Involvement of social processes on HRI debates

Workshop on „Avancierte Urbanität“

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Mensch und Technik

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Agenda

- Aims of IR@MI and I3RS projects
- Recent debates and relevance of the issue
- Complex working environments (CWE)
- Organisational dimensions of technology design
- Occurrences and decision at workplace
- Interaction and participation
- Final remarks

ARMAR-IV 2011

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KIT start-up projects

IR@MI project

Social implications of robotics in manufacturing industry

- To contribute for a national **research network of social scientists** in the field of industrial and professional robotics
- To prepare new research proposal
- To support MSc and/or PhD thesis
- To identify insights gained from research on robotics in manufacturing industry for generalizing into other working fields (e.g. service robotics in health care), and from those other fields that can be applied to industrial robotics and professional service robotics
- To contribute **to link research areas** of “People and Technology” (MuT) and “Anthropomatics and Robotics” (AuR) at KIT on the application field of manufacturing and production sectors
- To identify relevant **research questions** about the possibility of development of safer robot systems in closer human-machine interaction systems
- To prepare the basis for a **strategic research agenda for KIT** in the field of social implications of robotics and autonomous systems.

I3RS project

Intuitive interaction between humans and industrial robot systems

- To **conceptualise ‘intuitive interaction with technology**’ (robotic systems) in manufacturing industry with respect to its social dimension
- To contribute for a research network of social scientists in the field of industrial and professional robotics
- To link research areas of “Humans and Technology” (MuT) and “Anthropomatics and Robotics” (AuR) at KIT on the concept of intuitive interaction system.
- To identify relevant research questions about the possibility of development of safer robot systems in closer human-machine intuitive interaction systems at the manufacturing shop-floor level. Some of these questions will be tested in the **interviews** to be made to the robot manufacturers, experts and policy makers in different countries (Europe, Japan and US).
- To support MSc and/or PhD thesis
- To prepare the **basis for scenario construction** on these developments, while foresight of intuitive human-robot interaction would be a research task in the new project.

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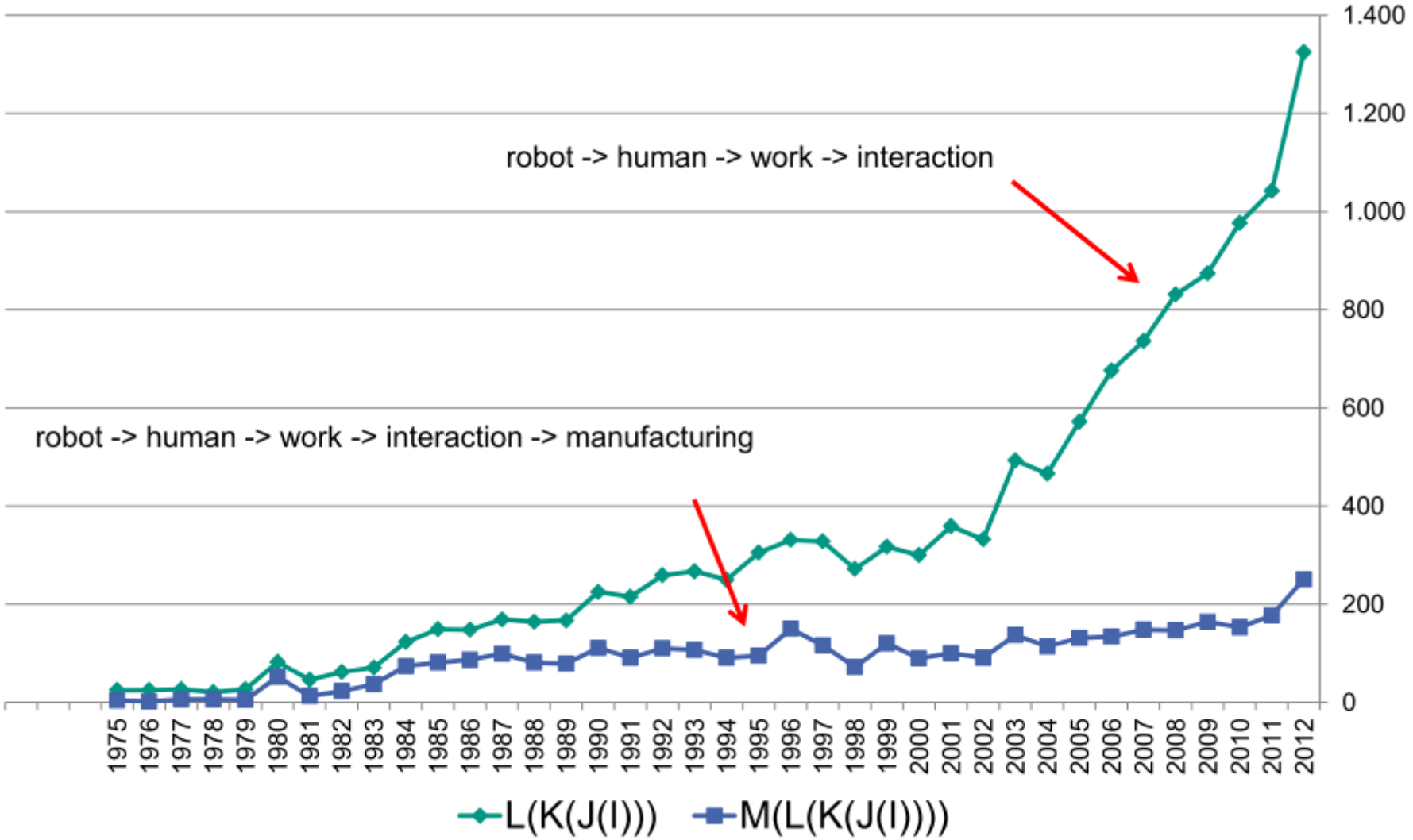
Publications on robot -> human -> work -> interaction -> manufacturing (SCOPUS)



