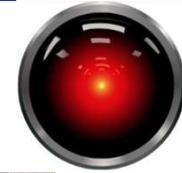# AI to Bridge Boundaries –
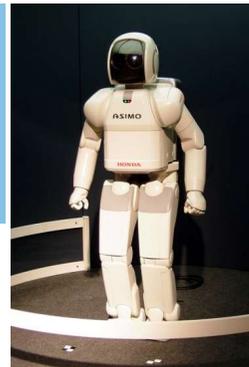# Boundary Crossing Robots for Future Societies

Introduction to Panel Session

Seminar on the 100th Anniversary of the
Diplomatic Relations between Finland and Japan

Meiji Kinen-kan

Kristiina Jokinen

AI Research Center AIST Tokyo Waterfront
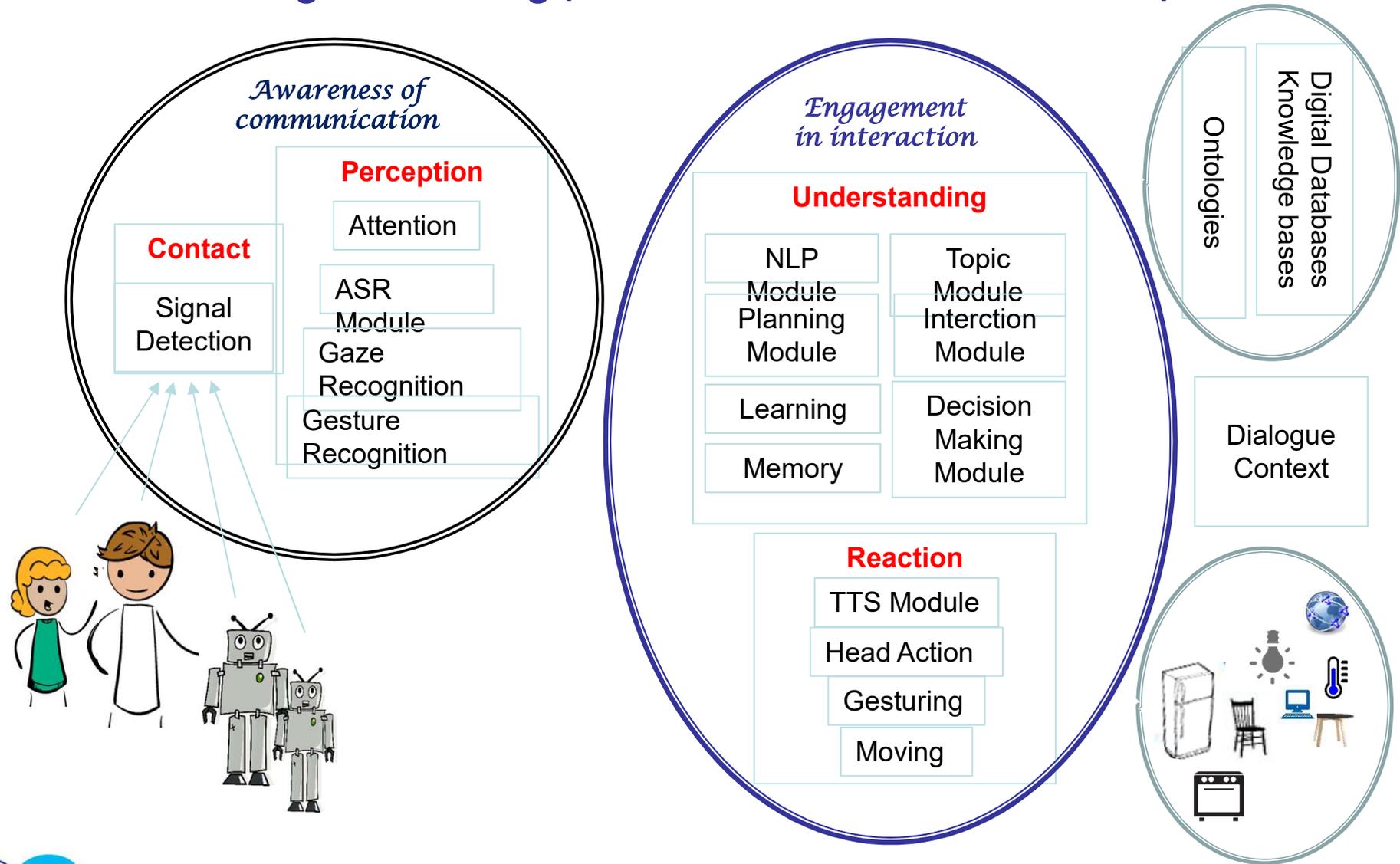
Boundaries to Cross

