Introduction to Intelligent Robotics

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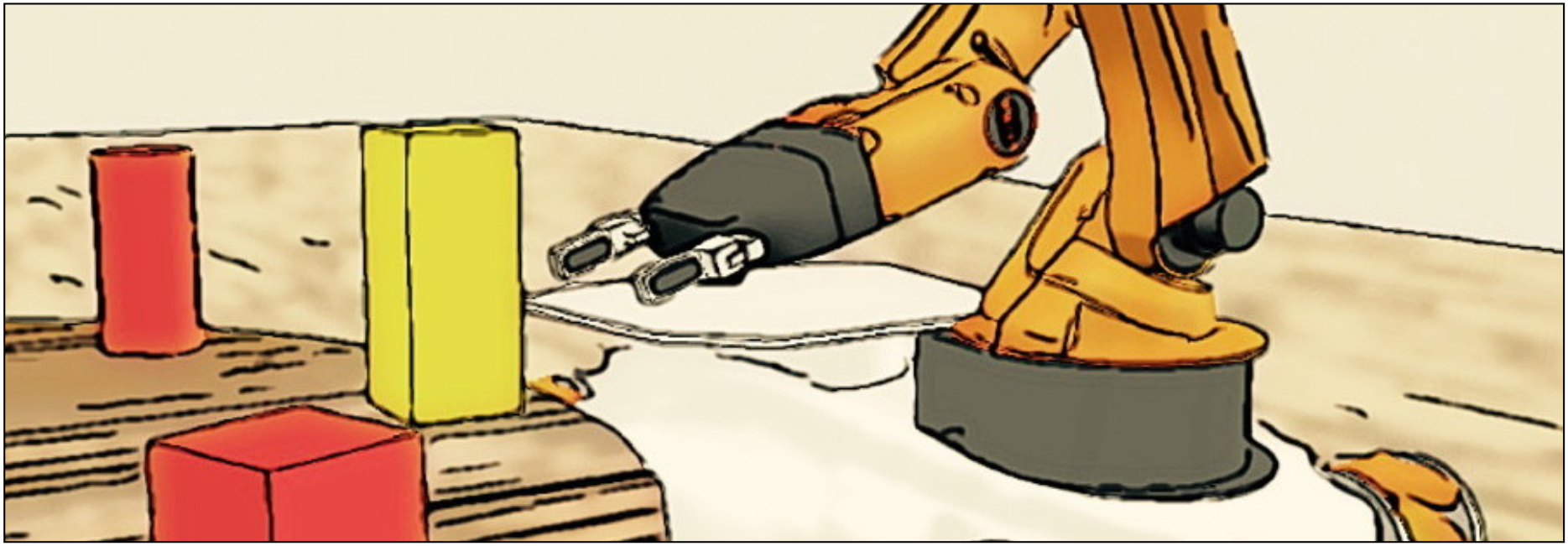


Organization (Spring 2017)

Contacts:

L.Wehenkel@ulg.ac.be (coordination)
tcuvelier@ulg.ac.be (projects)

Website:

http://www.montefiore.ulg.ac.be/~tcuvelier/ir

Lecture room/timing:

