



NEWHRI workshop, ICRA 2008

Modelling and control for Human–Robot Interaction

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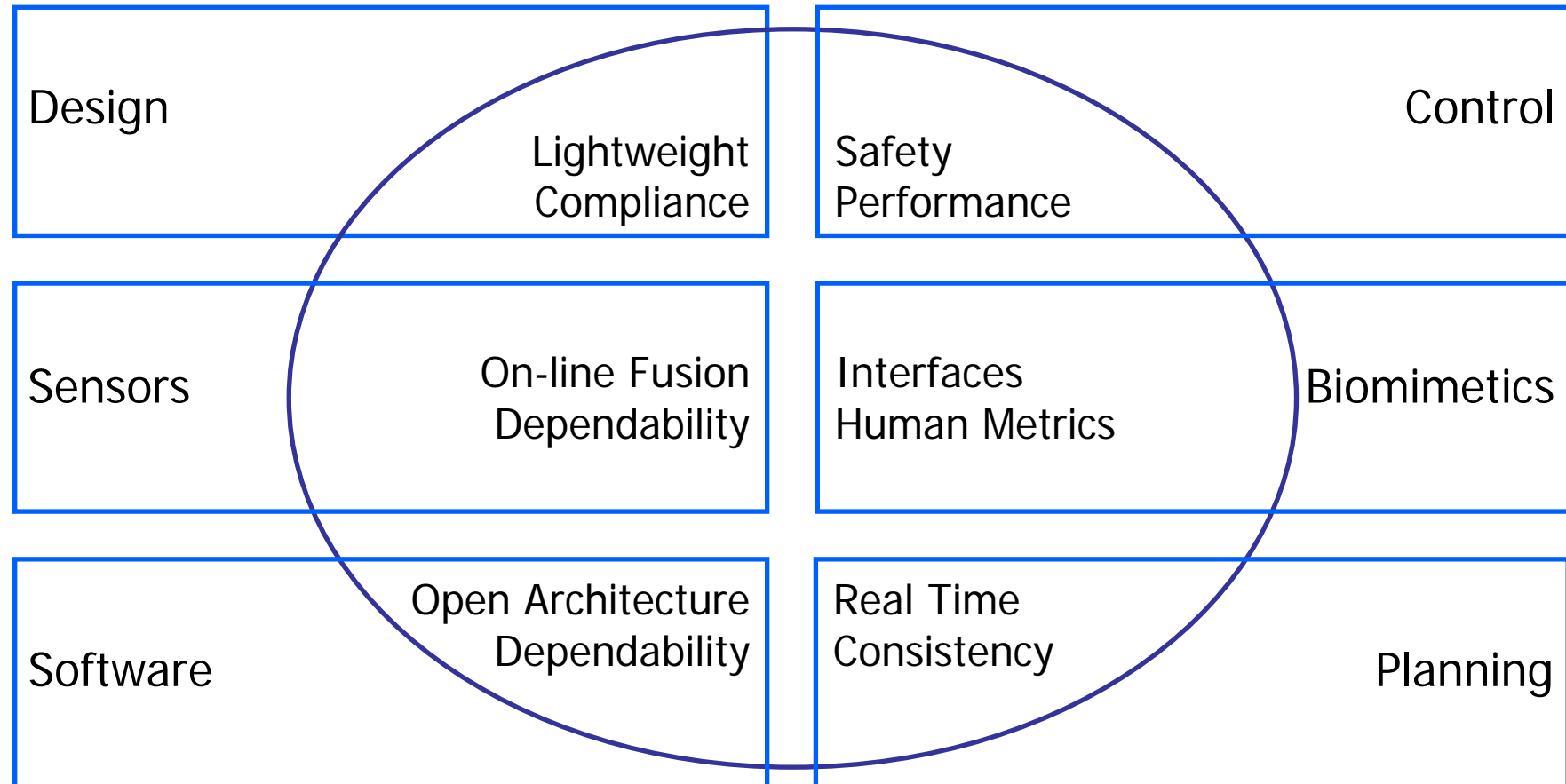
the physical viewpoint as a central aspect in HRI



- robots are distinct from computers or other machines: they physically embody the link between perception and action
- a very challenging feature of the next generation of robots will be physical Human–Robot Interaction: pHRI and CHRI
- provided “tools” for pHRI:
 - environment modelling for simple geometric computation
 - multiple-point approach both for multiple inputs and multiple outputs of the robot
 - arbitrary selection of the control points on a manipulator
 - reactive real-time control for safety
 - integration with deliberative tasks and other safety tactics
 - uncertainty and dependability