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Background

- **Technology Assessment**
  - *Early OTA study on "Social Impacts of Robotics", 1982*
- **Industrial Sociology**
  - These studies were prominent in the 1980's when the introduction of automated technology was extensively done in manufacturing industry. Increased complexity of technical systems
  - Need to develop the social sciences studies on the relation of humans with technology
- **Relevance** of human/operator-robot interaction (HRI)
  - Complex work systems
  - Scope on social aspects of working
  - New competences, skills and new training needs
  - Productivity and improved workplace environment

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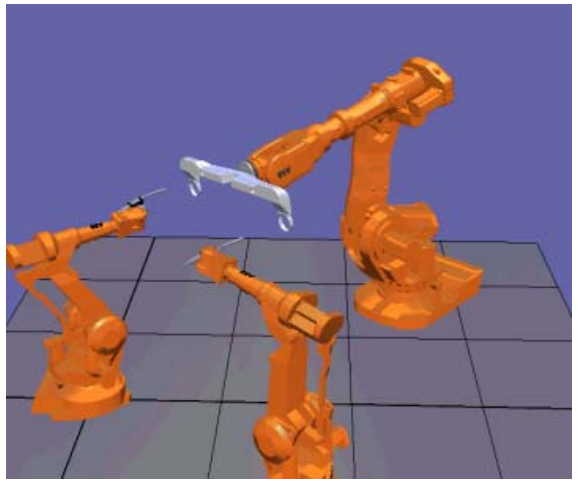
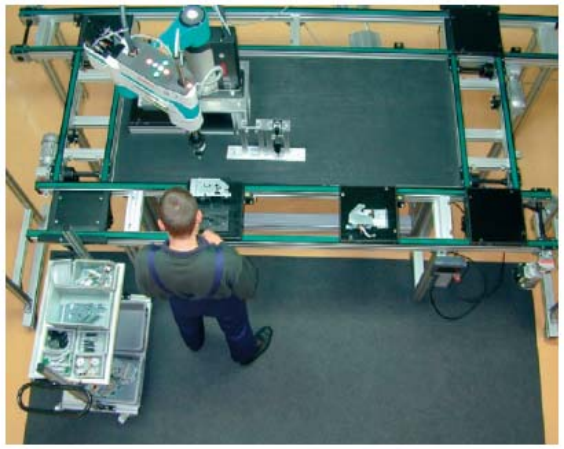
Complex working environments (CWE)

- concerned with the **interactions and the interplay** between humans and robots from the individual to the society perspectives
- contribute to the **design and development** of human-centred, usable and socially acceptable robotic work environments
- New **Human-Machine Interfaces** for programming of and interaction with industrial robots
- New sensor technologies and user interfaces for **enhanced safety**
- Sensor-based **control** of robotic systems in tasks, such as assembly, handling, inspection and testing



Combination of a manual and an automatic work station



workplace sharing
hybrid system
(team@work)

Example of a workplace and time sharing hybrid system (PowerMate

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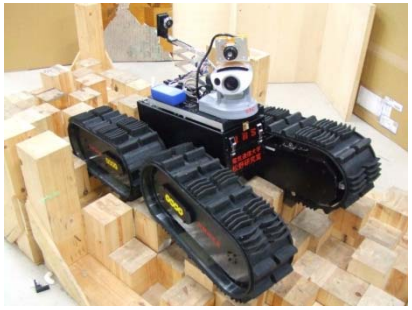
Organisational dimensions of technology design (robot, system integration, software)

