



iCub: An Overview

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Laboratory for Computational and Statistical Learning - Istituto Italiano di Tecnologia & MIT
CBMM Summer School - Woods Hole 16 Aug. 2015

Schedule

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Demos!!

iCub

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The Robot

Who: iCub.

What: a “child” humanoid robot.

When: project started in 2004.

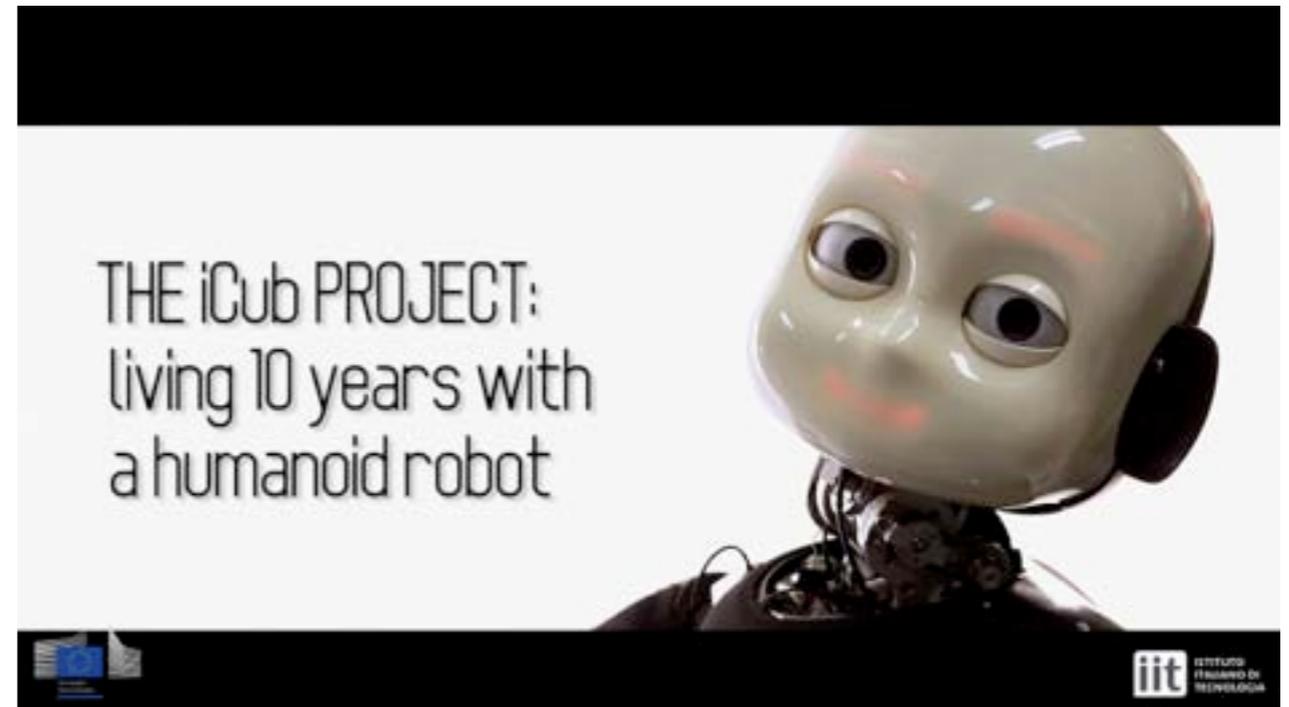
Where: IIT, Genova, Italy.

Why: a platform to study the emergence of cognitive capabilities in artificial, embodied systems.



The iCub “dads”

Image removed due to copyright restrictions. Please see the video.



2004
RobotCub
European FP7
Project

2010
Force/Torque
sensing

2012
body covered with
artificial skin

2014
Visuo-motor
Calibration

2015
Balancing

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1 Accelerometer and Gyroscope

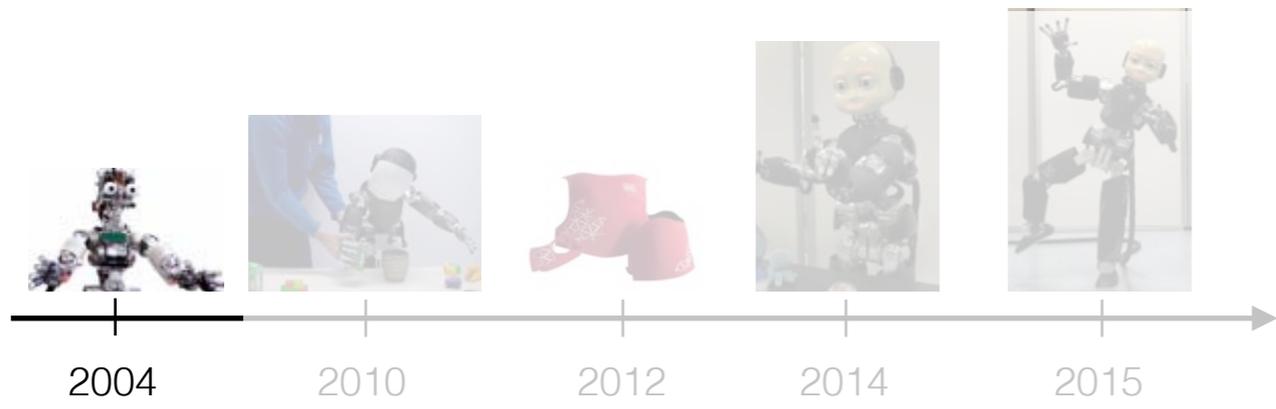
2 Dragonfly cameras resolution: 640 x 480

Highly dextrous hands: 9 DoFs



Overview

- Height: 1 meter
- Weight: 25 Kg
- 53 Degrees of Freedom (total).
- Force/Torque sensors in each limb.
- Tactile “skin” sensor over (almost) the whole body.
- 2 Microphones mounted on the head.



iCub is involved in many projects...

