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Cooperative learning for robot's social intelligence: a perspective from the iCub project

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Robot’s Social Intelligence and Natural Interaction Capabilities with End User Development

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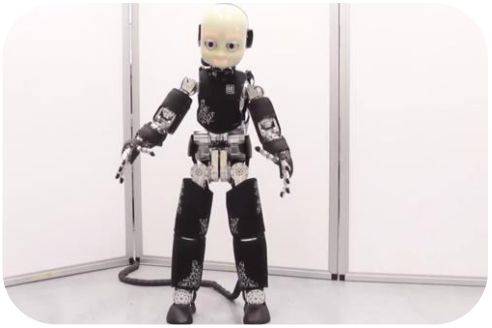
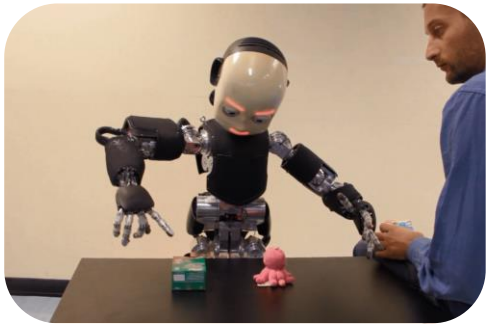
The iCub project

platform

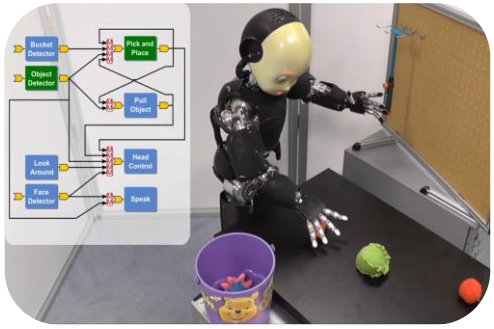


interaction

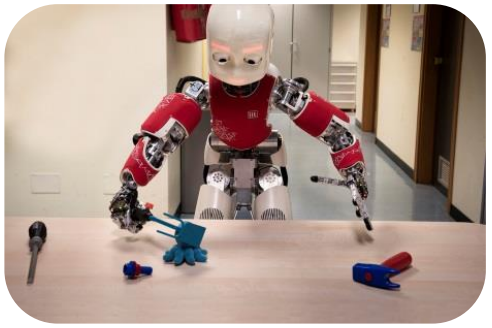
objects



system integration



tools



- Engineering
- Research/science

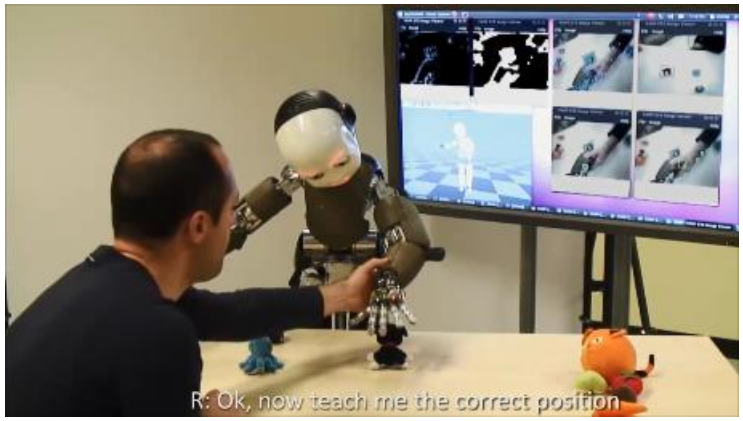
Motivations

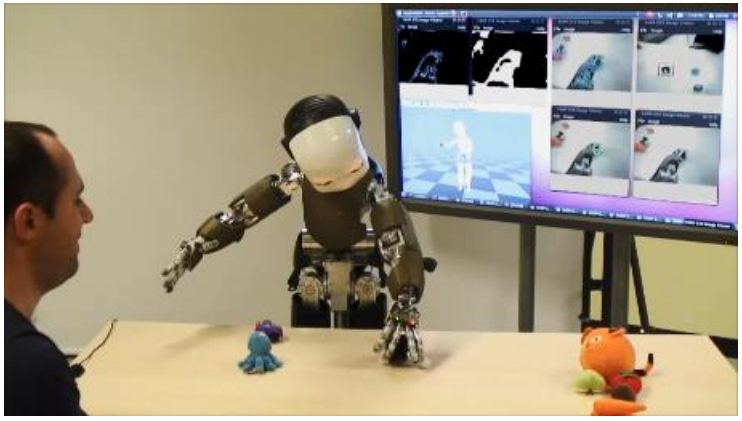
Autonomous
Friendly (humans)
Perception & control
Size/Weight/Power
Safety

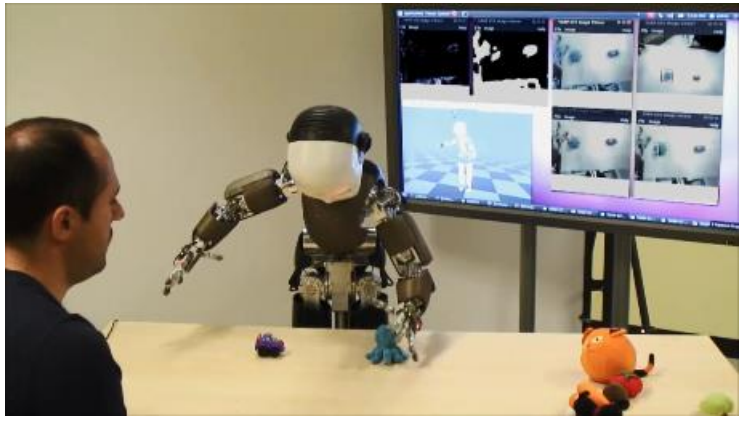

