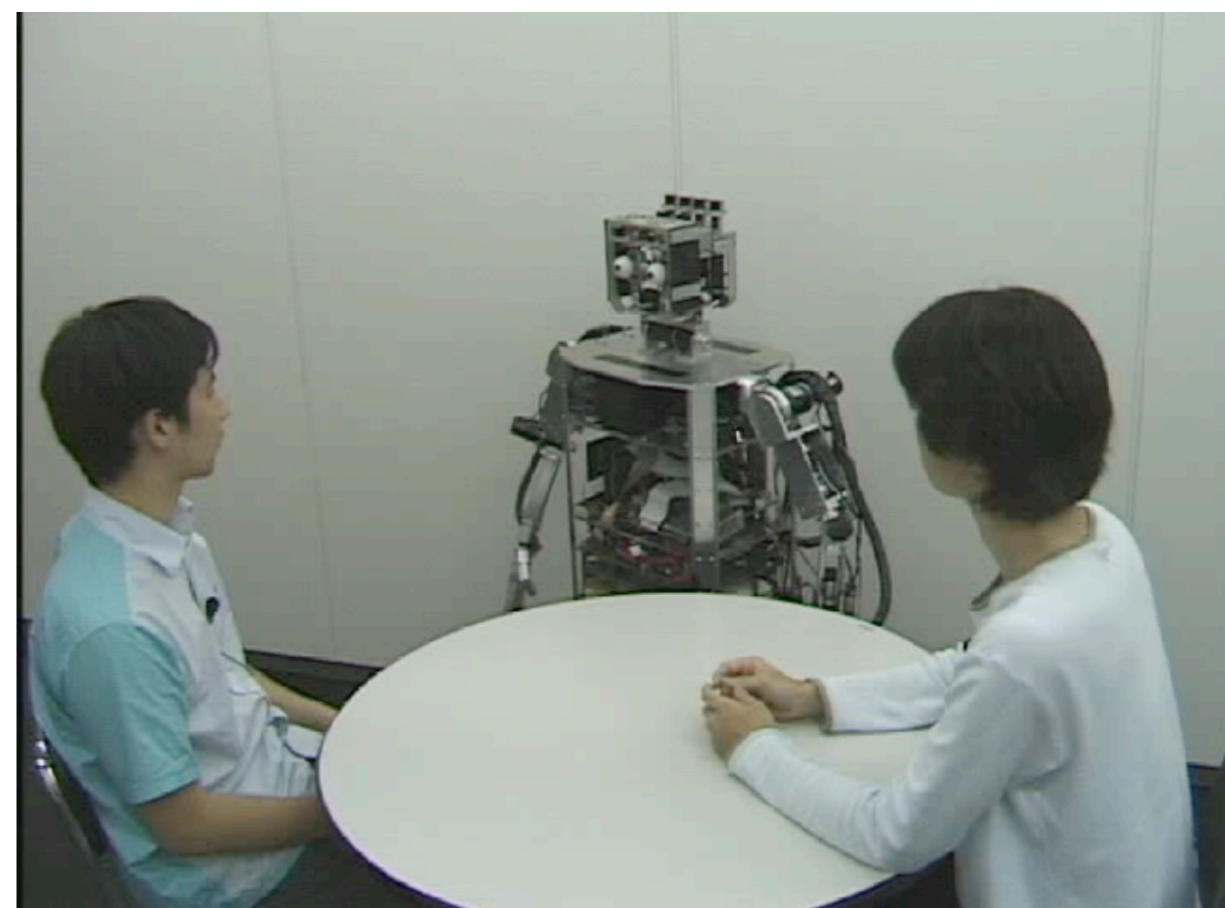


Waseda University's humanoid

How should robots act?



Hideki Kozima's research  
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Waseda University's humanoid

How should robots act?



How do we perceive robots?



# How can robots engage people?

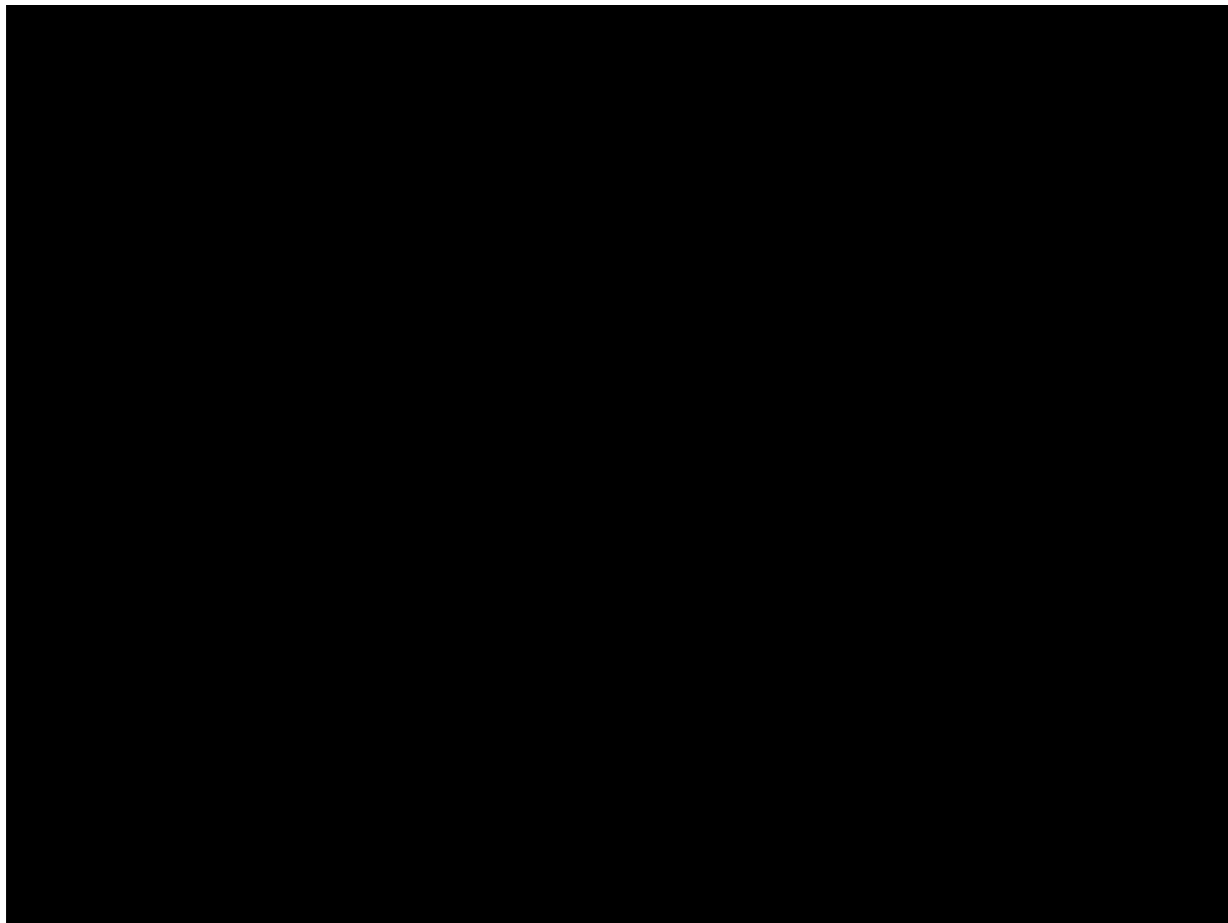
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CMU's Roboceptionist Valerie