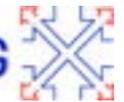
RoboSkin 

italk

 **CHRIS**
Cooperative Human Robot Interaction Systems

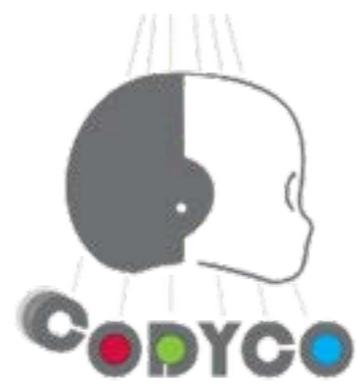


AMARS

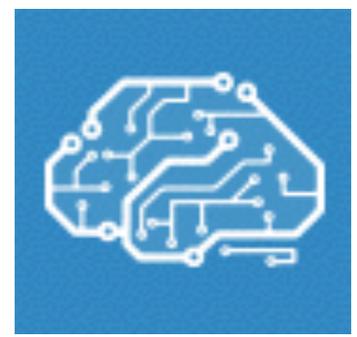
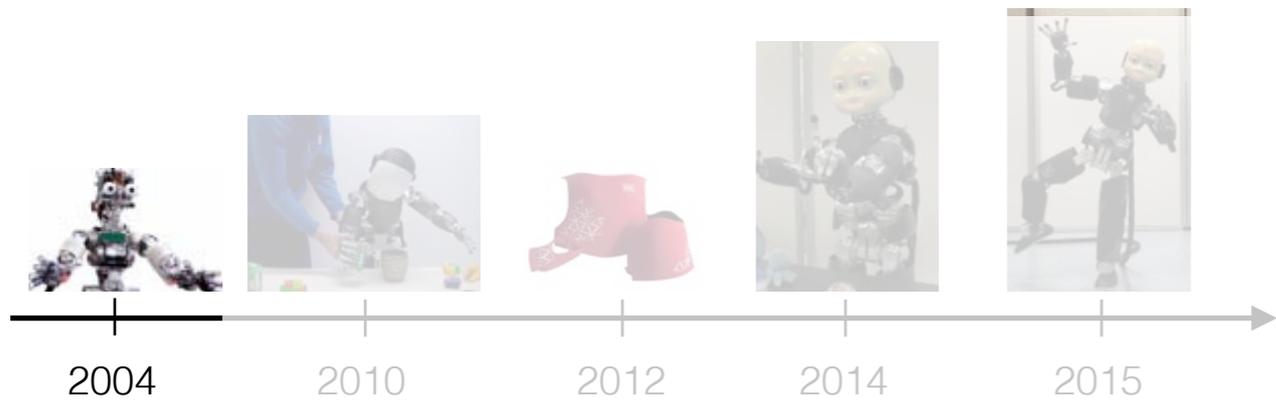
XPERIENCE.ORG 

RobotDoC

RobotCub

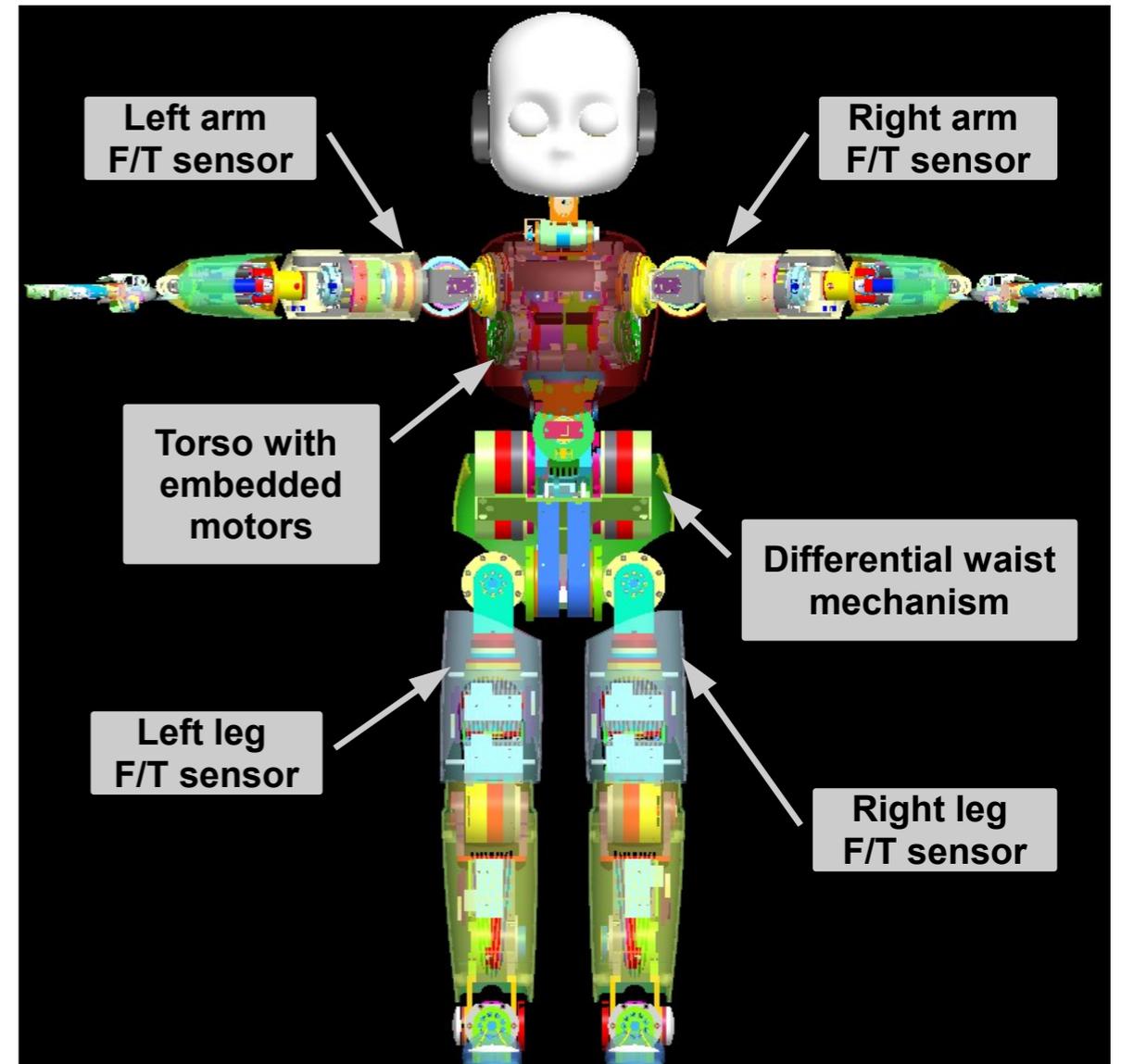


... in CBMM too!

