

# Presence - Grand Challenges Human-System-Interfaces

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## Key Areas in Human-System-Interface

- HCI - Human-Computer-Interface
  - Multi-modality: graphics, gestures, speech, etc.
- VR
  - Multi-modality: 3D graphics, audiovisual immersion, VR presence
- Telepresence - Teleoperation
  - Presence in real (remote) environments, also scaled micro-env.
- Haptic Interfaces
  - Touch virtual or real objects / environments with force feedback
- Systems to interact with:
  - VR: computer generated environments
  - Telepresence: through robots in real environments
  - **Joint Action:** cooperate with a technical system (robot)



Areas

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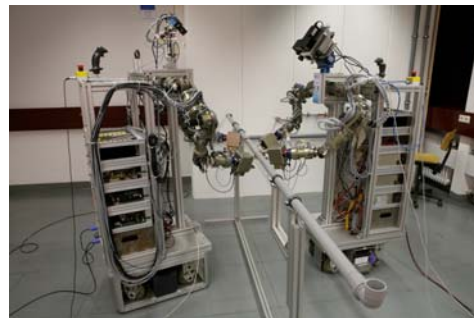
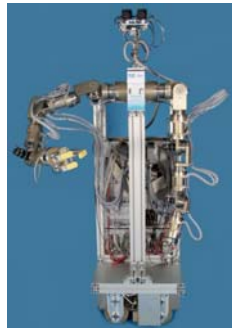
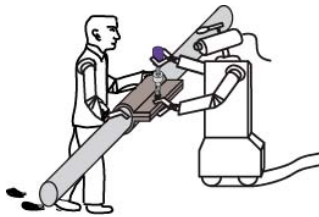
## Immersive Multi-Modal Interactive Presence

INTEGRATED PRESENCE RESEARCH - project for the creation of...



„...highly realistic multi-modal interactive immersion into virtual and augmented reality environments.“

## SFB453 - Telepresence and Teleaction



[www.sfb453.de](http://www.sfb453.de)



## TELE-ASSEMBLY IN WIDE REMOTE ENVIRONMENTS

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## INTERCONTINENTAL COOPERATIVE TELEMANNIPULATION GERMANY - JAPAN

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|                 |                        |
|-----------------|------------------------|
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| SANDRA HIRCHE*  | PAUL EVRAD**           |
| INGA KRAUSE*    | OLIVIER STASSE**       |
| CAROLINA WEBER* | NEO EE SIAN**          |
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## Cognition for Technical Systems



- Artificial Intelligence
- Cognitive functions on many levels:
  - Sensory-motor performance
  - Symbolic rule-based behavior
  - Abstract symbolic processing and reasoning
- VR: avatars; Reality: Robots
- Need learning / adaptation in all levels
- Level of autonomy in avatars and robots:
  - fully autonomous
  - semi-autonomous
  - remote control (teleoperation)
- Human-system-interaction means interaction with all of above
- Interaction on human terms, **JOINT ACTION !**

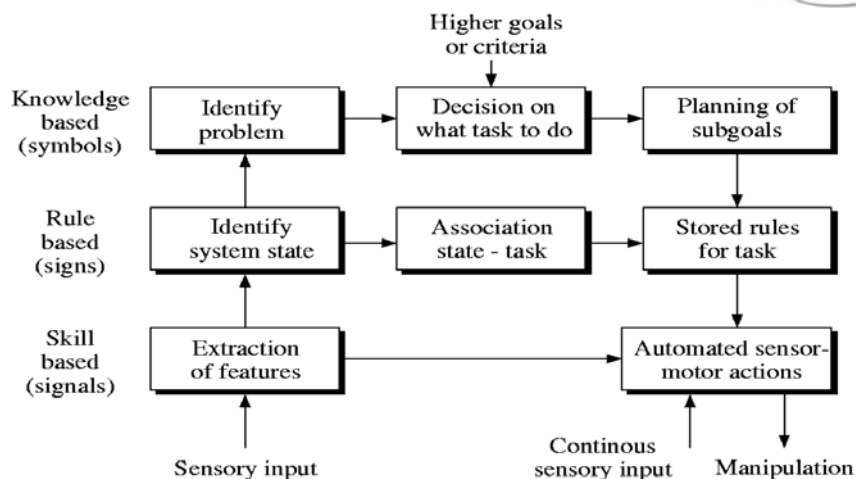


[www.cotesys.org](http://www.cotesys.org)