Muu at SIGGRAPH

# How can robots engage people?

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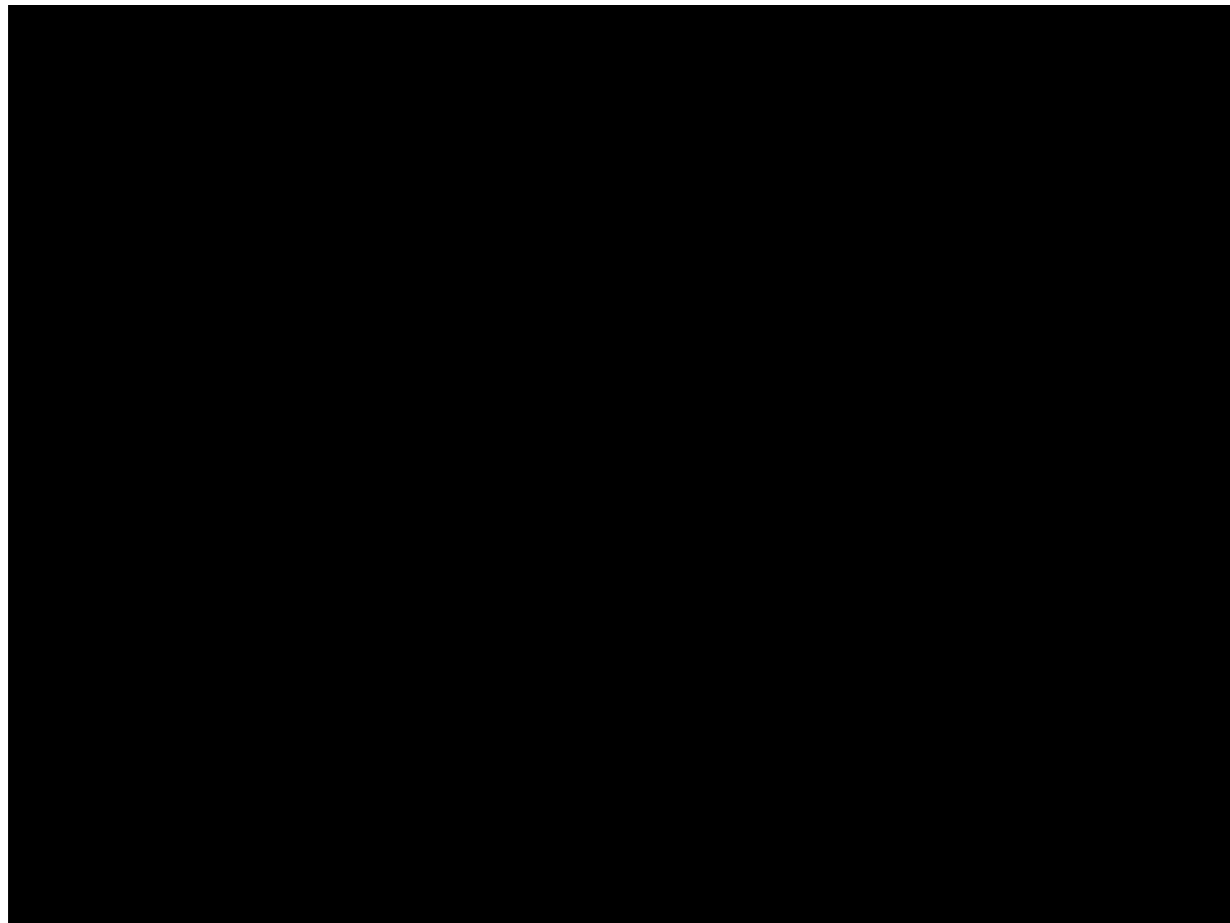
CMU's Roboceptionist Valerie