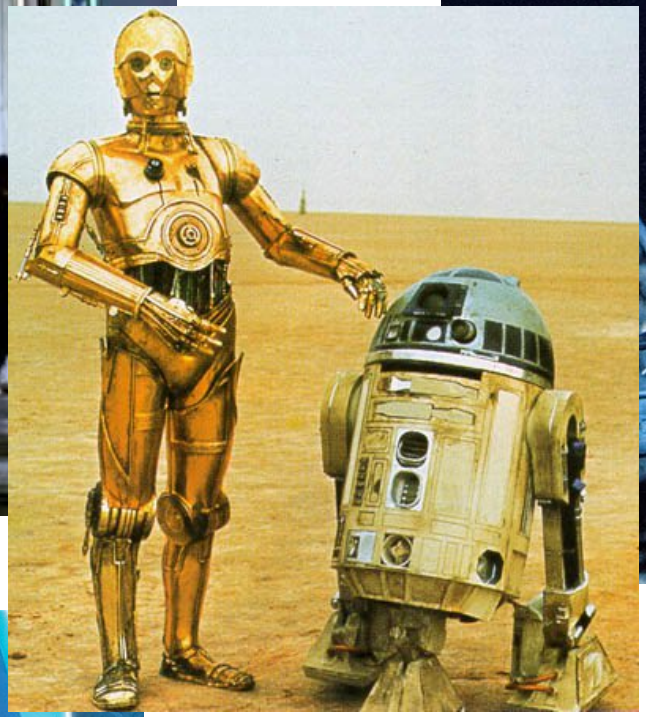
R18, B28 (Institut Montefiore)/8:30 AM

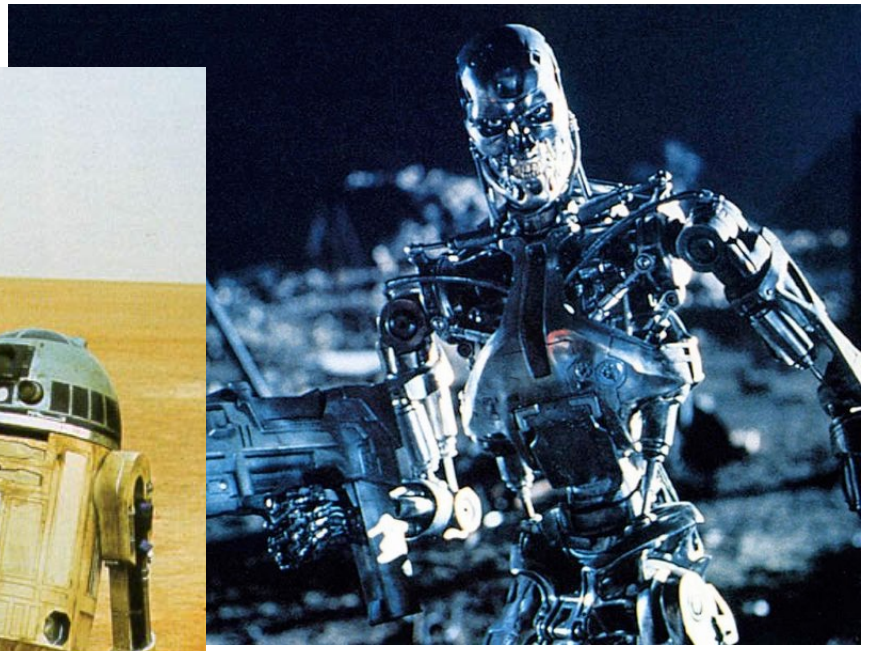
Today's Plan

1. History of robotics
2. Today's robots
3. What's missing?

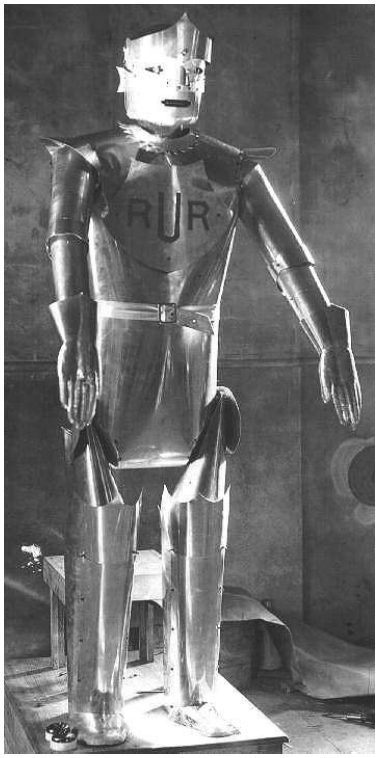