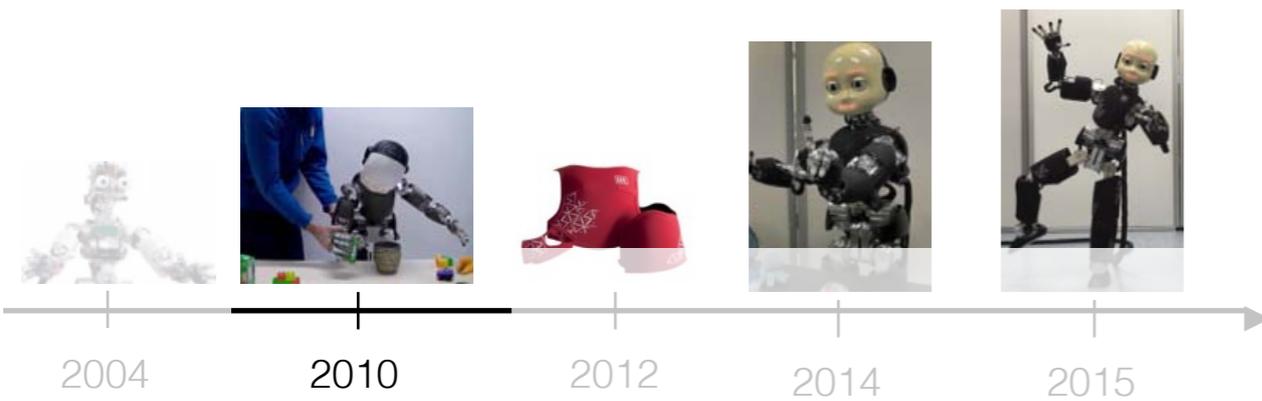


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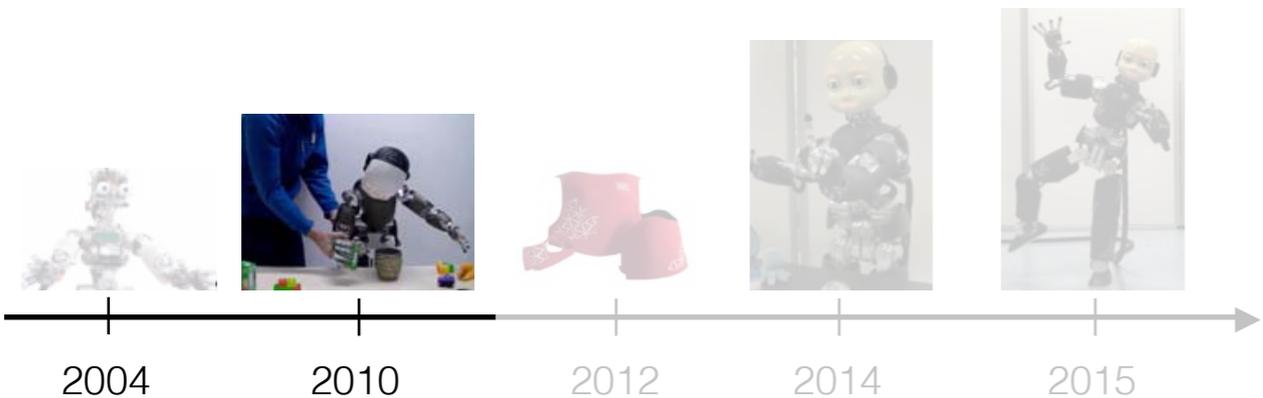
Force/Torque Sensors



One for each limb!



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Teaching Actions

Poeticon European Project

<https://www.youtube.com/watch?v=ZcTwO2dpX8A>

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Artificial Skin



capacitor



ground plane: e.g. conductive fabric
parameters: mechanical properties, impedance, etc.

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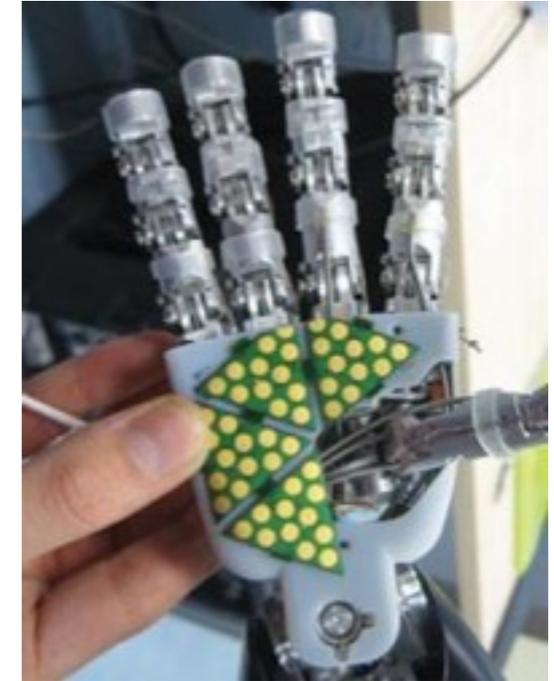
soft material: e.g. silicone
parameters: dielectric constant, mechanical stiffness, etc.

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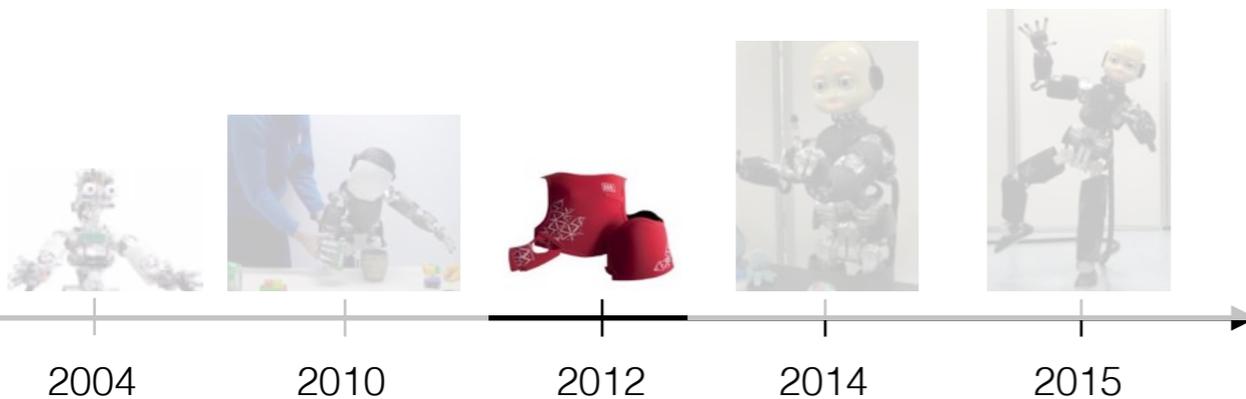


electrodes: etched on a flexible PCB
parameters: shape, folding, etc.