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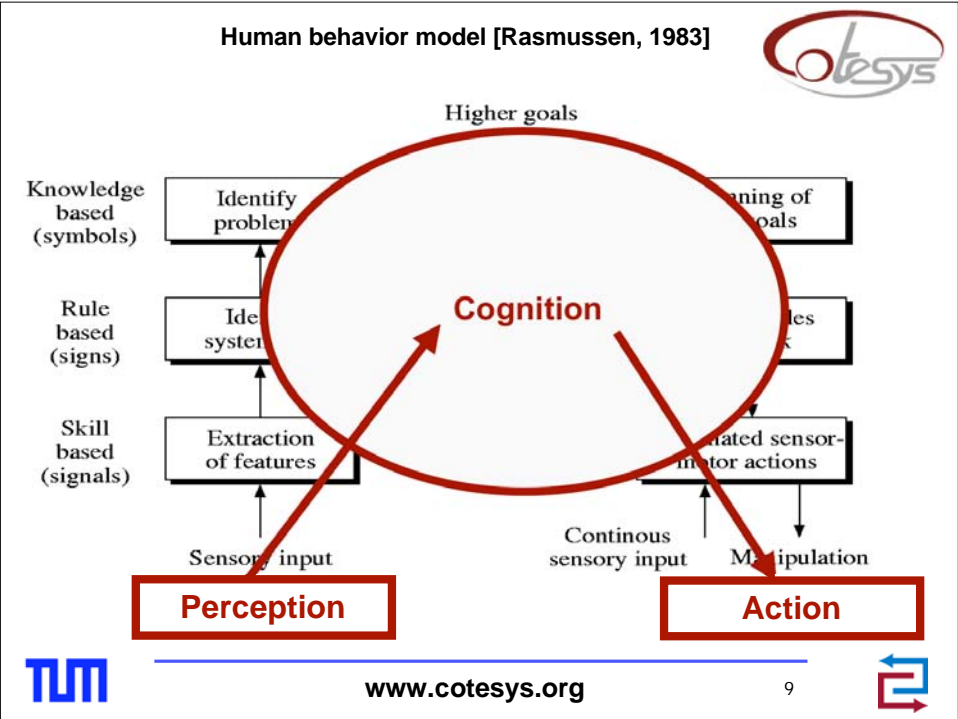
## Human behavior model [Rasmussen, 1983]



[www.cotesys.org](http://www.cotesys.org)

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# ACE

THE AUTONOMOUS CITY EXPLORER PROJECT

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## EDDIE - Nonverbal Communication / Interaction

Research Framework:

- integration of nonverbal cues
- nonverbal communication



Scientific Questions and Design Concepts:

- psychological analysis and design
- nonverbal cue recognition
- actuation/induction devices for nonverbal feedback
- system-theoretic modeling
- ....



Kismet @ MIT  
[Breazeal et al.]



## Grand Challenges

- **Multi-modal Interaction** including:
  - Haptics !!
  - Nonverbal cues / **nonverbal communication**
  - Symbolic reasoning and **learning / adaptation** on all levels
- Presence / Immersion in **real and augmented environments**
- **Joint action** with cognitive technical systems in real environments
  - Sensory-motor joint action
  - Cognitive joint action
- **Systems** to interact with:
  - VR: computer generated environments
  - Telepresence: through robots in real environments
  - Joint Action: cooperate with a technical system (robot)



### THANKS to sponsors and coworkers:

- DFG, EU-IST, BMW, ...
- Dr. Kolja Kühnlenz, Dr. Dirk Wollherr,
- Angelika Peer, Dr. Sandra Hirche
- ... many students ... many technical staff