1. Autonomous agents: tools vs communicating agents

AI system's dual characteristics

- AI system as a computer
  - Data crunching (big data)
  - Algorithmic steps, statistics
  - Deep Blue, AlfaGo
  - Not human-like
  - Mechanical movements

- AI as an agent
  - Dialogue interactions
  - Knowledge
  - Humanoid appearance
  - Attachement
  - Long-term interactions

Constructive Dialogue Modelling (Jokinen, 2009, 2012, Jokinen et al. 2014, 2015)

Awareness of communication

Perception

Attention

ASR Module

Gaze Recognition

Gesture Recognition

Contact

Signal Detection

Engagement in interaction

Understanding

NLP Module Planning Module

Topic Module Interction Module

Learning

Decision Making Module

Memory

Reaction

TTS Module

Head Action

Gesturing

Moving

Digital Databases Knowledge bases

Ontologies

Dialogue Context

Dialogue Modelling for Human Agent (robot) Interaction

Awareness of Communication
# =
Situated Cognition and Situational Awareness

- Natural Interaction requires knowledge of what is going on around the agent

- Level of autonomous behaviour:
  reaction vs. conscious and intentional
- Particular activity the participants
  are engaged in: task vs. chatting,
  instruction vs. entertainment
- The role and mutual status of the participants
- Feedback = communication of one's
  awareness to the partner, concerning
  - intention
  - engagement
  - attention
- Learning new words, concepts, situations, skills
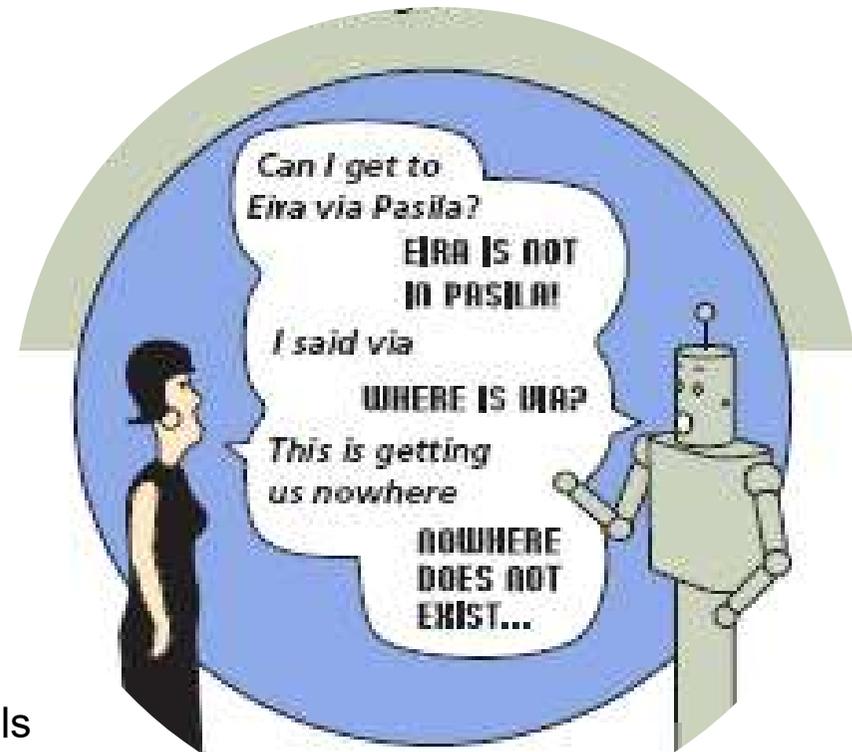
Boundaries to Cross

