

# Exploring Human-Robot Cooperation Possibilities for Semiconductor Manufacturing

*Astrid Weiss, ICT&S Center – University of Salzburg & CDL on  
Contextual Interfaces*

*Workshop on Worker-Robot interaction in manufacturing industry  
Karlsruhe, October, 25-26, 2012*



**ICT&S Center**

Advanced Studies and Research in Information  
and Communication Technologies & Society  
University of Salzburg



# *Motivation, Background*

- Robots in work cells
  - No cooperation
  - Designed for static environments
  - Invisible configuration for the operator
- HRC
  - Both parties contribute their special abilities
  - Make production scenarios in constantly changing environments possible
  - E.g. for short-term interaction like turn taking



# *New concepts on human-machine co-working?*

1. *Are there new concepts on human-machine interaction?*
  - *yes, shoulder-to-shoulder, robots should no longer do just 3D tasks but cooperate with humans*
  
1. *These concepts are related to complex integrated manufacturing systems?*
  - *yes, from that perspective robots can be considered as just another equipment*
  
2. *Will they have increased impact on future working systems?*
  - *yes, making the production flow more flexible and allow better just-in-time production*

# *Examples of new concepts*

6. *Language processing? Is it becoming more relevant?*
  - *ambivalent, it is still hoped that it is the most intuitive input modality...*
7. *How far haptics is a research topic for operator-robot interaction?*
  - *considered as option, but not for near future*
8. *Is intuitive programming a topic for manufacturing applications?*
  - *yes, above all to decrease the need of maintenance personell for simple error cases*
9. *How to combine the ideal input and output modality (task-dependency!)?*

# *Organisational and social dimensions*

10. *Does the technology design (robot, system integration, software) have consideration for organisational dimensions? Which are relevant?*  
→ *yes, cleanroom standards and ergonomics, restructuring of work spaces*
11. *And does such design have consideration for social dimensions? Which?*  
→ *yes, acceptance aspects as well as perception of the robot (reducing human operators vs. sophisticated support tools)*
10. *Why that technology design integrates/doesn't integrate such dimensions?*  
→ *it is not just about design, but about organisational changes*

## *Workplaces design*

*14. Do workplaces design implies more interaction of operators with robots?*

*→ yes, but it above all means a restructuring of the overall work routines of operators*

*14. Do workplaces design with robots implies different competences from human operators?*

*→ In more sophisticated cases and future scenarios, yes*

*→ How to handle standards, ISO norms, and laws?*

# *Responsibility of operation*

*18. The location of responsibility lies just with human operators?*

*→ Definitely not.*

*18. The location of responsibility lies with the coordinators of human operators?*

*→ As well, but it is an overall company issue!*

*18. This concept (responsibility) is not anymore important with autonomous systems. Do you agree?*

*→ The concept even becomes more important!*



## *Occurrences and decision*

20. *When a problem (unexpected event) occurs are the operators able to stop the robot operation? Why?*
- *yes, clearly to ensure error-free production and operator safety*
20. *When a problem (unexpected event) occurs the robot operation is self-regulated (no operator intervention is needed)? Why?*
- *Pratley true as well, but end-control is always on the operator side*
20. *What is the principal innovation related with operator-robot interaction?*
- *Human and robot shoulder to shoulder...*



## *Human-robot interaction (HRI) challenges*

*23. What is the principal challenge in the HRI research (all fields)?*

*→ Reasonable use case development that leads to higher social awareness*

*23. What is the principal challenge in the HRI in manufacturing environment?*

*→ Combining right input and output modalities*

*23. Are these challenges tackled in your research group? Why?*

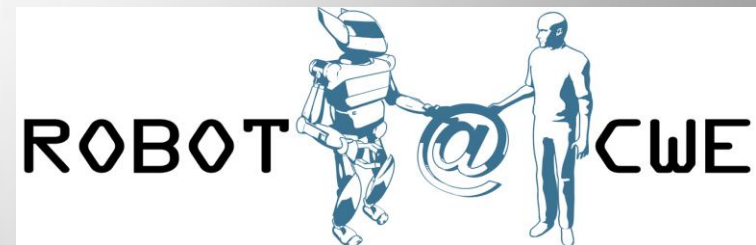
*→ yes, because they are principal challenges ;-)*

## *Main research issues*

- 27. Please give examples of main projects related with the research on HRI*
- 28. Please give examples of main projects related with social sciences research with possible relation with HRI*
- 29. Or give examples of research projects related with complex work systems in manufacturing*

# *ICT&S Center and ROBOT@CWE*

- Role:
  - concerned with the interactions and the interplay between humans and robots from the individual to the society
  - analyse the requirements, give design recommendations and evaluate the robotic systems
  - contribute to the design and development of human-centred, usable and socially acceptable robotic work environments
  
- Main Tasks:
  - usability & user experience evaluations
  - interaction models
  - technology acceptance assessment & social appliance recommendations



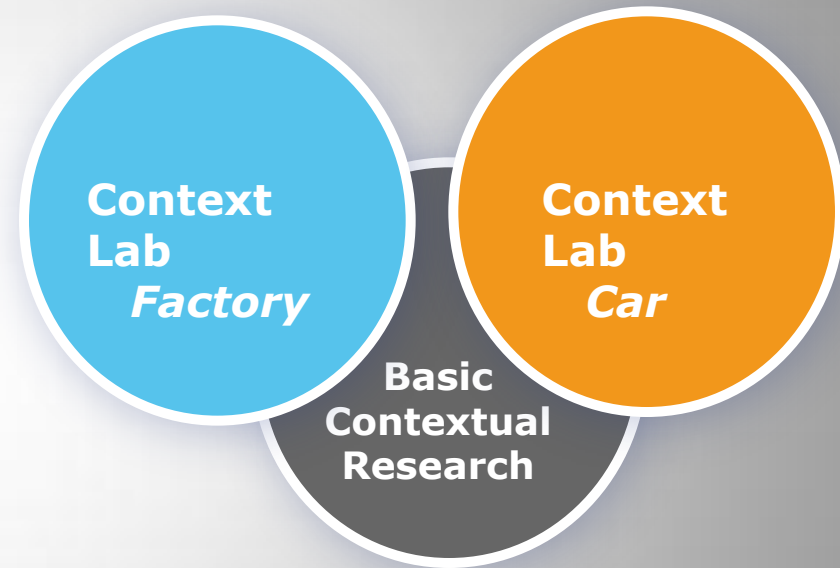
# *ICT&S Center and IURO*

- Interactive Urban Robot
- Objective:
  - develop and implement methods and technologies enabling robots to navigate and interact in densely populated, unknown human-centered environments and retrieve information from human partners in order to achieve a given navigation or interaction goal.
- 2010-2013
- FP7-ICT-2007-4 Cognitive Systems, Interaction, Robotics
- STREP with 5 Partners



# *Christian Doppler Laboratory*

- Research in Contextual Interfaces
  - User Experience Research
  - Context Research
  - Evaluation Research
- Duration
  - Dec. 2009 - Dec. 2016
- Funding:
  - Christian Doppler Society
  - AudioMobil
  - Infineon



# *Future analysis*

*30. Will the topic of operator-robot interaction increase the research interest in the next 5 years?*

*→ yes*

*30. Is there a need to support more interdisciplinary research on this issue?*

*→ yes, above all we need to involve law, ergonomics, and social-psychologists*

*30. The existent research seems to be the needed and sufficient one?*

*→ yes, but how to get it into the factory?*

*30. Would it improve the research quality if social scientists integrate HRI projects?*

*→ Have to say yes, as I am a social scientist 😊*