H: This is an octopus


R: I think this is the dog


R: I will learn the new object


R: Ok, now teach me the correct position





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Current limitations

- Can an untrained human communicate with the robot?
- Insufficient feedback: humans cannot adapt to the robot
- Problems for perception: detect humans, their intentions, and behave accordingly
- Communication should be: verbal, visual, tactile, behavioral…

What is missing?

- Multimodal, perception (speech, vision touch, force)
  - Perception must be robust
- Whole-body
- Seamless, natural interaction
  - Backchannels
  - Continuous perception
  - Reactive behaviors

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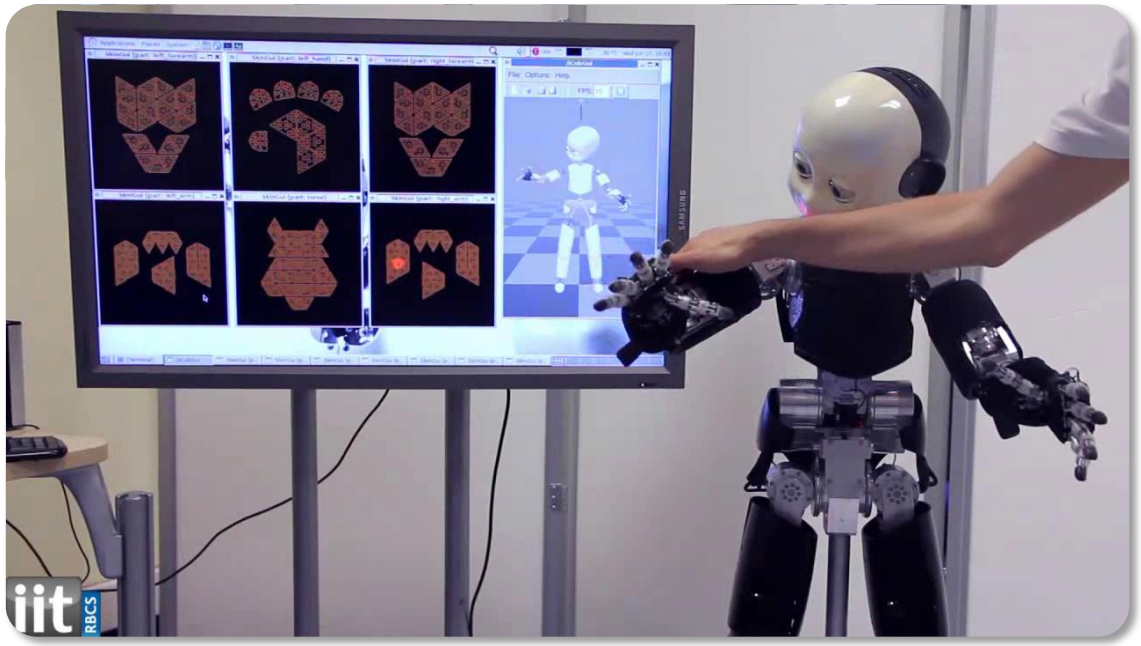
Towards whole body skin