4. Practical information

Robots in our Imagination



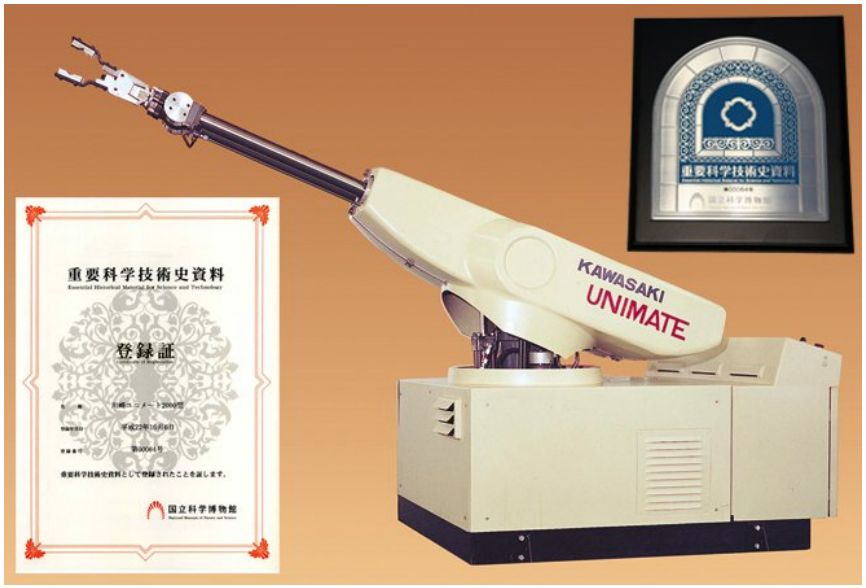


Brief History of Robotics



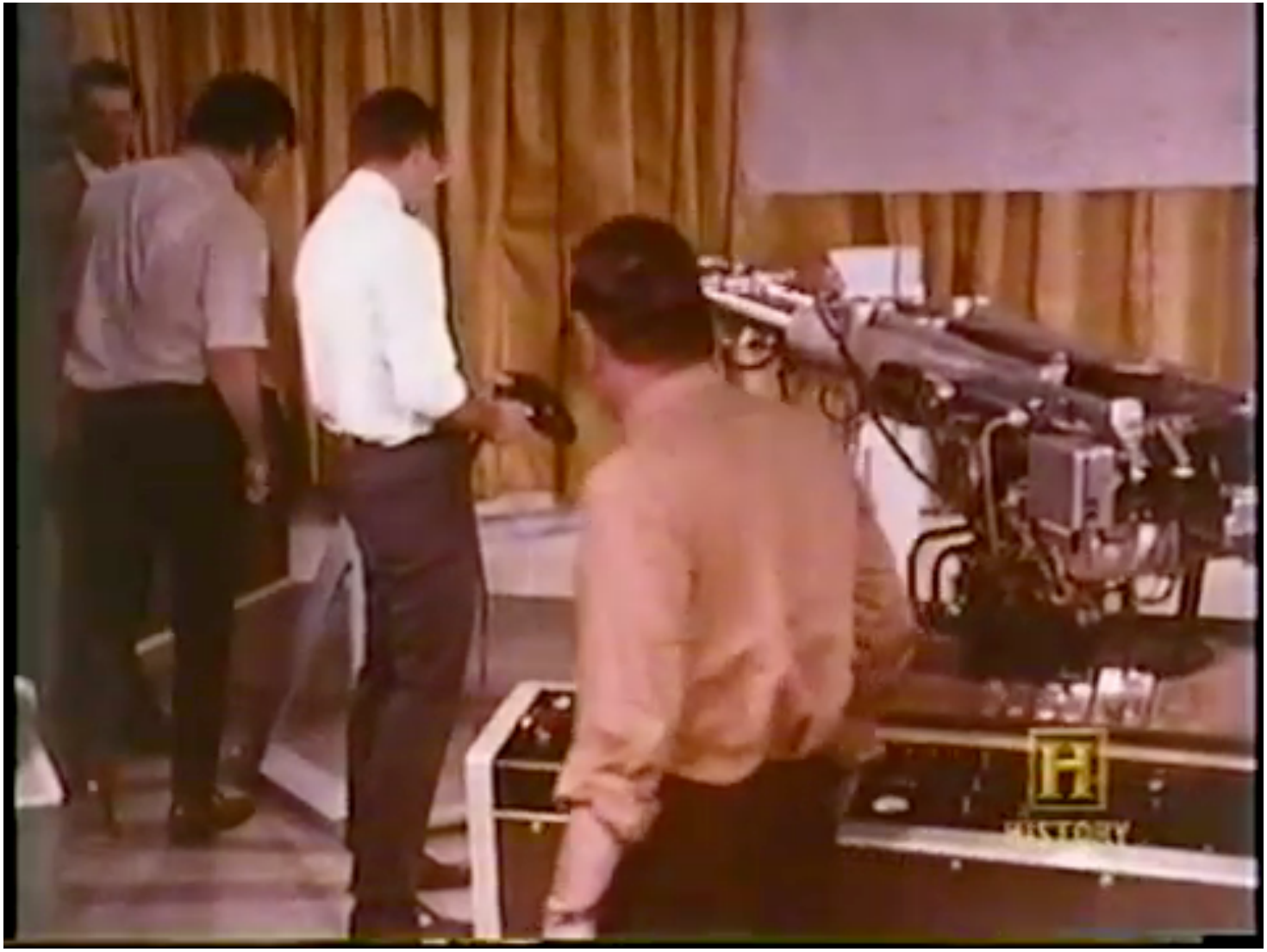
1921: Karel Capek invents the term "Robot" in "Rossum's Universal Robots"