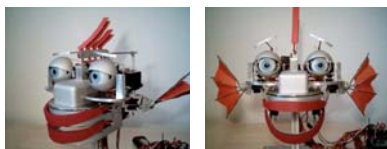
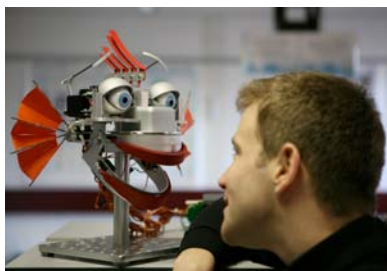
Directions

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ROMAN'2008 in Munich <http://ro-man2008.org>

- IEEE Int. Conf. ROMAN'2008, 1-3 August 2008
- Cooperation on all levels: research, people exchange



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IMMERSIVE MULTI-MODAL INTERACTIVE PRESENCE

INTEGRATED PRESENCE RESEARCH - project for the creation of...



„...highly realistic multi-modal interactive immersion into virtual and augmented reality environments.“



[www.immersence.info](http://www.immersence.info)



IMMERSIVE MULTI-MODAL INTERACTIVE PRESENCE

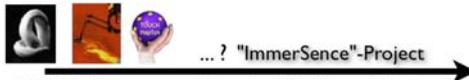
Integrating visual, haptic and auditive sensory components...



VISION Vision is advanced



AUDITION Audition is advanced



TOUCH ... ? "ImmerSence"-Project  
Touch is highly underdeveloped

with a specific focus on the haptic dimension...



[www.immersence.info](http://www.immersence.info)







IMMERSENCE overall objective:

**The implementation of 3 Driving Scenarios for Interaction in VR Environments**



- **P2O:** Person-to-Object interaction.
  - New ways of multimodal model generation
  - Modelling free-hand object manipulation

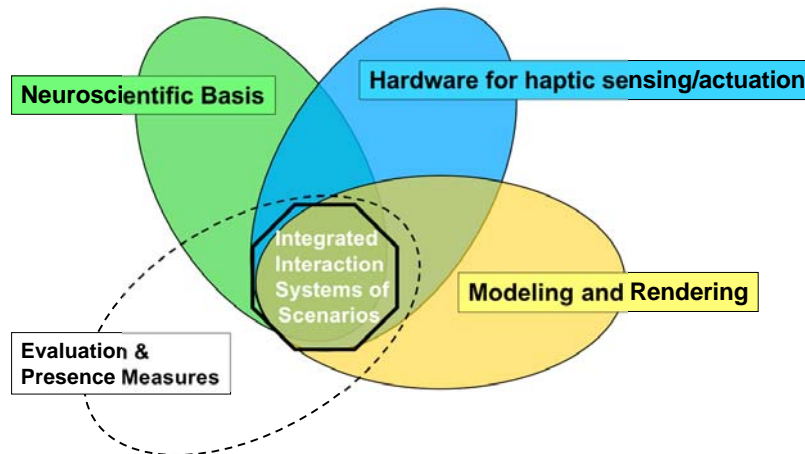


- **P2P:** Person-to-Person interaction; multimodal, interpersonal interaction e.g. handshake, dance

- **POP:** Person-through-Object-Person interaction; collaborative work between two people mediated by an object, e.g. carrying a heavy object in collaboration



**Research Fields involved:**





### Neuroscientific Basis for Haptic Enhanced Multimodal Interaction

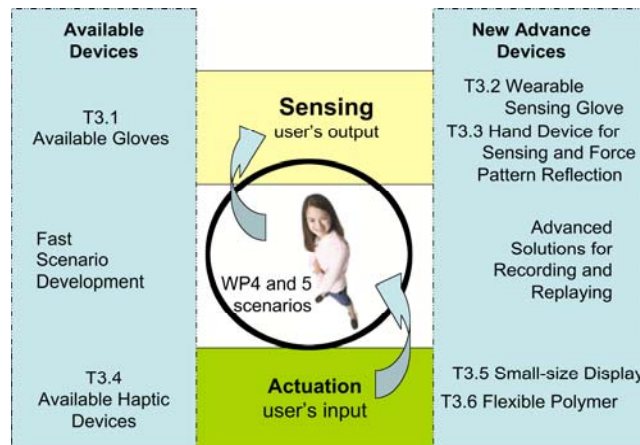
- *Interaction - Direct Contact*
- *Interaction – Information Exchange*
- *Interaction - Dynamic haptic enhanced multimodal perception*