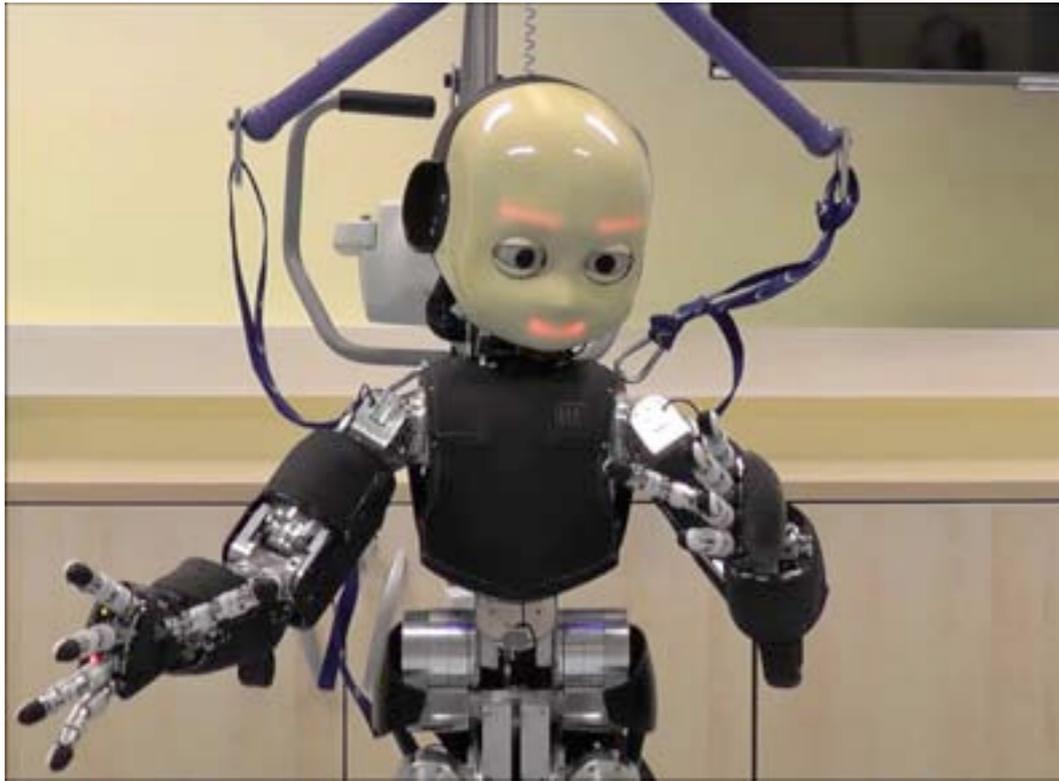
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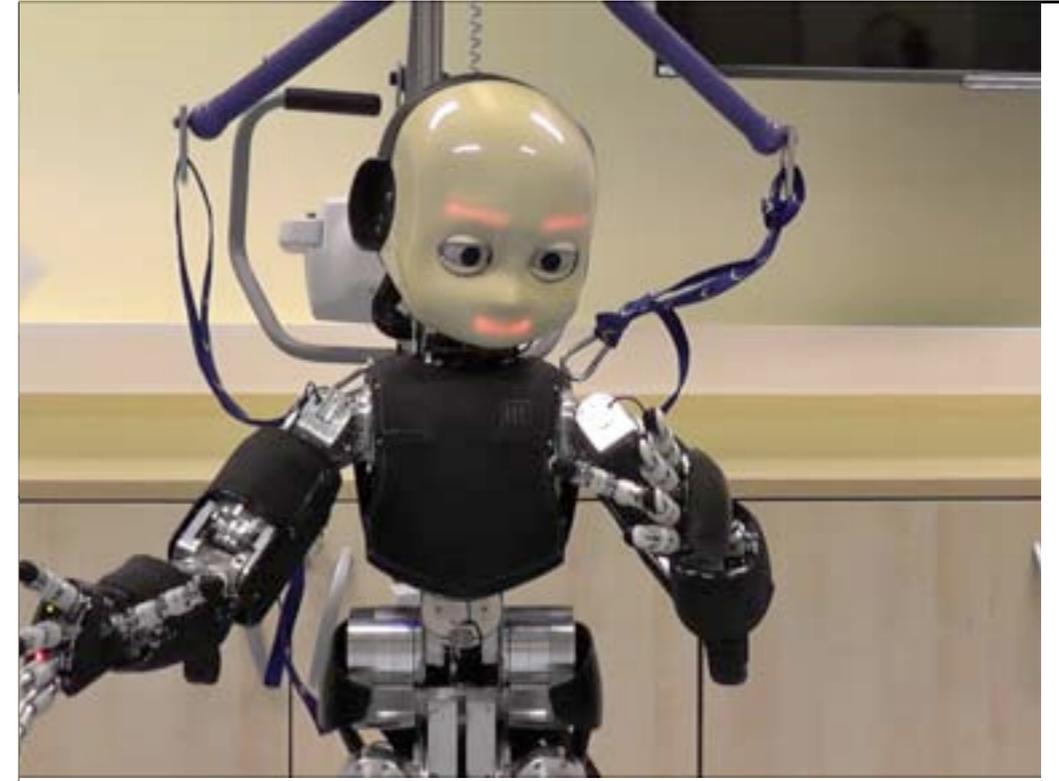
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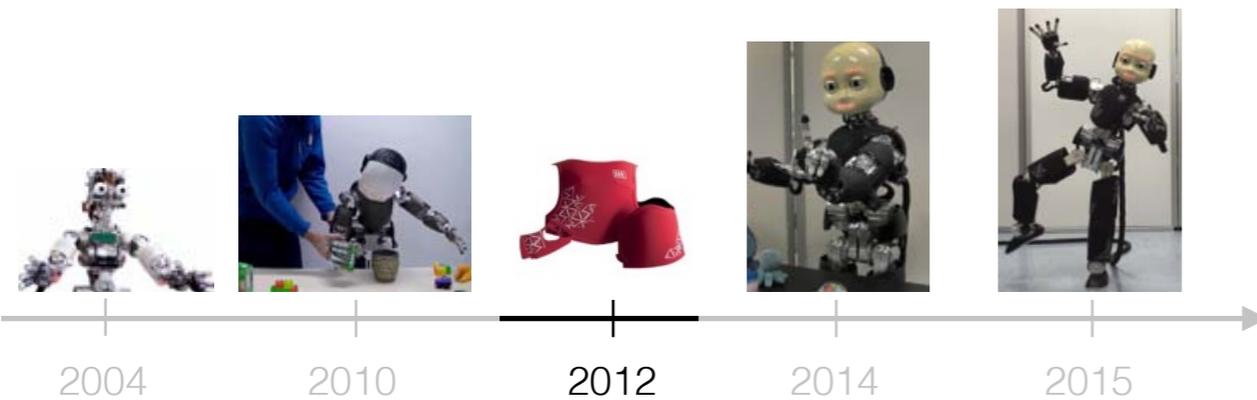
Artificial Skin