Muu at SIGGRAPH

# How can robots engage people?

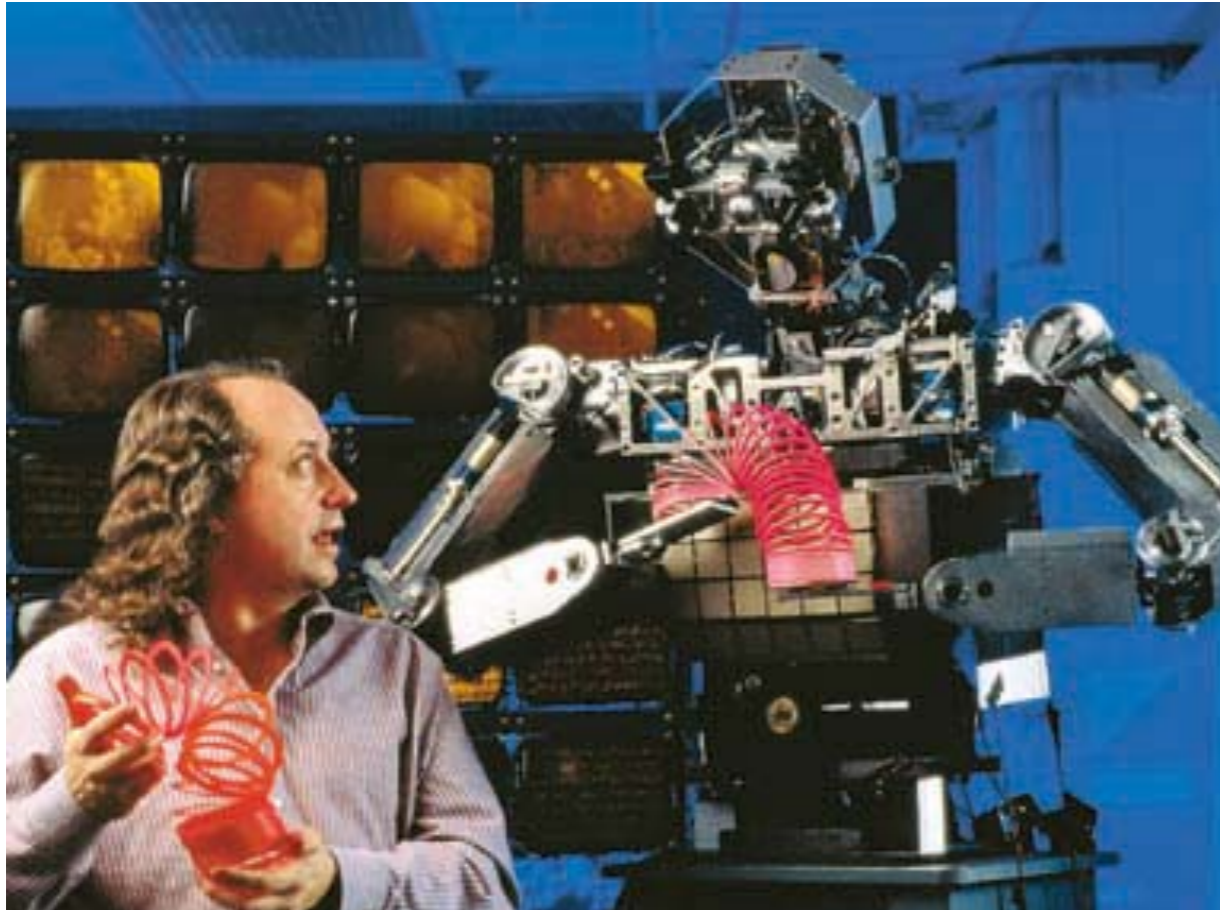
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CMU's Roboceptionist Valerie



Muu at SIGGRAPH



R. Brooks with Cog at MIT's CSAIL

What can robots tell us about ourselves?



R. Brooks with Cog at MIT's CSAIL

**The Cog Project**  
**Imitating Head Nods**

**Brian Scassellati**  
**MIT Artificial Intelligence Lab**

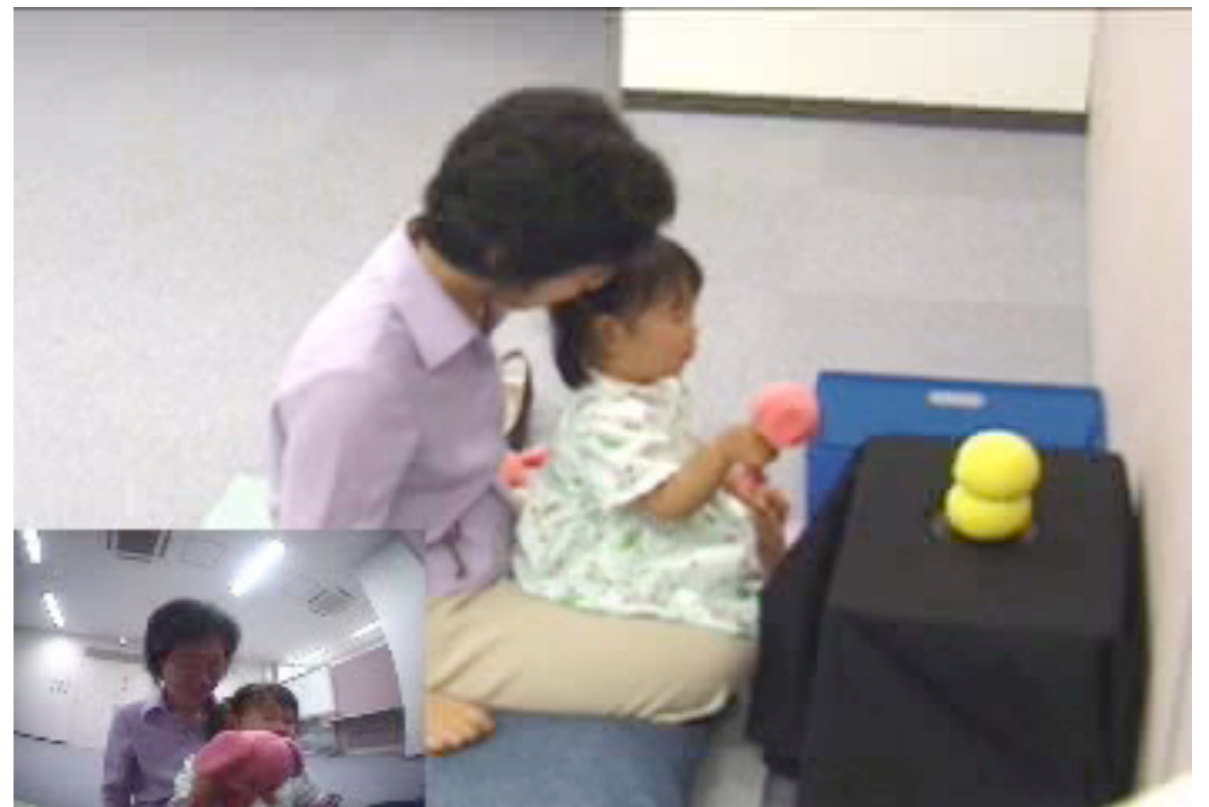
What can robots tell us about ourselves?