Hands: 104x2
Forearms: 230x2
Upperarms: 380x2
Torso: 440
Legs and feet: 1310x2

Total: 4488 + accelerometers in the palms and arms

Towards better human perception

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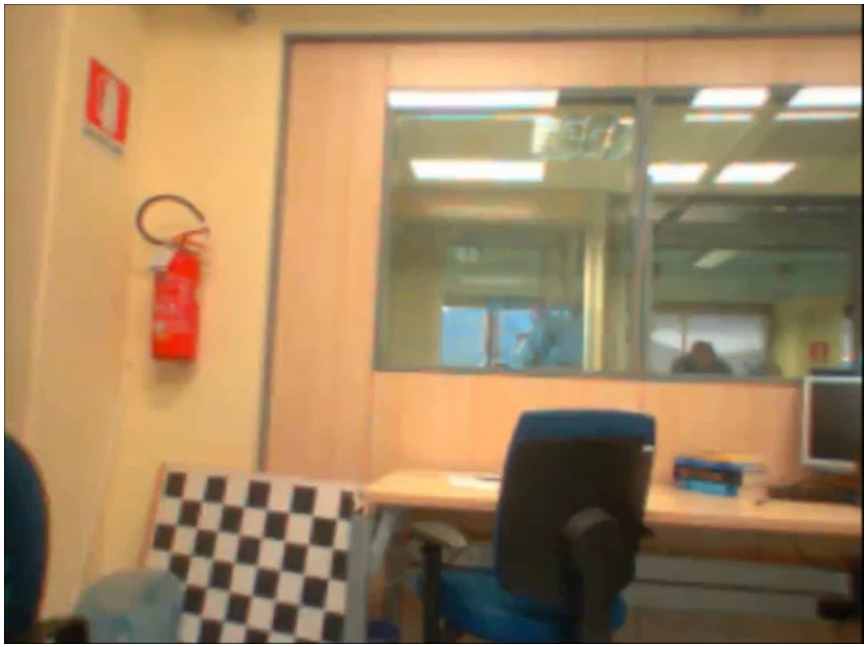
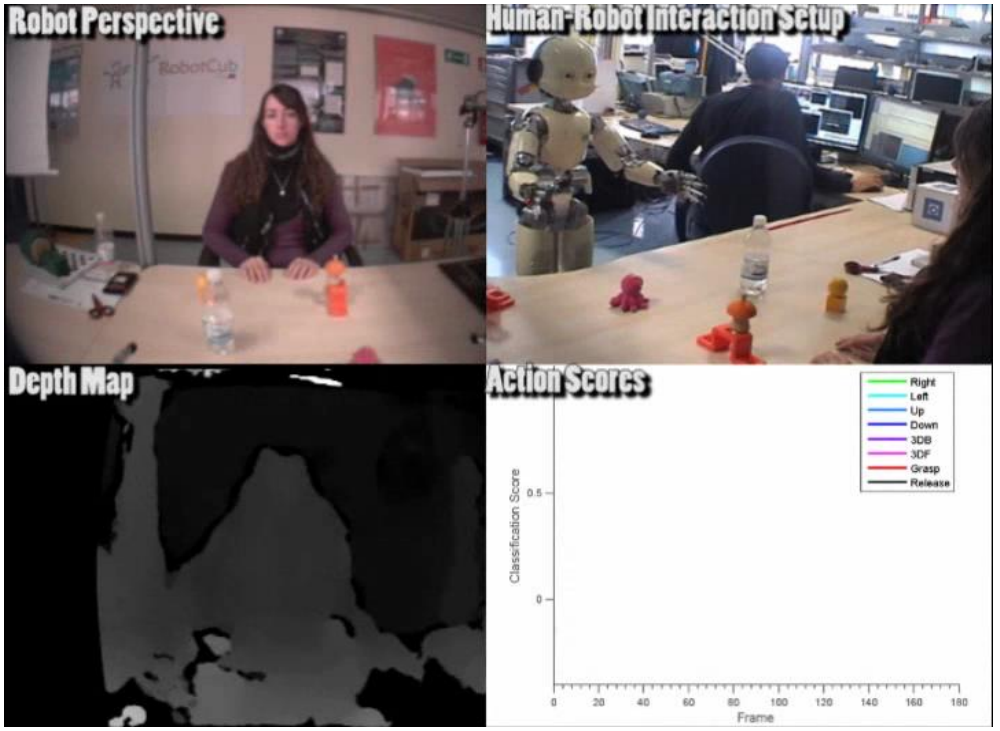