No Tactile feedback

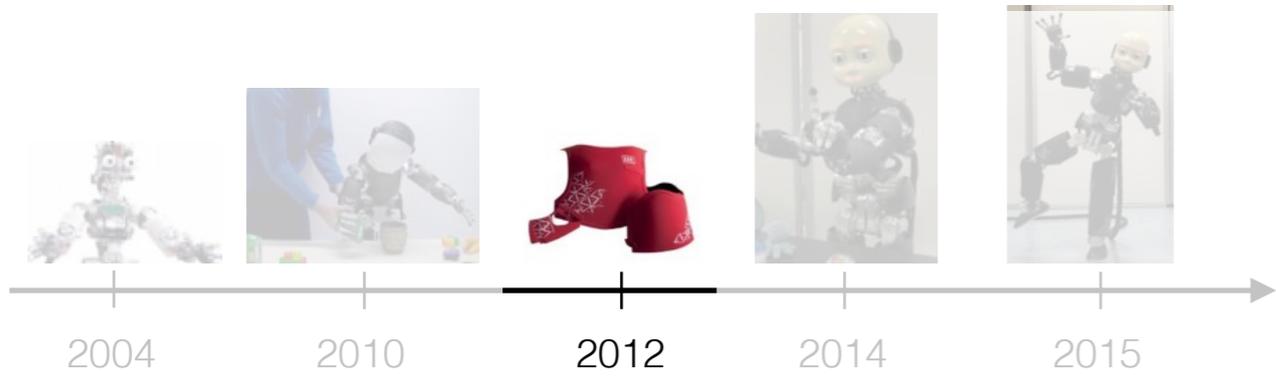
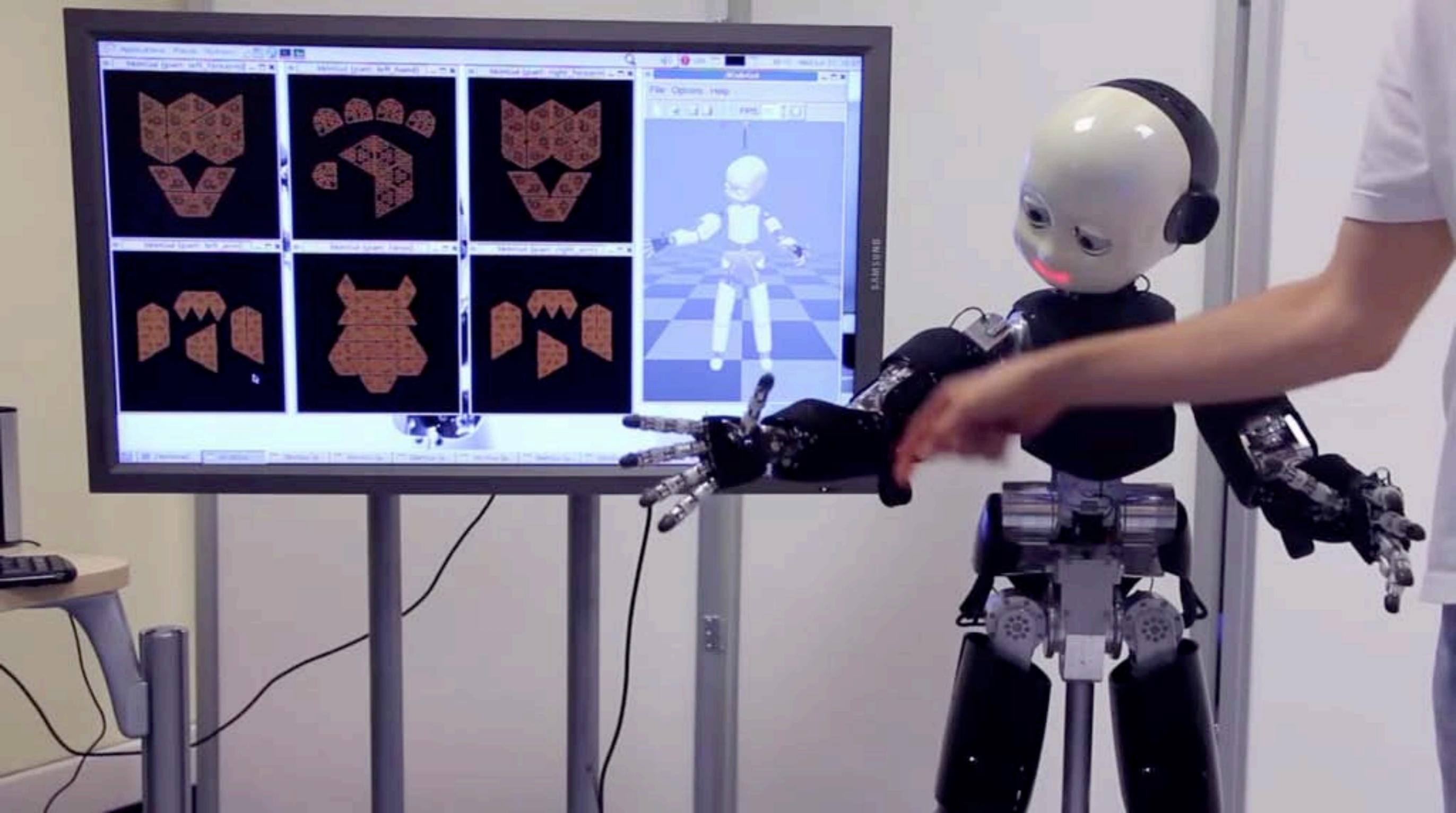