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How do we develop interactions with robots?



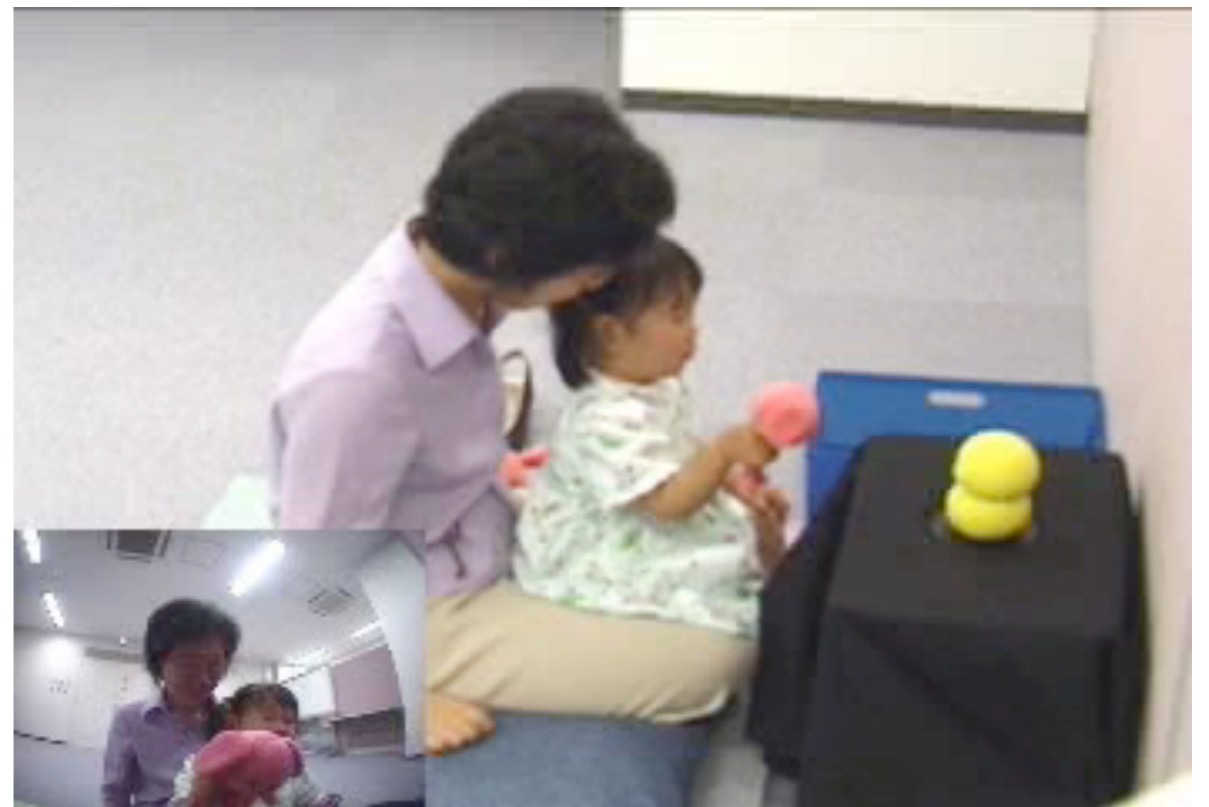
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How do we develop interactions with robots?



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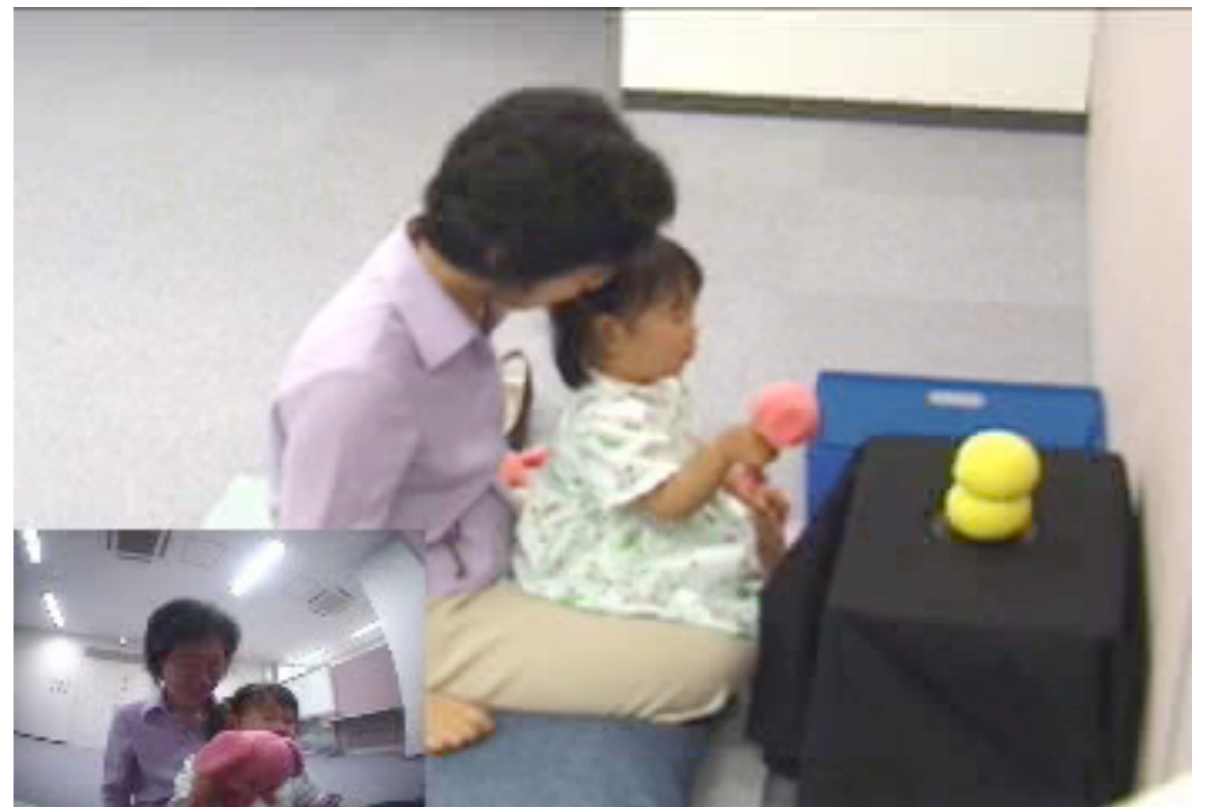