Head pose detection using HOG features and landmarks (Kazemi, Sullivan 2014)



Gesture recognition, using HOF, sparse coding and ML

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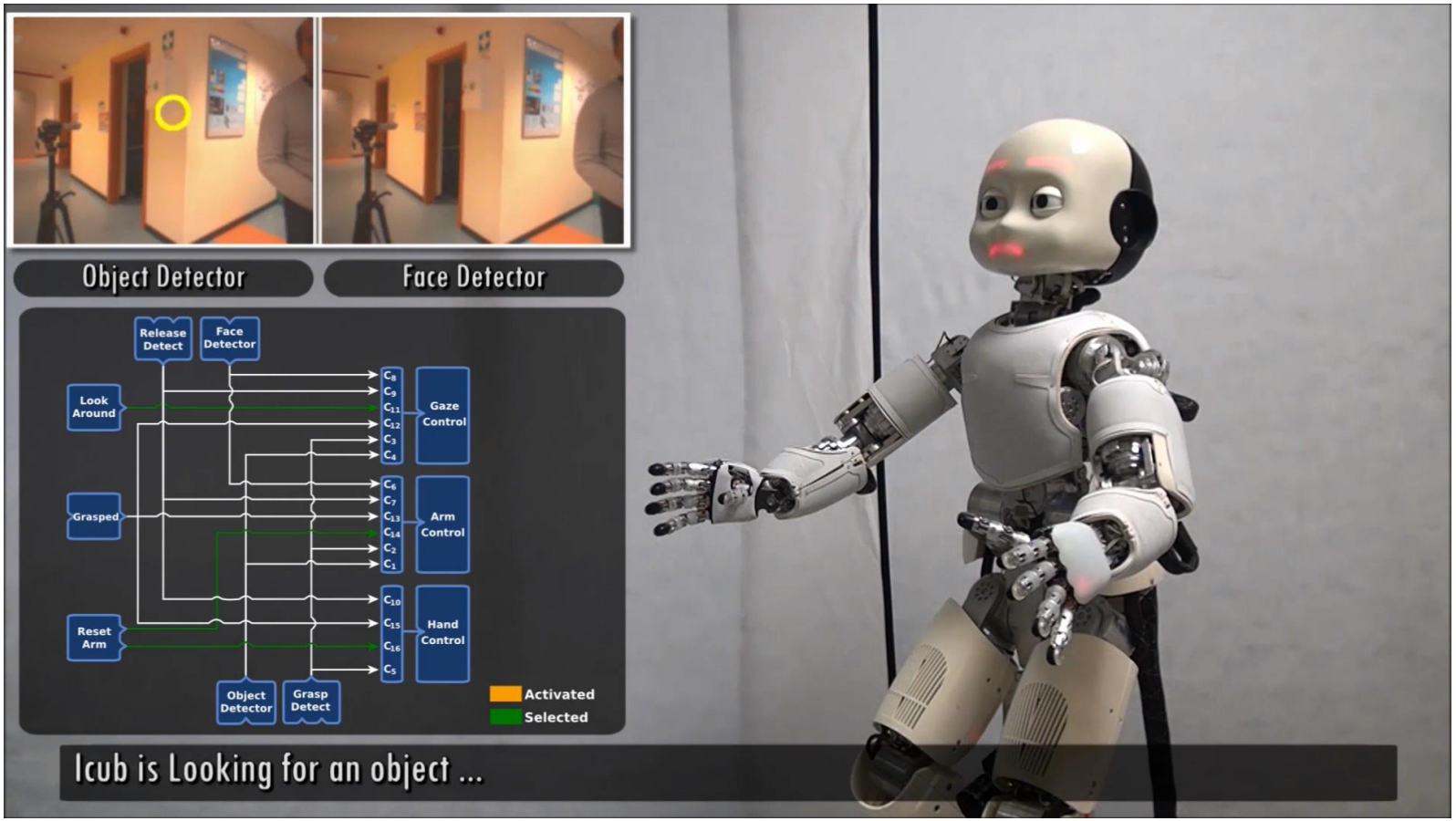
Programming reactive behaviors