1. Autonomous agents: tools vs communicating agents

2. Actors in the context: autonomous agents and smart environments
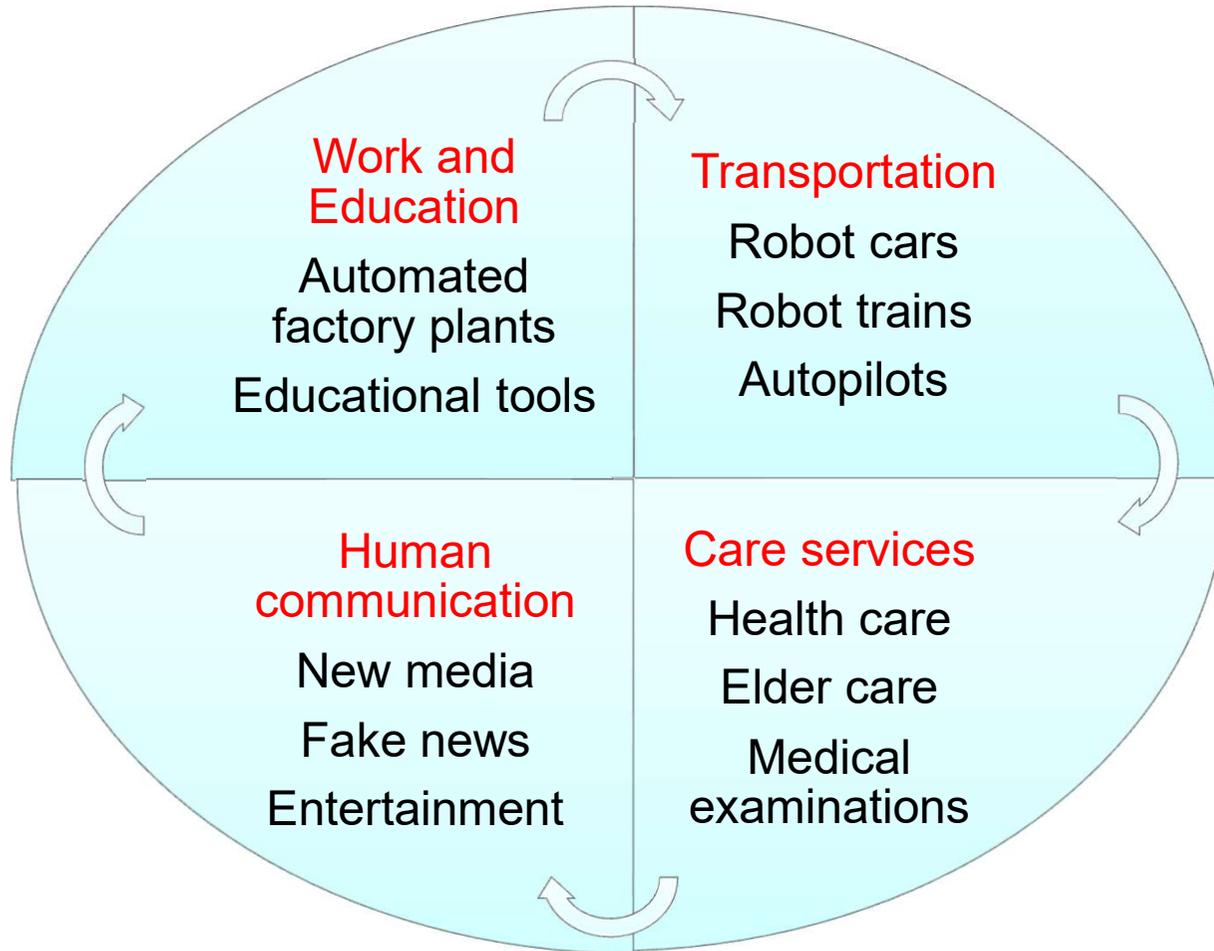
AI system's two contexts
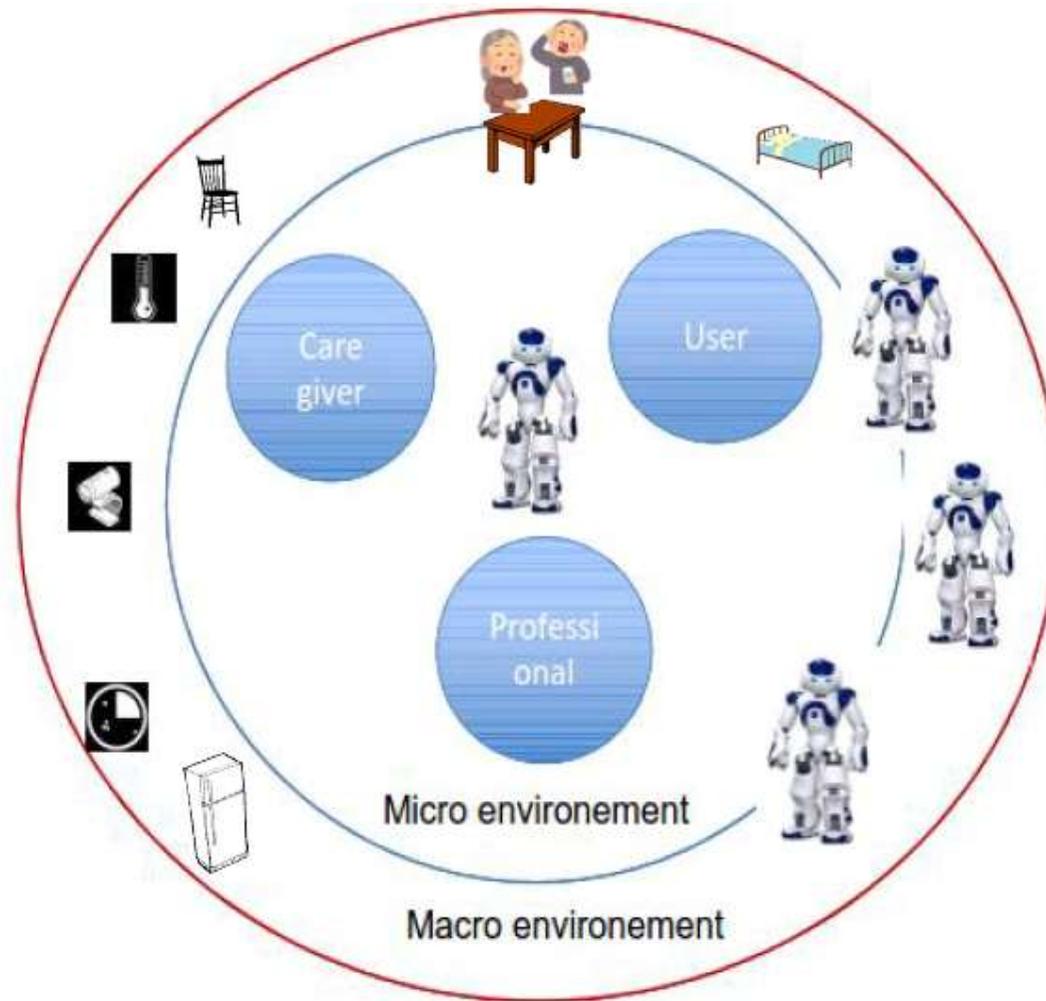
Boundaries to Cross