With Tactile feedback



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<https://www.youtube.com/watch?v=S7Kk6KEw3C4>

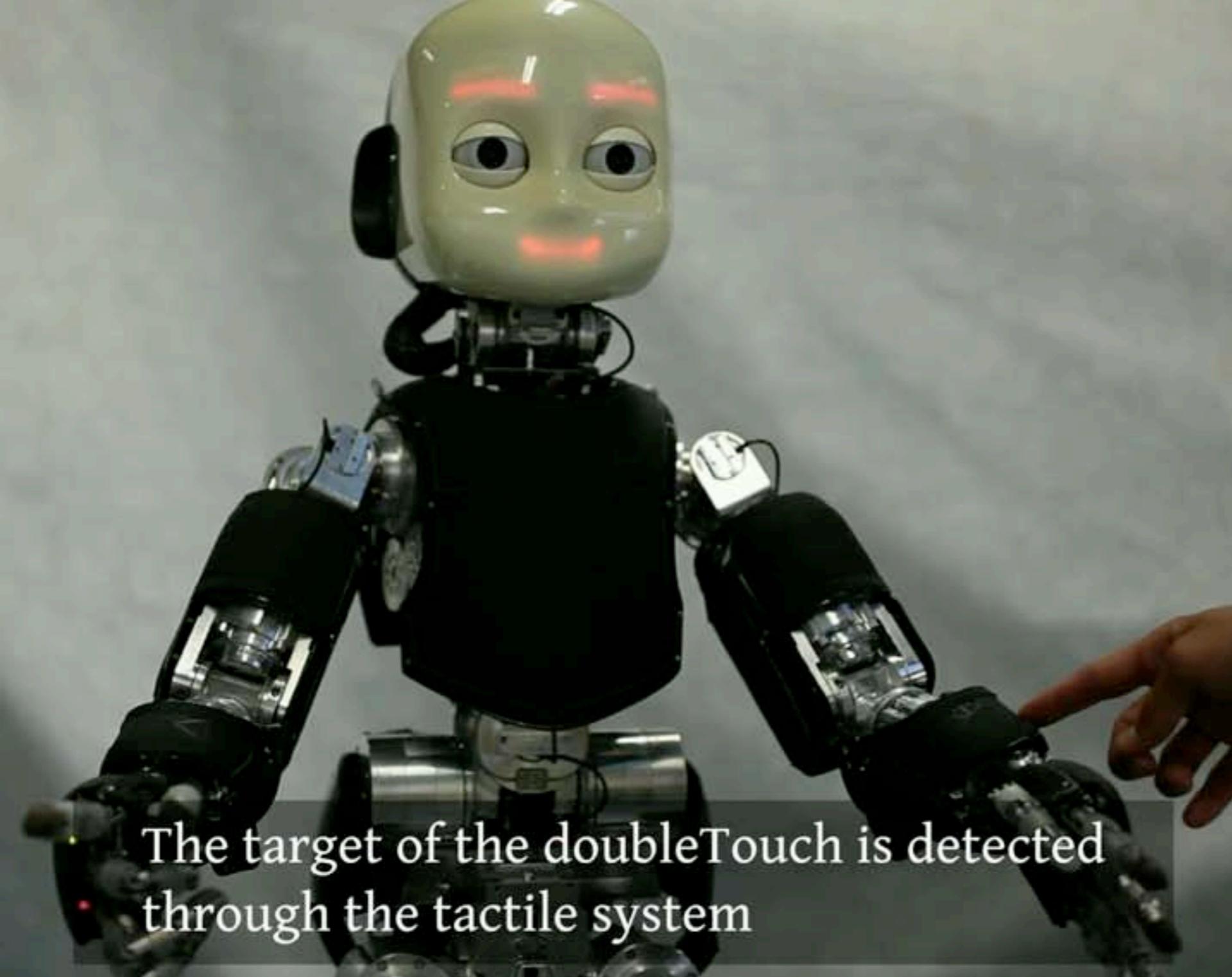


Zero Force Control

Del Prete, A. et al. *Control of Contact Forces: the Role of Tactile Feedback for Contact Localization*, IROS 2012

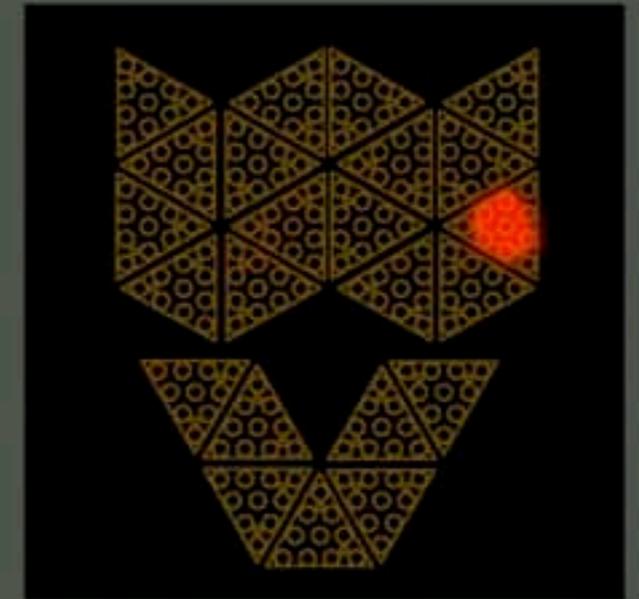
<https://www.youtube.com/watch?v=S7Kk6KEw3C4>

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The target of the doubleTouch is detected through the tactile system