1961: Devol and Engelberger's first industrial robot



1996: Honda presents the first humanoid robot

1961: Devol and Engelberger's first industrial robot



https://www.youtube.com/watch?v=eAb6cB-gklY

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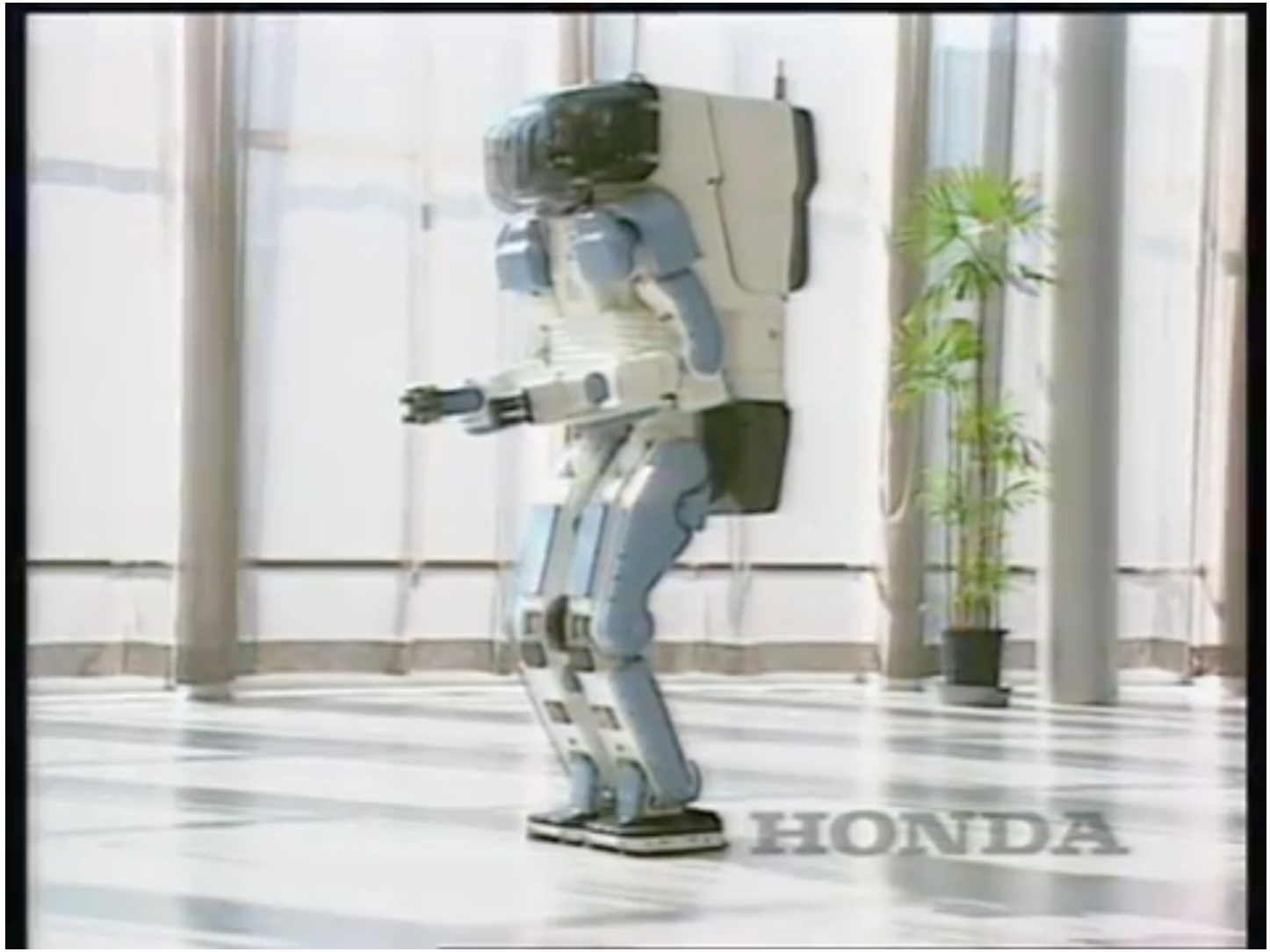
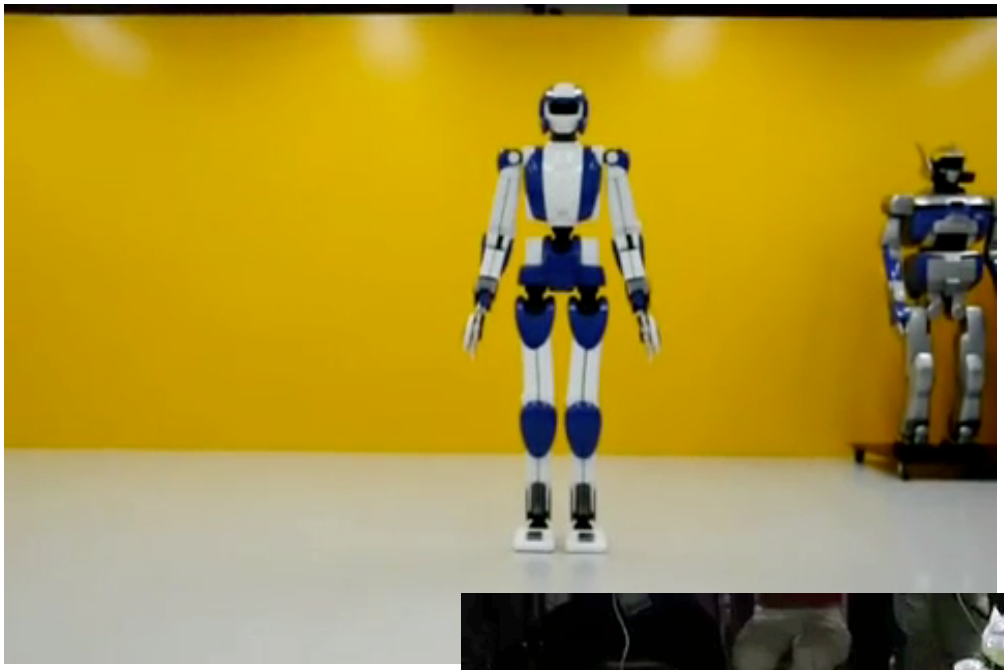