How do we develop interactions with robots?





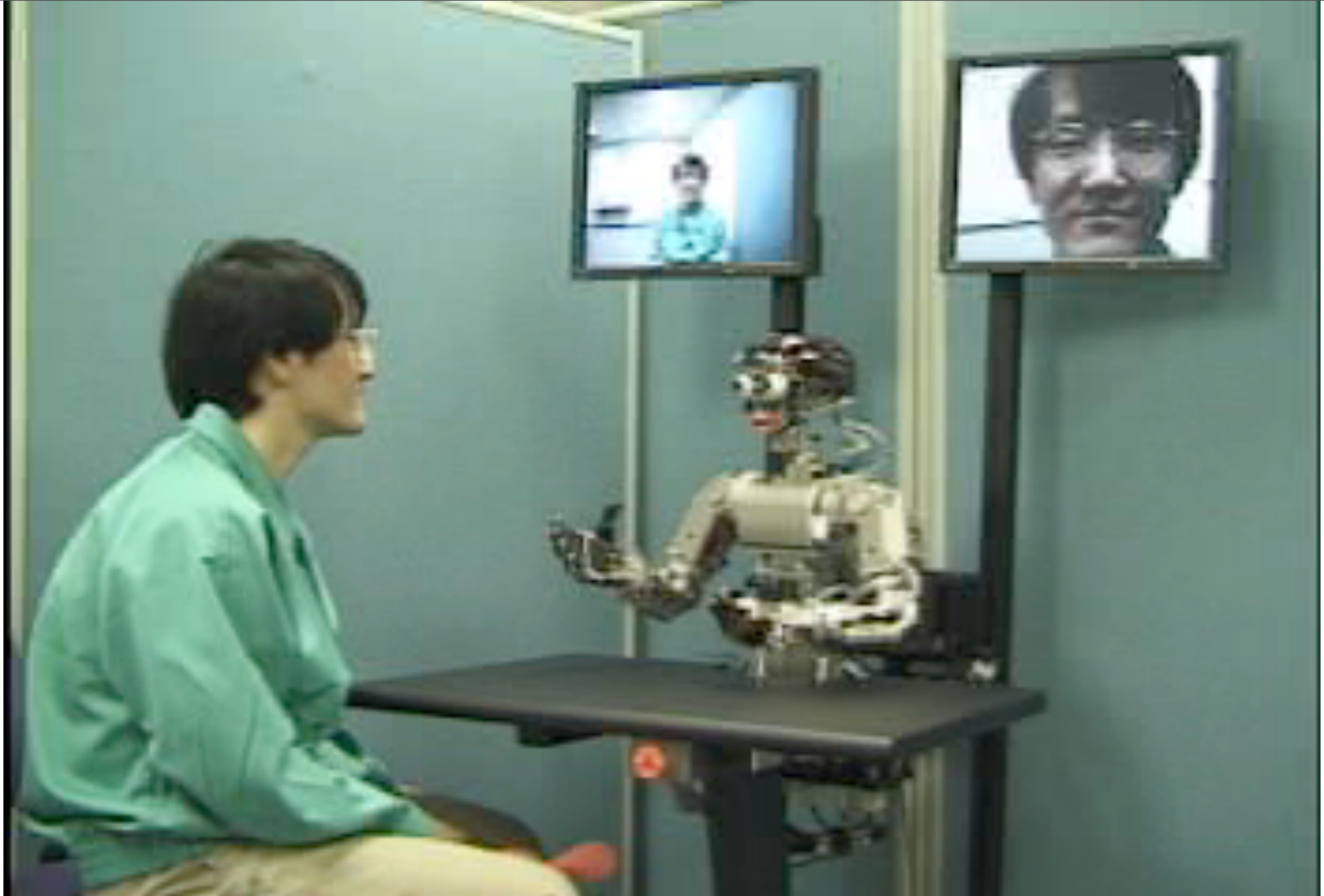
Hideki Kozima's research  
with Keepon at ATR.



How do we develop interactions with robots?

Can robots grow into  
social actors?

Hideki Kozima's Infanoid,  
ATR Japan



Can robots grow into  
social actors?

Hideki Kozima's Infanoid,  
ATR Japan

Can robots learn from  
people? Can we collaborate?

Andrea Thomaz's work on social  
learning at Georgia Tech

# Task Learning with Both Discrete and Continuous State Variables

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Crystal Chao, Maya Cakmak and Andrea L. Thomaz

ICRA 2010



Can robots learn from  
people? Can we collaborate?