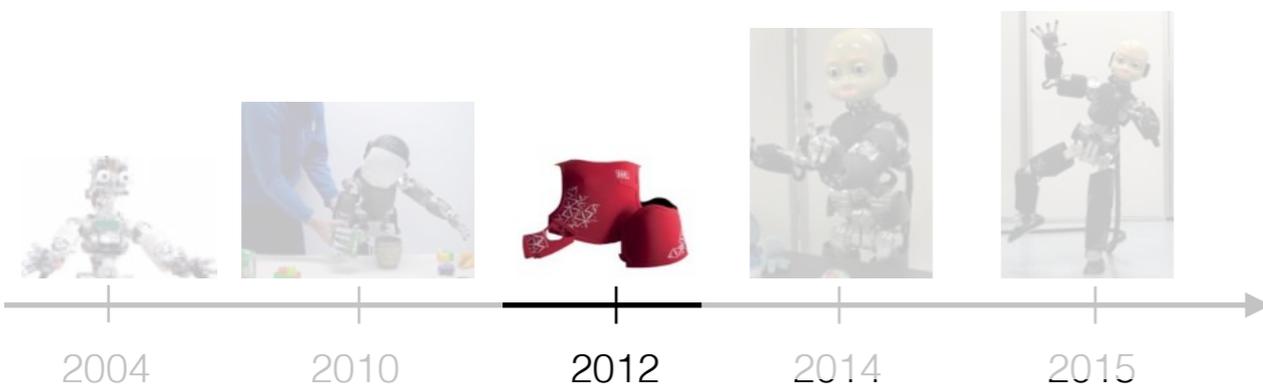
Left Forearm Skin



Right Hand Skin

Skin Self-Calibration

Roncone A., et al. *Automatic kinematic chain calibration using artificial skin: self-touch in the iCub humanoid robot*. ICRA 2014



2004

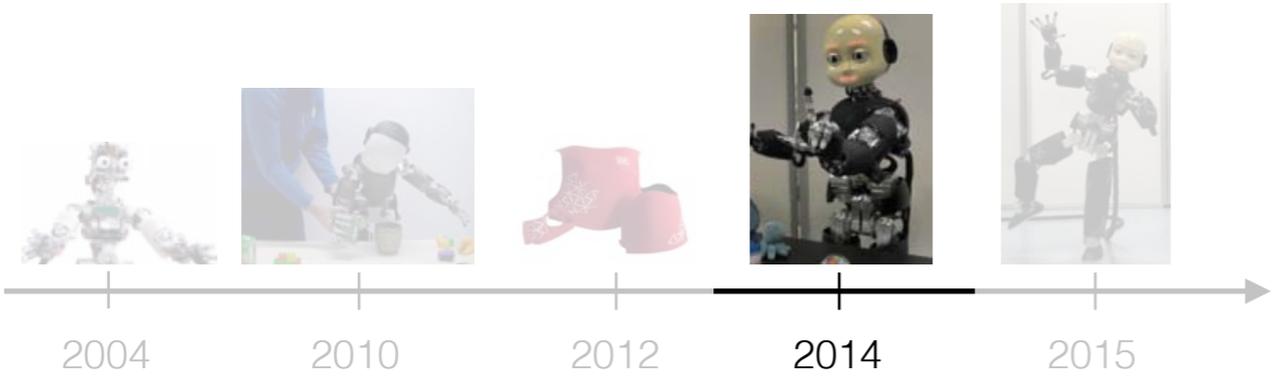
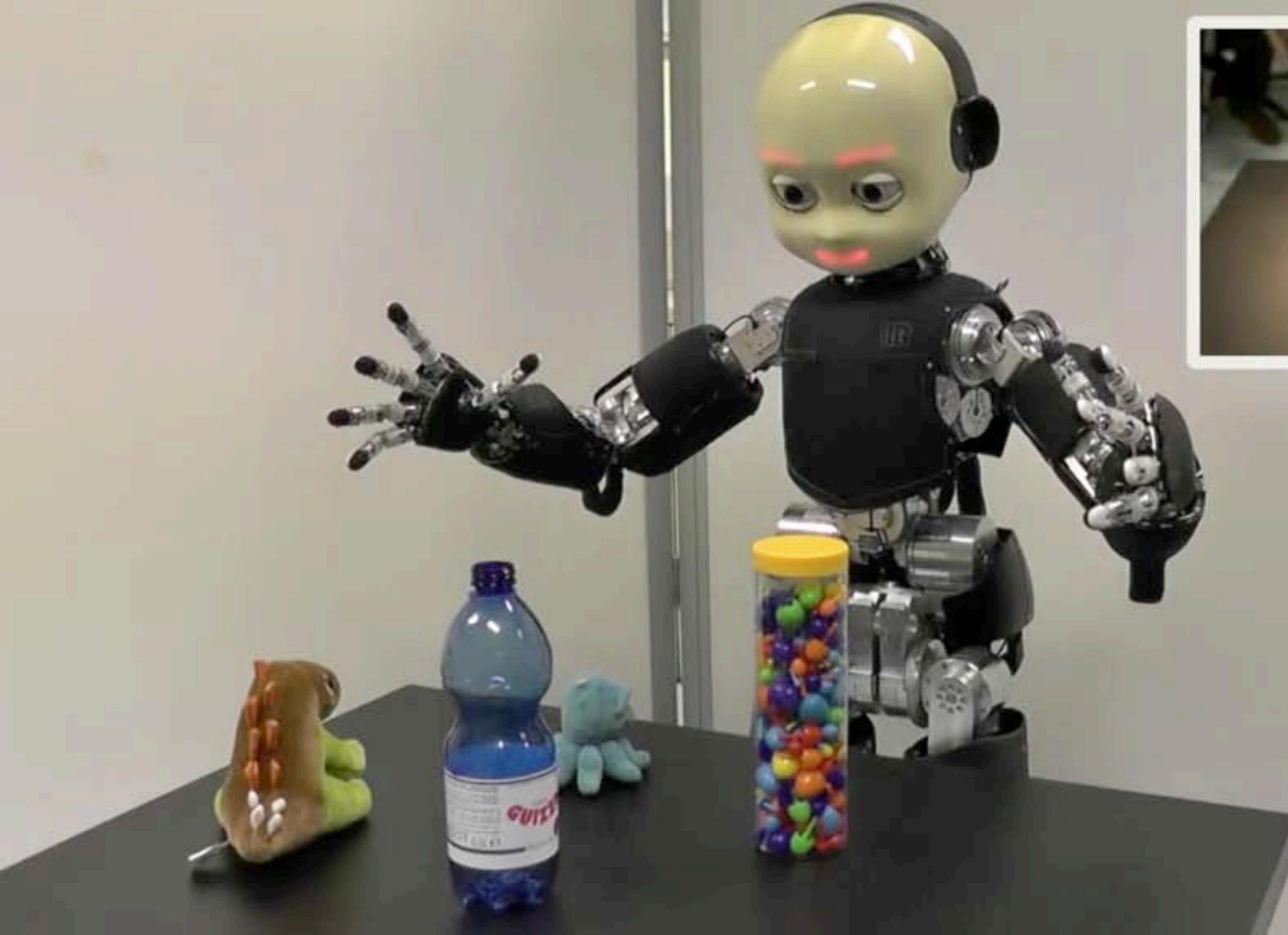
2010