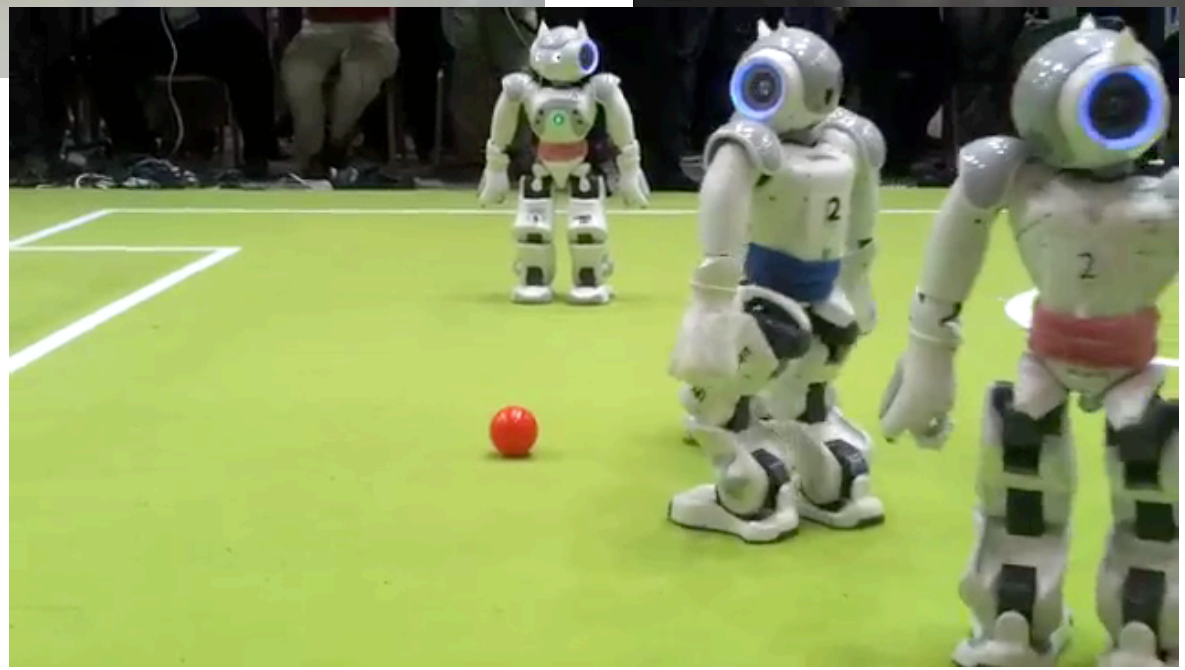
http://www.youtube.com/watch?v=d2BUO4HEhvM