- Usually technical innovations created **surprises** when they were introduced in real industrial environment.
- **Social sciences** has been more focused on macro- and meso-levels and not on micro- and workplace levels
- These systems are not usually designed to be used by **working groups** or individuals. Here we can find some difference from the Japanese approaches and the Western ones.
- **Constructive Technology Assessment** tries to have consideration for organizational dimension and that can affect technology design.
- **Anthropocentrism** of technological design is state of the art: design of technology with social needs
- Importance of **safety issues**. Such dimensions are technology driven and consider the legal framework and the need for wide acceptance.
- Less consideration for the **employment factors** and ethical aspects

Occurrences and decision at workplace

- Operators should be able to stop the operation **when a problem (unexpected event) occurs** and contribute to solve the problem.
- They must also know what the consequences are for stopping the system, and for not doing it.
- An assessment capacity is needed (Shah et al., 2008)
- Humans should have the capacity to intervene whenever possible, also because of safety
- The principal **innovations** related with operator-robot interaction are:
  - The possibility to use communication capacities.
  - Tacit knowledge must be taken in consideration to improve the operator-robot interaction



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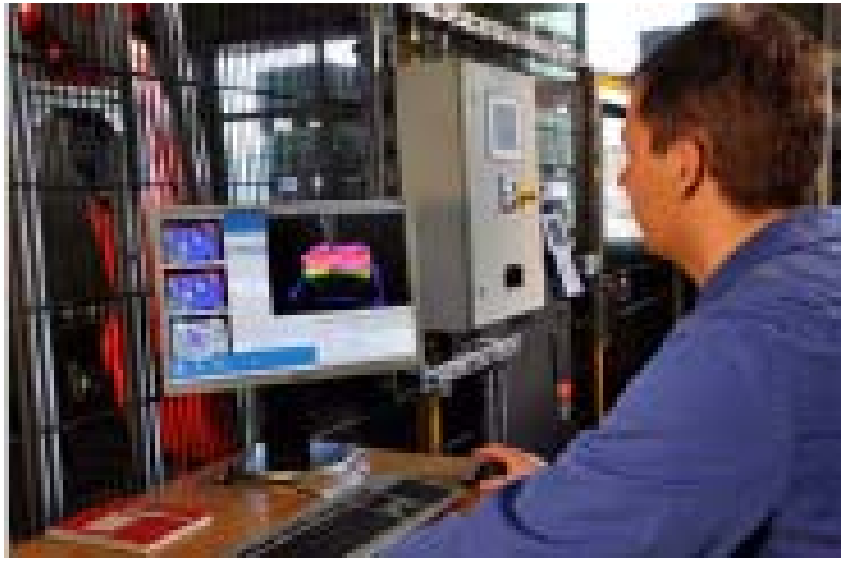
Interaction and participation

- In order to improve the productivity and to use the technical capacities of new robotic systems, it is needed to develop further **involvement of operators in the decisions**;
- This involvement needed **participatory strategy** for workplaces design;
- Such design implied **more interaction** with robots;
- The need for interaction pushed more **research** on software development and on social systems



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Research issues on intuitive interaction with industrial robots systems in Japan

- Kyoto University
  - Matsuno Lab, Kyoto University, Graduate School of Engineering, Mechatronics Lab
  - Design and Implementation of Grouped **Rescue Robot System** Using Self-Deploy Networks
- Chuo University, Tokyo
  - Human-System Laboratory, Department of Precision Mechanics
  - Research topics range from **Intelligence Space** (iSpace) and its applications to cognitive interactive communication between human and robotic systems in iSpace.
- Keio University
  - Systems Design & Management – SDM
  - **human-machine interface**, system design management methodology, system design
- National Institute of Advanced Industrial Science and Technology – AIST Tokyo Waterfront
  - Digital Human Research Center
  - **Human modeling**, user modeling and its application; Probabilistic models and statistical learning theory; Probabilistic reasoning
- Tokyo Institute of Technology,
  - Shoichi Hasegawa Lab (HaseLab)
  - **high quality haptic display** working with low update rate rigid body simulator; method for generating the motions of characters using multidimensional keyframe animation in parallel with real-time physical simulation.

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Final remarks and trends

- **Automation models and technology** are being transfered from manufacturing industry to other sectors (health, agriculture, logistics, etc)
- Industrial robotics design must use an increased **interdisciplinary approach**
- **Safety** is still a non-solved problem in robotics
- **Environment recognition**, human–machine **interfaces** and safety system technology are forecasted to be future technical trends.
- Analysis of HRI in manufacturing sector must include further
  - **Micro-level** empirical evidence
  - **Social science** studies on workplace changes

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Thank you for your attention

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