Andrea Thomaz's work on social  
learning at Georgia Tech

Designing from the human, as well as robot, point of view

# Robot design can be critiqued and improved through observation

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## **Observe and analyze:**

- How robots react and act towards humans
- Which aspects of behavior lead to breakdown in interaction
- When robots succeed and fail to engage humans



Robots that fit into ongoing flow of human interaction and coordination

Observing rich interactions with robots

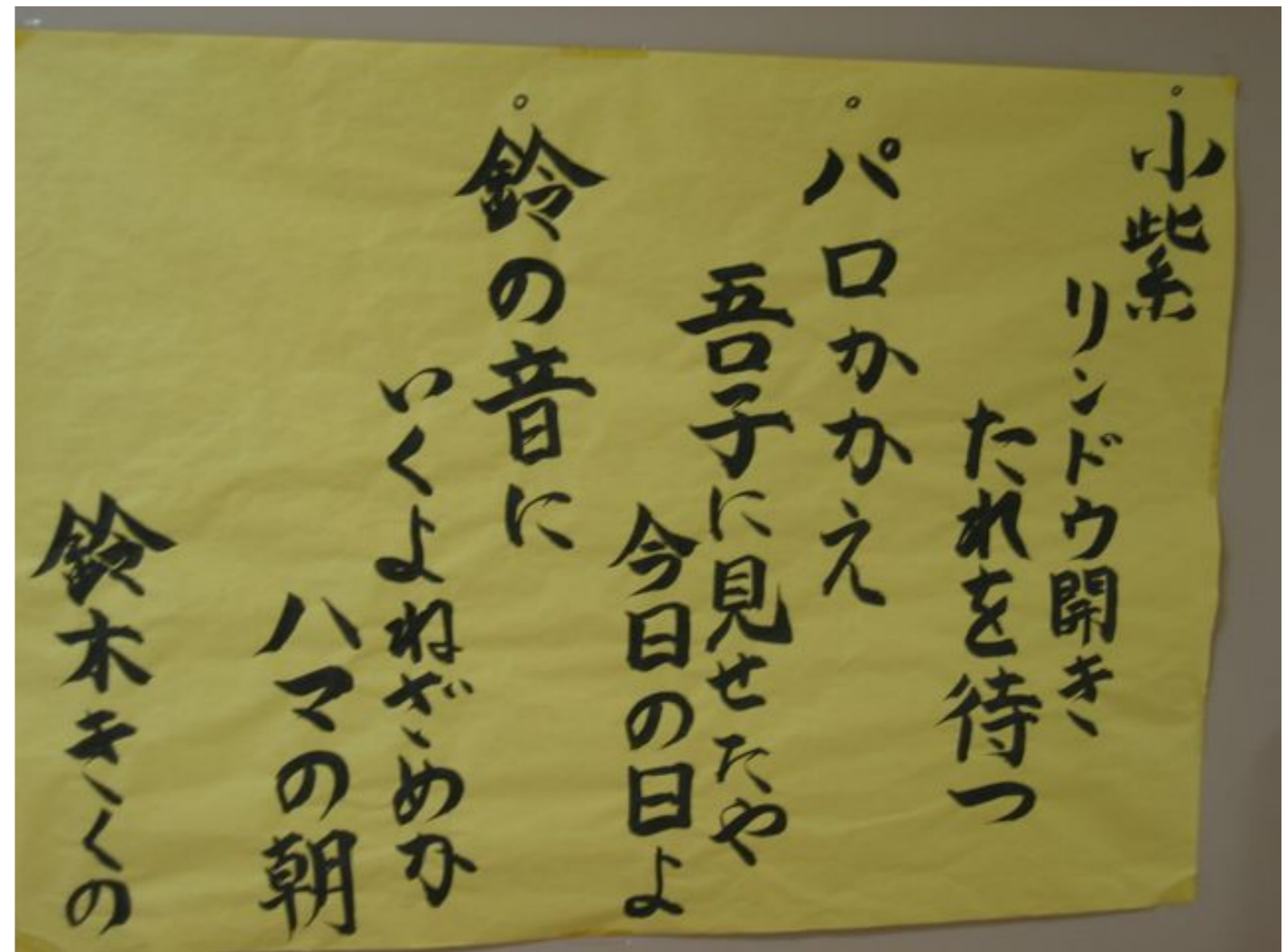




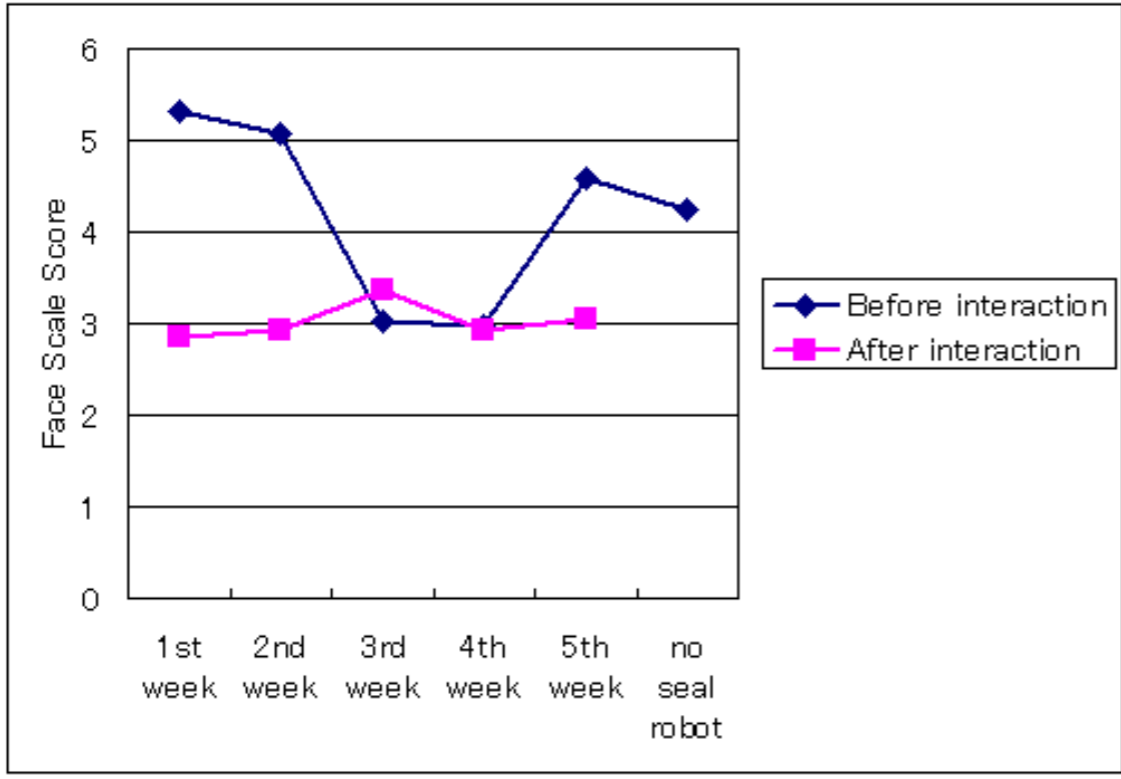
Observing rich interactions with robots



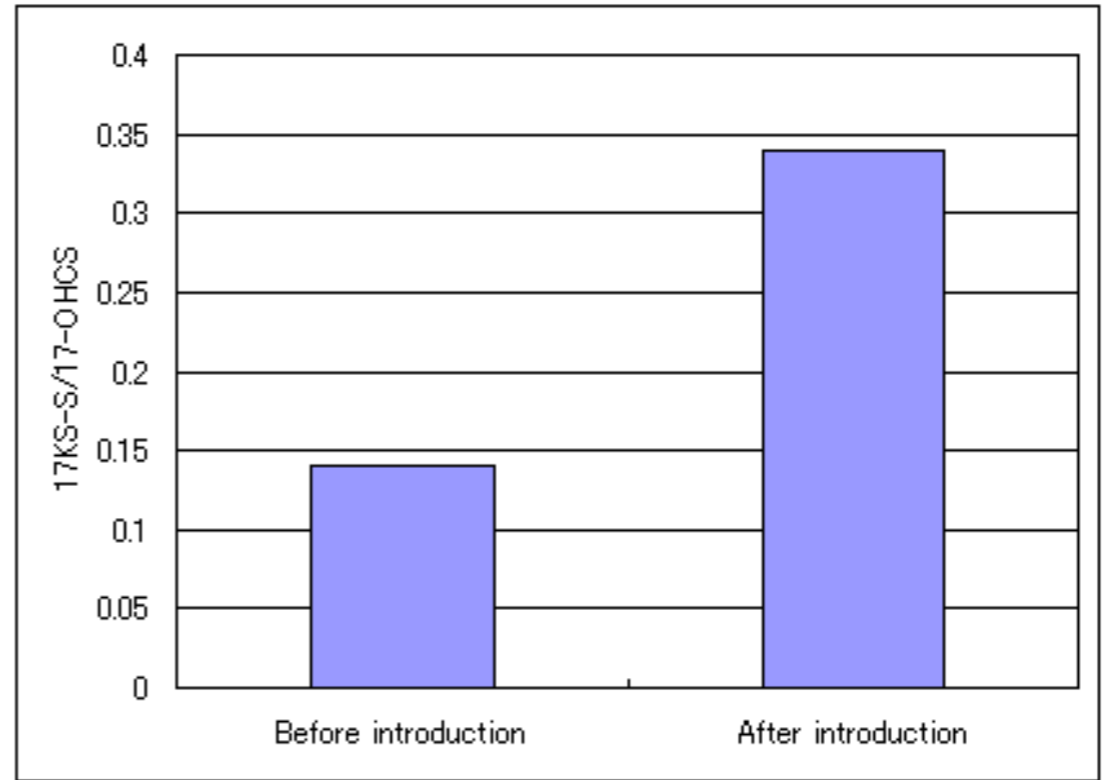
Observing rich interactions with robots



Contextualized use and understanding of robots



Face scale test



Urine test

# Psychological and physiological measures

**Abstract**—Robot therapy for elderly residents in a care house has been conducted since June 2005. Two therapeutic robots were introduced into a care facility, and activated for over 9 h each day to interact with the residents. This paper presents the results of the first month of this experiment. **To investigate the psychological and social effects of the robots, each subject was interviewed, and their social network was analyzed.** In addition, the activities of the residents in public areas were recorded by video cameras during daytime hours (8:30–18:00). For physiological analysis, residents' urine was obtained and analyzed for hormones 17-ketosteroid sulfate and 17-hydroxycorticosteroids. The experimental protocol was reviewed and approved by the ethical committee of the National Institute of Advanced Industrial Science and Technology. The results indicate that interaction with the seal robots increased their social interaction. Furthermore, the urinary tests showed that the reactions of the subjects' vital organs to stress improved after the introduction of the robots.