Humanoid Robots Today



HRP-4

ASIMO



NAO

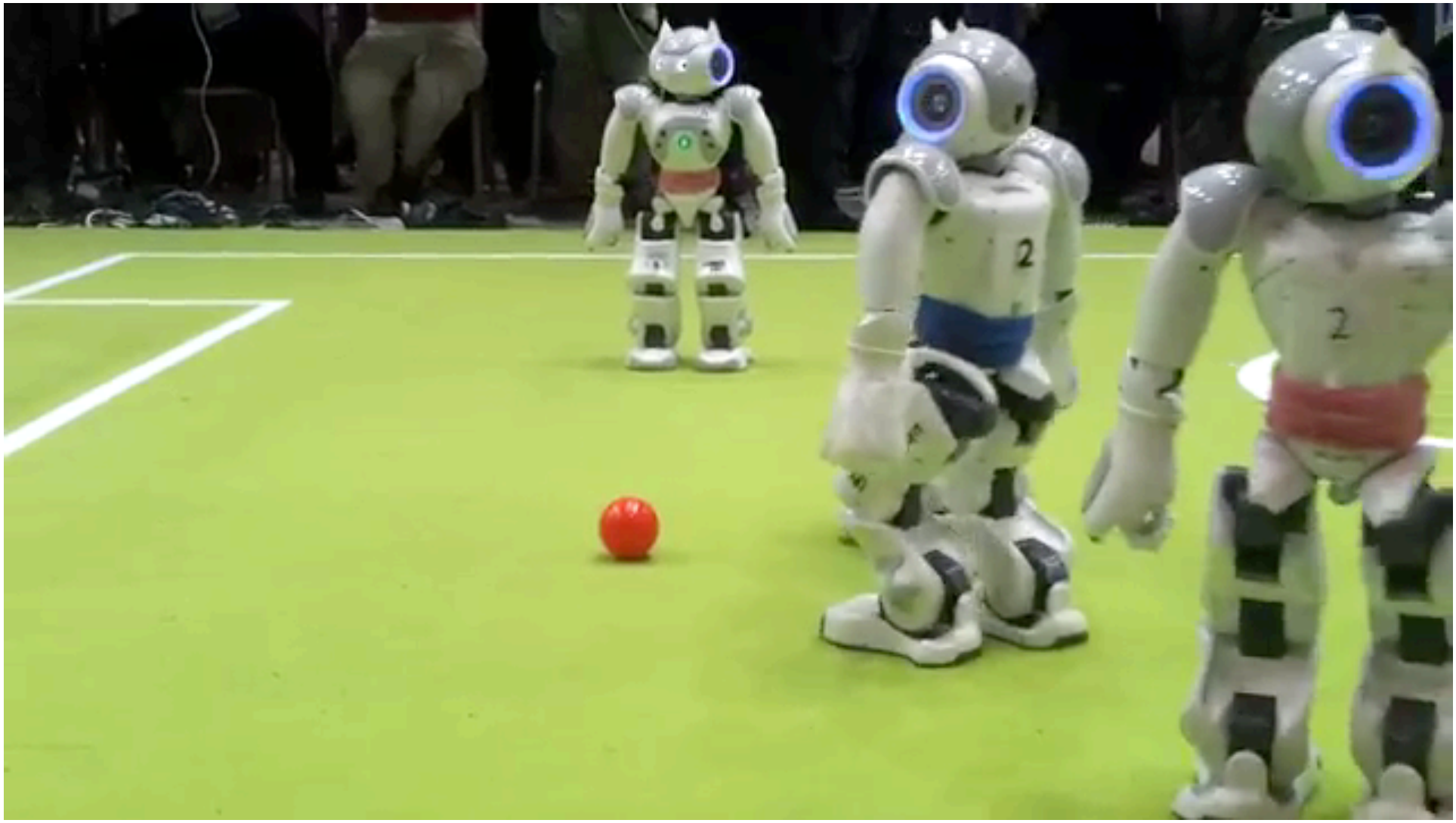
Humanoid Robots Today

HRP-4

Humanoid Robots Today

ASIMO

Humanoid Robots Today



NAO

Other Robots

Ishiguro Androids, (ATR, University of Osaka)

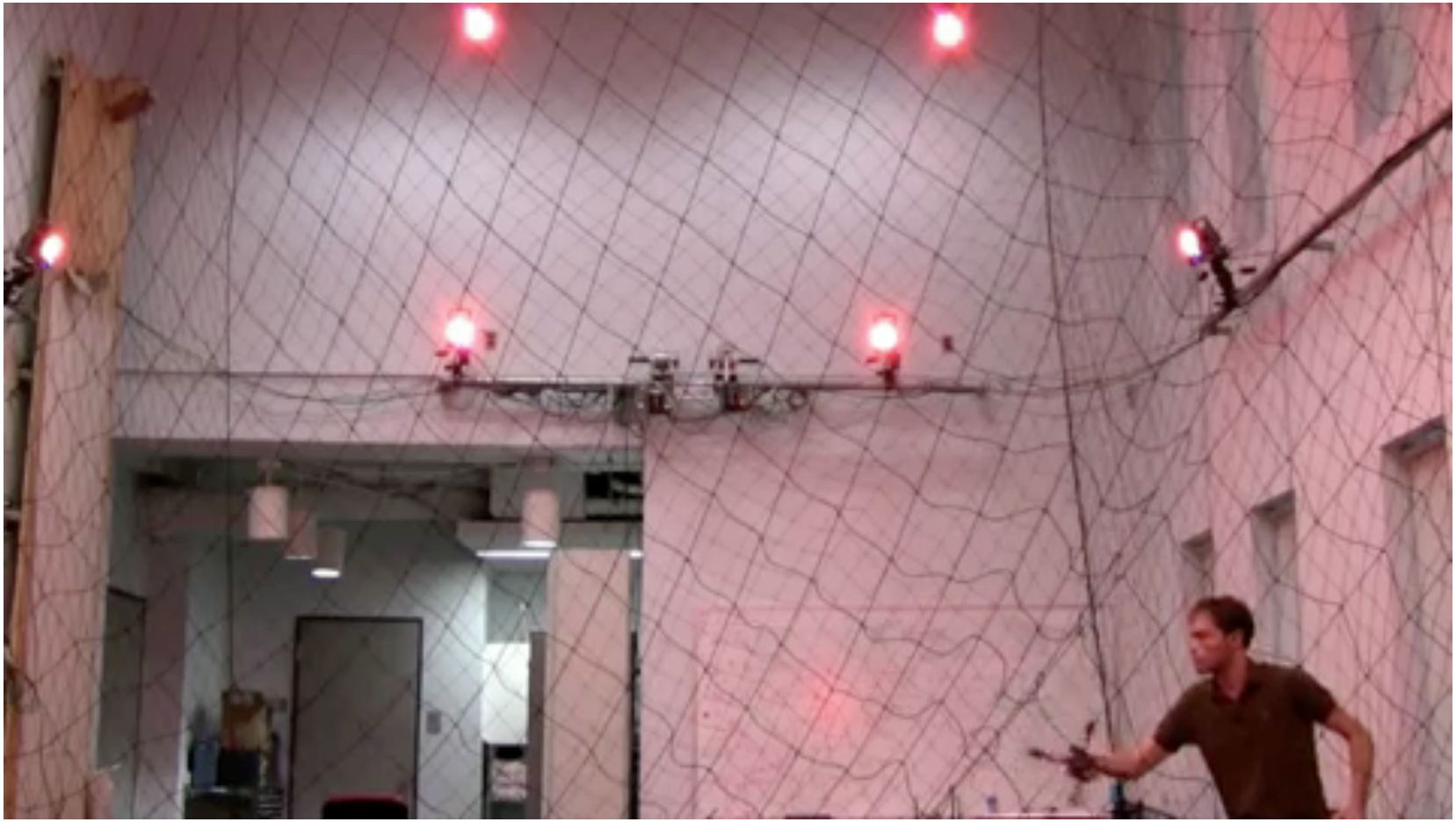
Other Robots

Justin (DLR, Germany)