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### Hardware for Haptic Sensing and Actuation

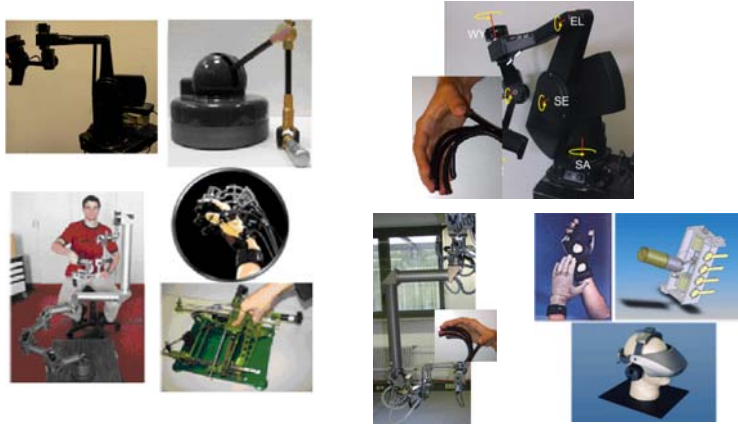


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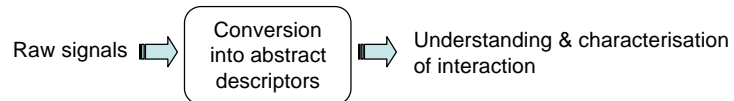


### Hardware for Haptic Sensing and Actuation: Existing devices



### Modeling and Rendering: Record – Replay – Create

#### I. RECORD:



#### II. Faithfully REPLAY

➡ Replacing the real counterpart by a virtual (object, avatar)

#### III. CREATE

➡ Integration of classical modeling methods into interpolation-based prediction scheme. *Create* sensory feedback even beyond extrapolation.





IMMERSIVE MULTI-MODAL INTERACTIVE PRESENCE

### Evaluation and Presence Measures

- Provide Evaluation Criteria for Human Multimodal Interaction Behavior
- Provide Presence Measures for Haptic Enhanced Multimodal Interaction
- Evaluation and Measurement in P2O – P2P – POP scenarios

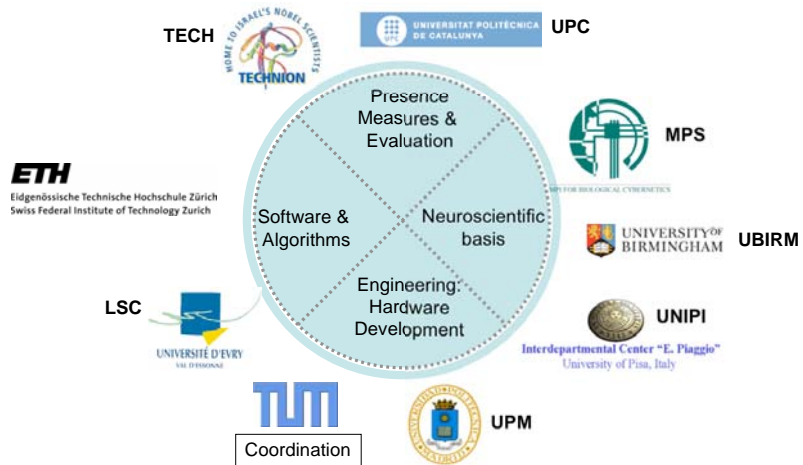


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IMMERSIVE MULTI-MODAL INTERACTIVE PRESENCE

### Distribution of Roles in the Project:



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