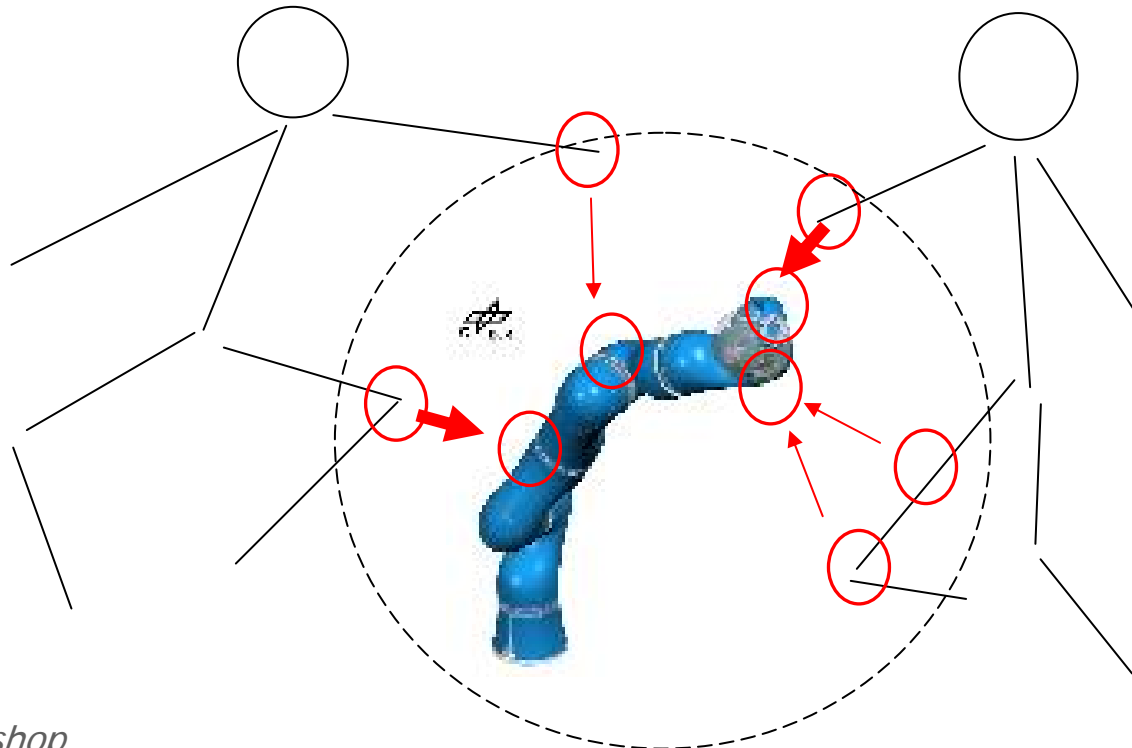
the framework of PHRIENDS





multiple-point control for physical interaction

- necessity of controlling multiple points
 - multiple input channels
 - multiple possible colliding parts
 - intrinsic multiple-task behaviours



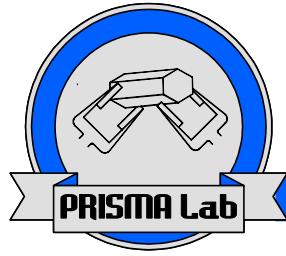


reactive control techniques in HRI

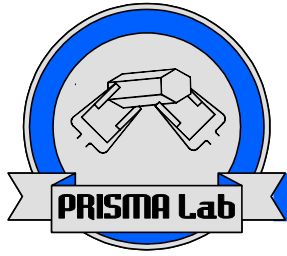


- collision avoidance for the DLR Justin manipulator
 - whole-body modelling
 - repelling force/velocity
 - higher intrinsic safety due to lightweight design
- vision and recognition for safety
 - face detection
 - safety by mean of control
 - dependability





- which parameters can be related to cognitive aspects?
 - intensity of force/velocity
 - weighting joint involvement (e.g., rules, fuzzy)
 - safety distances
 - damping, possible anisotropy
- priorities in case of multiple tasks
 - “important” control points
 - time-varying properties of the environment
- learning and anthropomorphism
- merging deliberative and reactive behaviours



evaluation of acceptance, comfort, “mental” safety

- realistic simulations in virtual reality for cHRI



- evidence: users want to “keep control”

Experiments



suggested synergistic keypoints in HRI



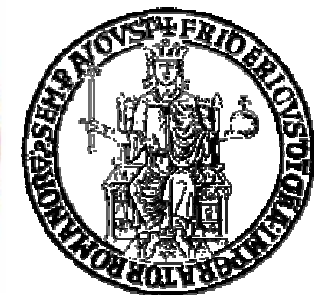
- safety (intrinsic or by mean of control) vs. performance
- different levels for dependability
- definition of legibility of the motion
- evaluation of acceptance, ethics
- possible biomimetic solutions
- metrics, benchmarks, and international standards for HRI
- learning algorithms, rules for validation, interfaces, simulation
- involving researchers from different areas and within the IEEE/RAS



acknowledgment



- PHRIENDS is about developing key components of the next generation of robots, including industrial robots and assist devices, designed to share the environment and to physically interact with people





NEWHRI workshop, ICRA 2008

Thank you very much for your kind attention 😊

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