Other Robots

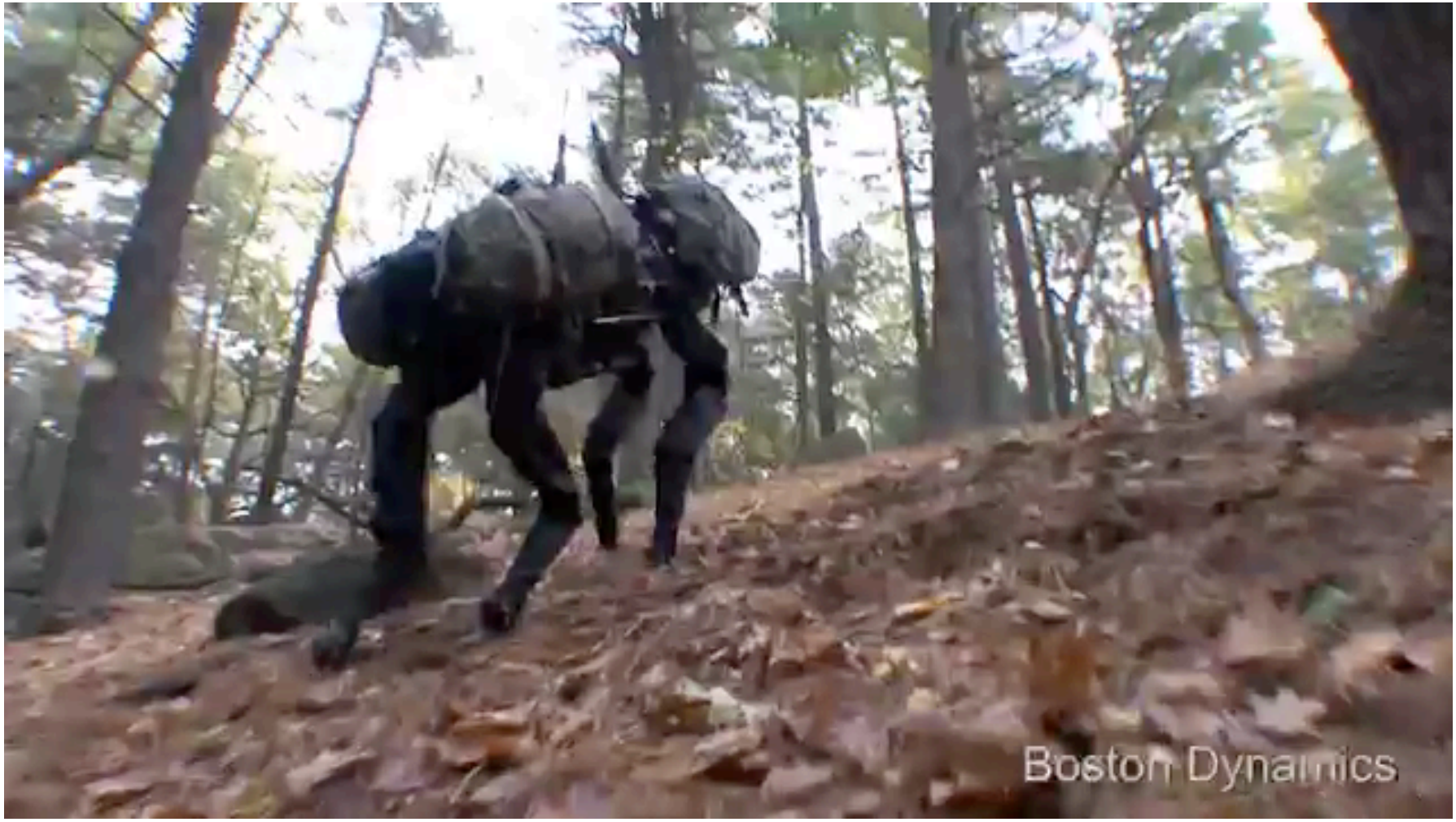
PR2 (Willow Garage) (video: 50x)

Other Robots



GRASP Lab (UPENN)

Other Robots



Big Dog (Boston Dynamics)

Other Robots

Wild Cat (Boston Dynamics)

Other Robots

Big Dog (Boston Dynamics)