1. Autonomous agents: tools vs communicating agents

2. Actors in the context: autonomous agents and smart environments

3. Social needs and services: societies for the citizens and for good life

Robots for today and tomorrow

- Society 5.0
  - Japanese government vision for

    "A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space."

  - Autonomous agents co-evolving with humans to improve services and build AI for all

- World Robot Summit
  - Robotics for happiness
  - Challenges for
    - industrial robots (automation, bridge repairs)
    - disaster robots (earthquake survivors)
    - service robotics (assistance in convenience store, store houses; sorting garbage)
    - junior category (school challenge: make their school life better; home challenge: improve life in home environment)

AI Changes Society => Society 5.0

Work and Education

Automated factory plants

Educational tools

Transportation

Robot cars

Robot trains

Autopilots

Human communication

New media

Fake news

Entertainment

Care services

Health care

Elder care

Medical examinations

Examples of changes

Technology	Application
Automation	No need for human action
Robots	Collaborators and co-workers
Virtual reality as work space	No regular commuting
AI as creative directors	Provide objective ideas
Microchip implants	Open doors, login to computers, make purchases
Biometrics, iris recognition, fingerprint, face recognition	authorized access to sensitive

Huffingtonpost (2017): 85 % of the jobs that will be available in 2030 have not even been invented yet !

Boundaries to Cross

1. Autonomous agents: tools vs communicating agents

2. Actors in the context: autonomous agents and smart environments

3. Social needs and services: societies for the citizens and for good life

4. Cooperation and socio-technical systems: symbiotic and co-evolving relation

Boundary-Crossing Agents

Activity Theory (Vygotsky, Engström):
All knowledge is situated in activity bound to social, cultural and physical contexts

Learning is doing and acting together

Software agents operate as boundary-crossing agents that facilitate interaction and mutual intelligibility between different perspectives

=>

We need to find novel ways to interact with AI systems as cooperative agents

Symbiotic relation between humans and robots

- Mori (1970): Uncanny valley.
- Moore (2012): Bayesian explanation of Uncanny Valley:Cognitive Dissonance between conflicting categories Cognitive Categories
- Jokinen & Watanabe (2019): Boundary-Crossing Robots: Societal Impact of Interactions with Socially Capable Autonomous Agents. ICSR-2019.
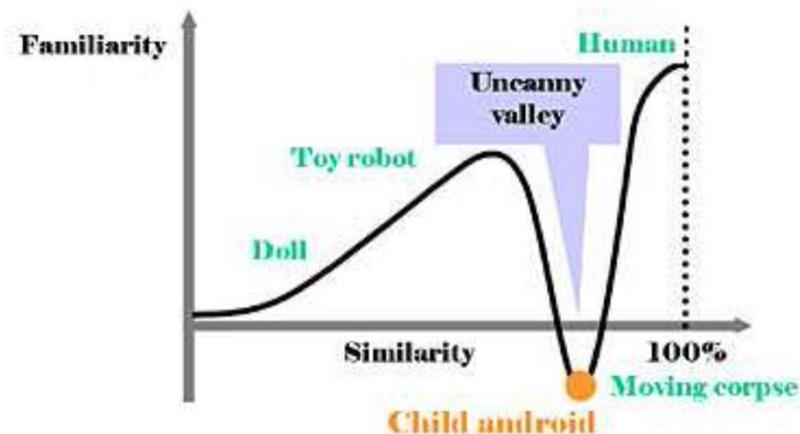
Boundaries to Cross

- Attention and Agents
  - Robots acting and interacting in the physical world
  - They need to talk to their human partners -> social interaction

- Beliefs and Contexts
  - Computers with access to remote sources of knowledge
    (web, database, other agents)
  - Interactive smart environment

- Common Good
  - Changing jobs and services require learning on non-tangible things
  - User-centred society and knowledge explication

- Generation Z:
  - Already accustomed to digital world and autonomous agents
  - Scientific progress slow and continuous while social and economic impact
    can be disruptive

Topics in Today's AI2BB

- Human vs Computer/Robot

- AI in real world

- AI and cooperation

- Artificial General Intelligence vs practical application with "little" intelligence

- Self navigating robot with a model of environment

- Explanatory AI: video captioning (to link data to knowldege)

- Resource sharing

- Ethics

- Generation Z

- Business

- Scientific progress slow, but societal changes can be disruptive

Panel Session

- Expert Panelists: Invited Speakers
  - Arakawa, Gotcheva, Leino, Mendieta, Sunaga, Wilcock
- Topics

  1. Challenges and opportunities for AI research and applications for society
  2. Concrete opportunities to bridge borders
     - global, local, bilateral contexts
     - cognitive, physical, social

- Each speaker turn limited to 2 minutes!
- Questions from the audience