2012

2014

2015

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Visuo/Motor Calibration

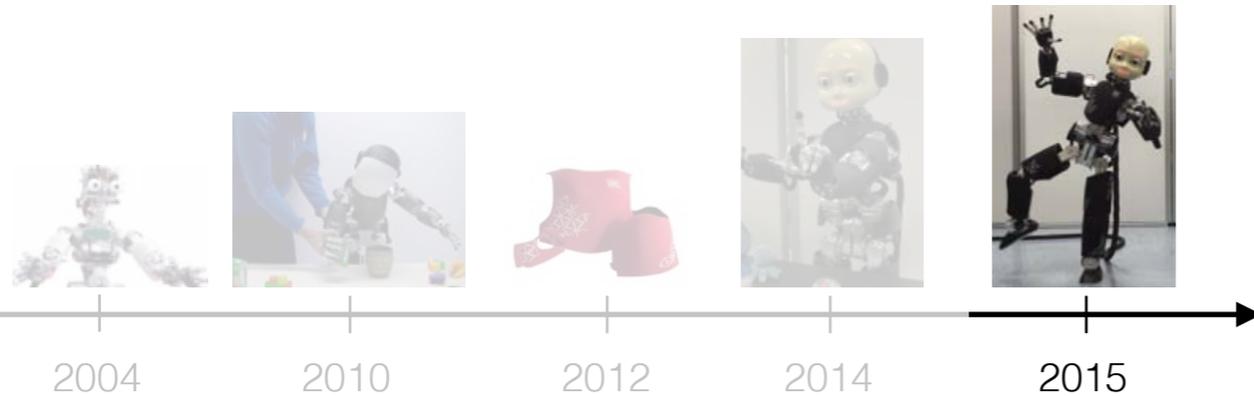
Fanello S.R. et al. 3D Stereo Estimation and Fully Automated Learning of Eye-Hand Coordination in Humanoid Robots, Humanoids 2014

<https://www.youtube.com/watch?v=mQpVCSM8Vgc>

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iCub

One-foot balancing via external force control



<https://www.youtube.com/watch?v=VrPBSSQEr3A>



2004
RobotCub
European FP7
Project



2010
Force/Torque
sensing



2012
upper body covered
with artificial skin



2014
Visuo-motor
Calibration

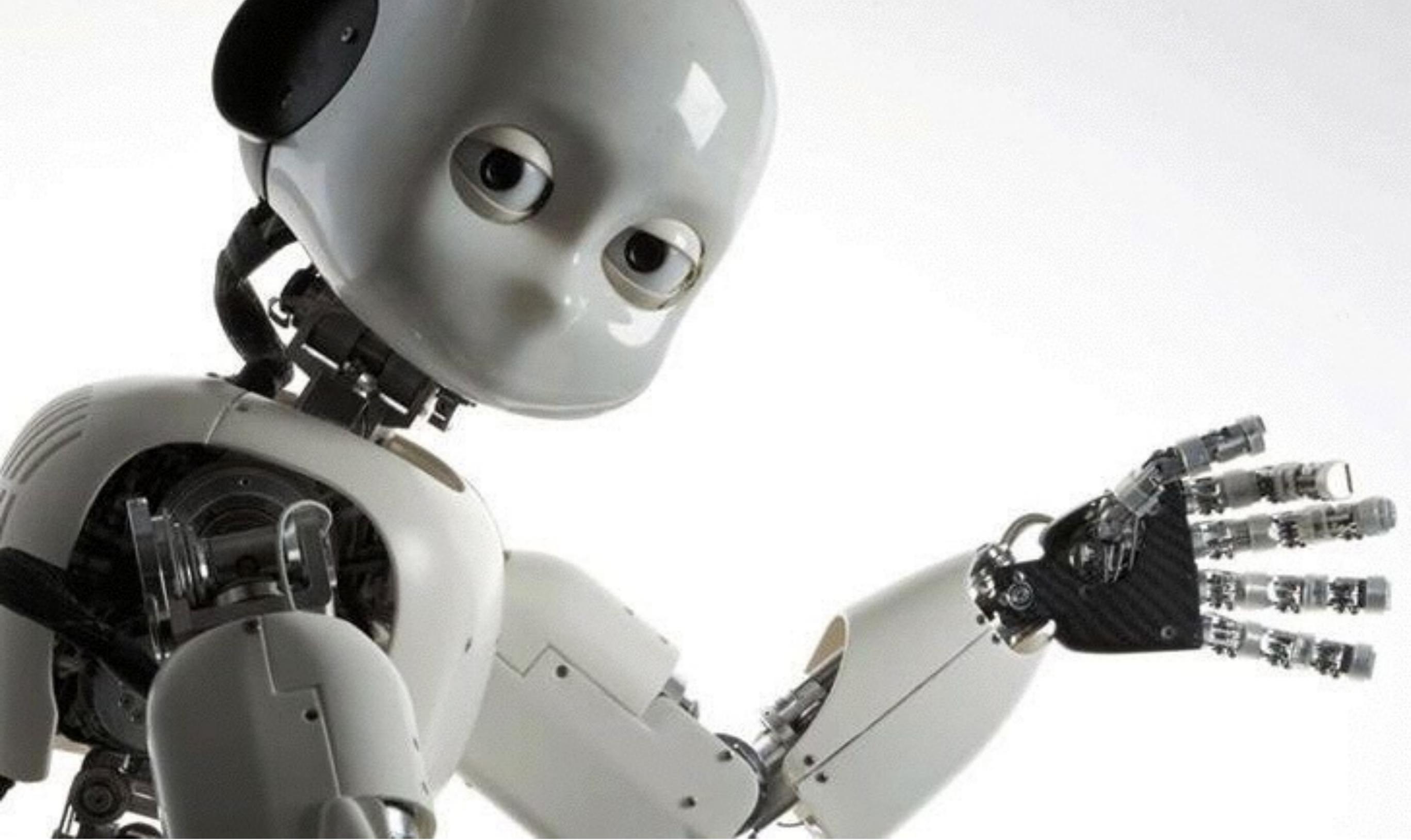


2015
Balancing



???
Next Talks!

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