**Index Terms**—Elderly care, human–robot interaction, mental commit robot, psychotherapy, robot therapy.

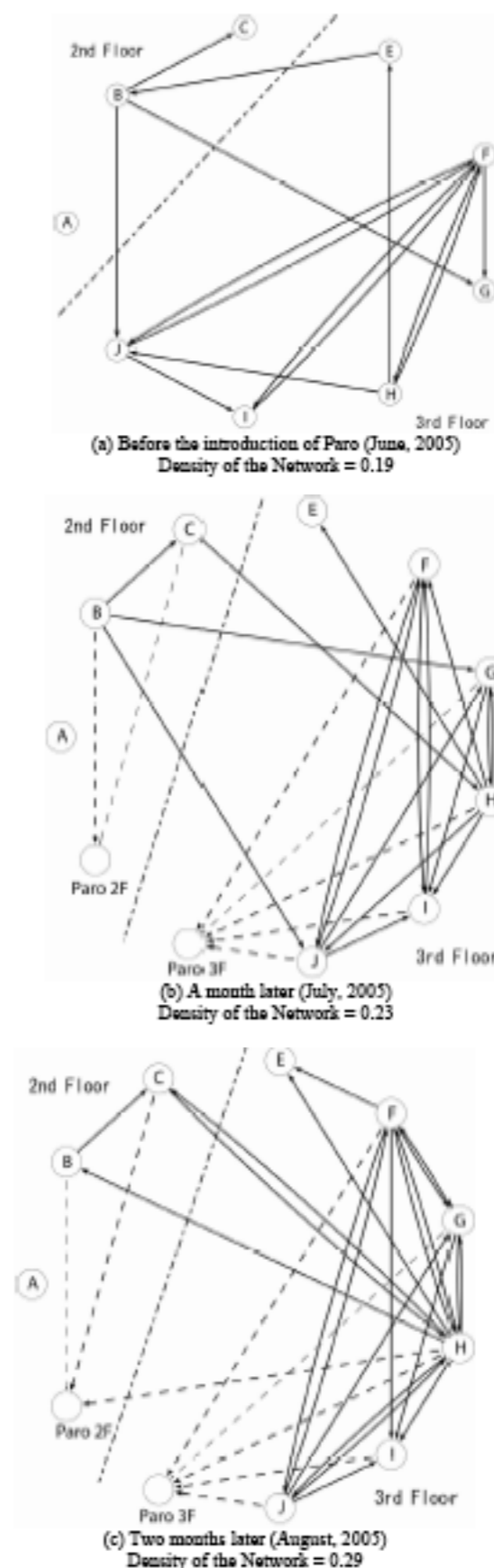
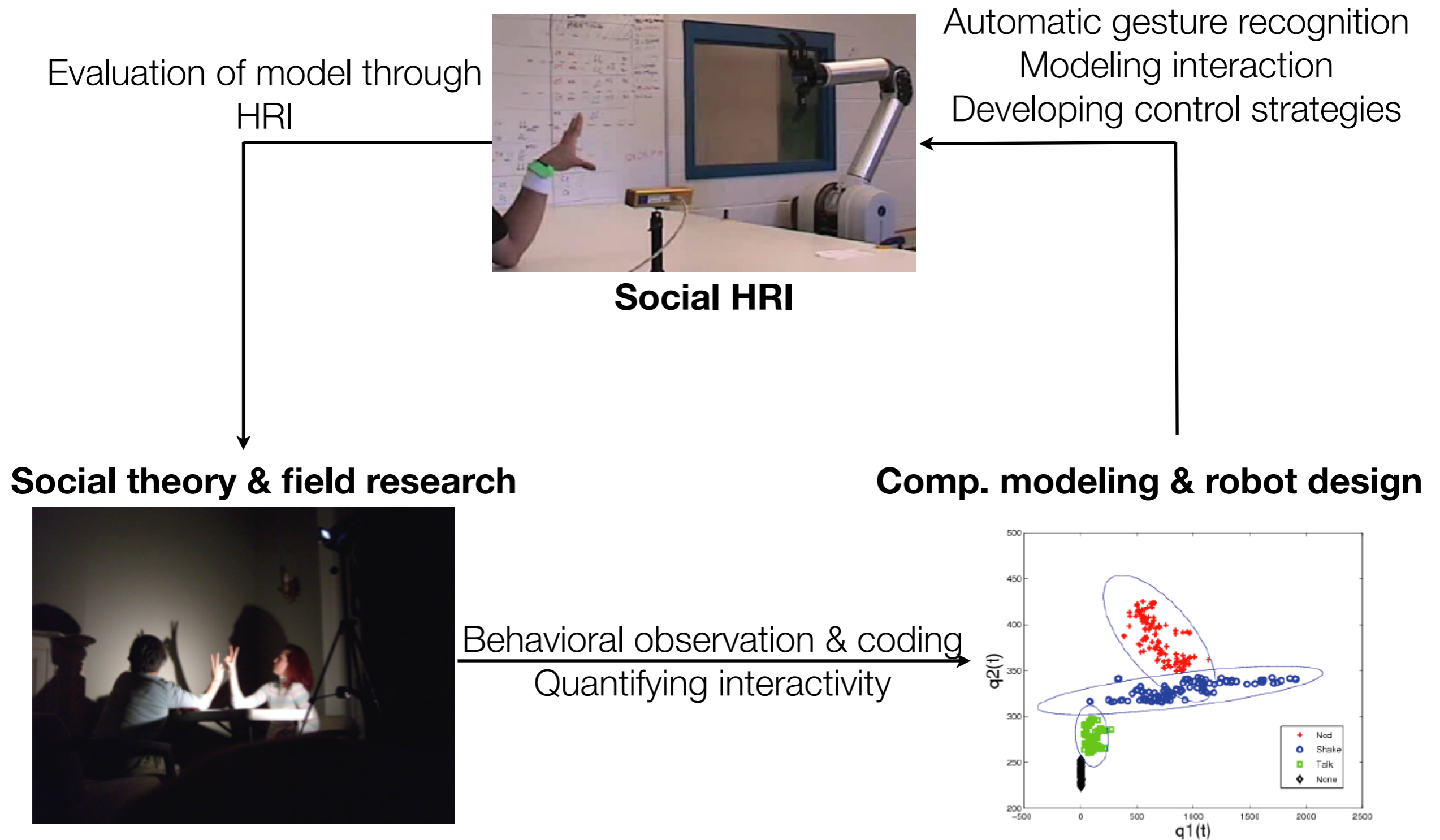


Fig. 4 Change of Subjective Social Network

# Using robots to build & test models of behavior



# Multidisciplinary methodologies

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- Field studies
- Experiments
- User studies & design approaches
- Anthropology, sociology, psychology, cognitive science, robotics, computer science, complex systems, etc.

# Domesticating robots at R-House

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- designing and testing technologies in a domestic environment
- collaborative robot design & participatory modeling;
- Granny@home
- Cooperative tasks and adaptive action







Questions?

More information at:  
[www.informatics.indiana.edu/  
selmas](http://www.informatics.indiana.edu/selmas)