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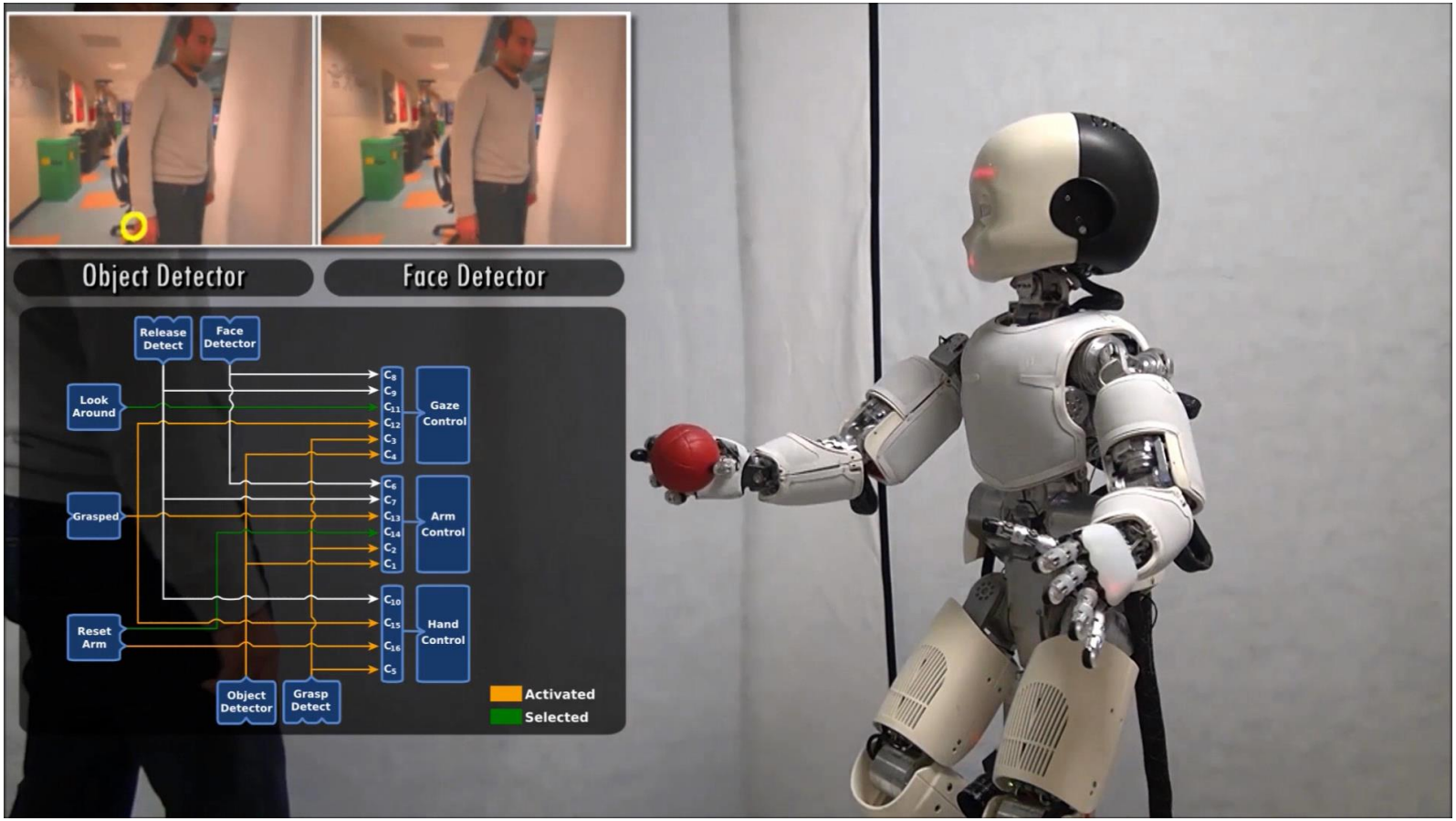
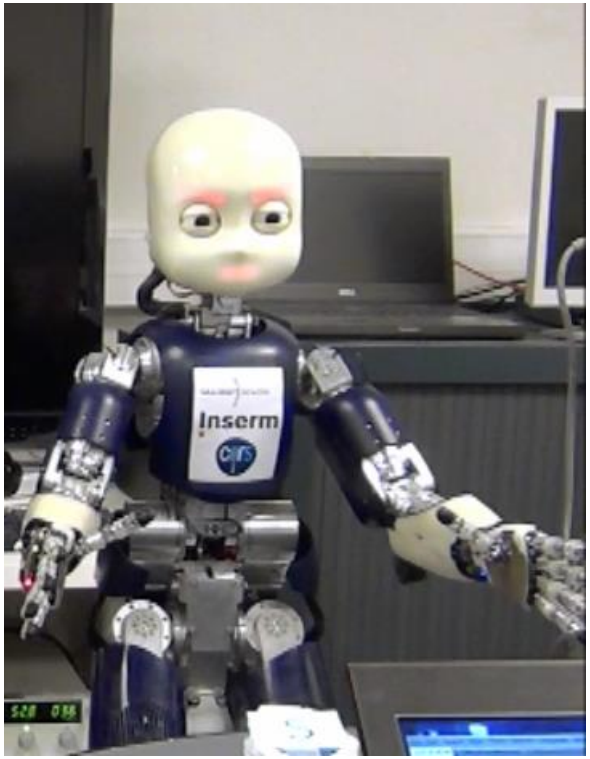
Programming reactive behaviors



More on coordination

- Example: eye blinks
  - Need to notify perception that should ignore frames (this is non-trivial)
- Coordination between actions, gaze, pointing, nodding etc…
- *Put that there!*



Video credits: G. Gibert ,INSERM, Lyon

Wrap-up

- Multimodal, robust, perception (speech, vision touch, force)
- Whole-body
- Seamless, natural interaction
  - Continuous perception
  - Reactive behaviors
- Benchmarking:
  - (performance metrics)
  - Dataset
  - Simulators
- Robots designed for social interaction (hardware and software)

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Thank you!