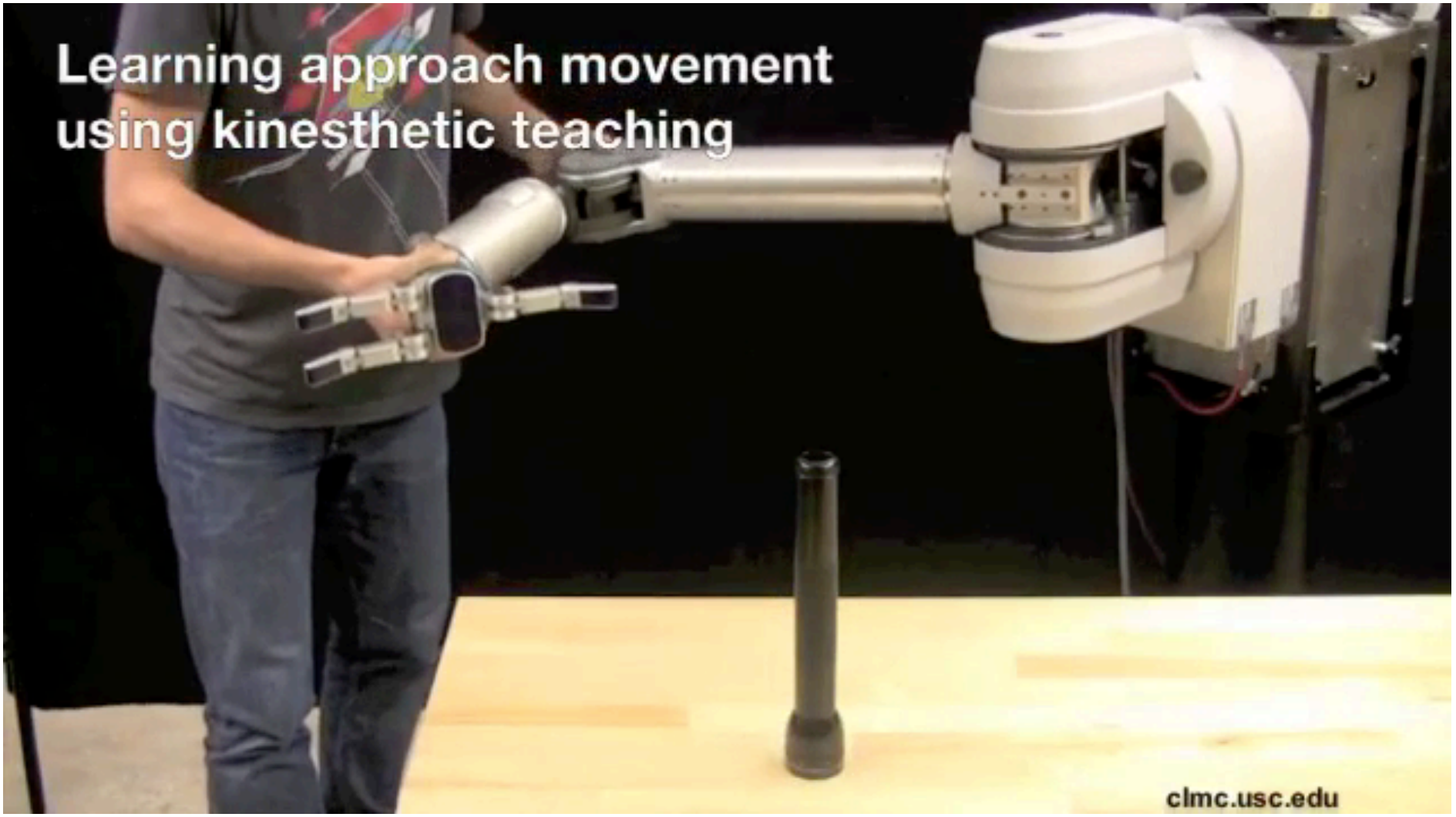
Back to (Partly-) Humanoid Robots

RLL, MPI Tübingen

Back to (Partly-) Humanoid Robots

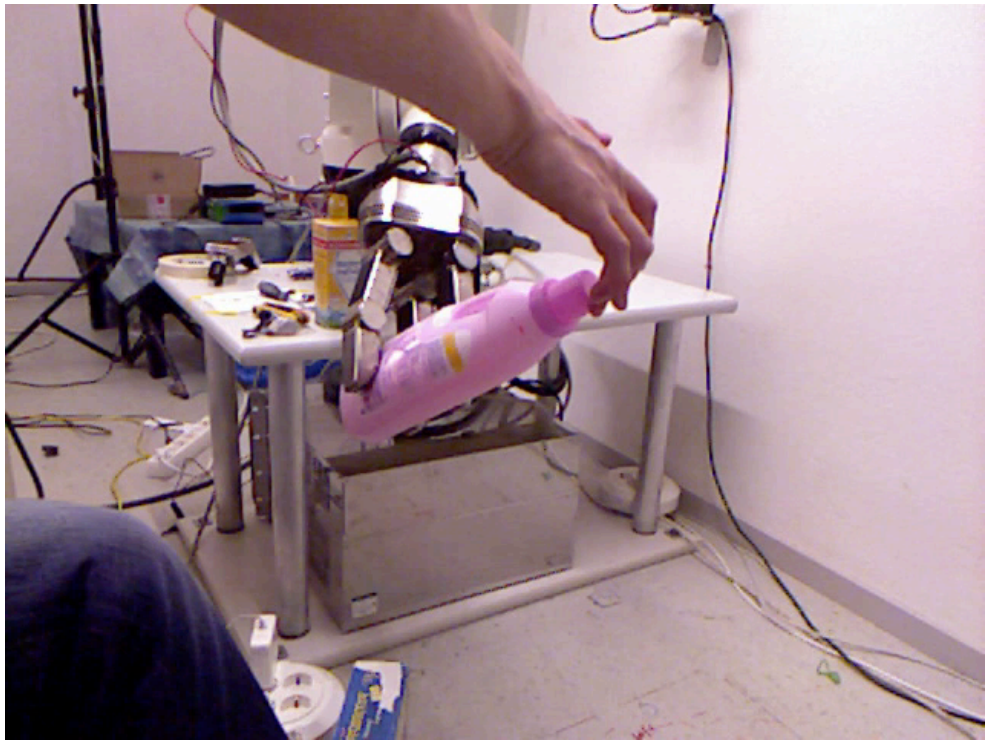
LASA, EPFL

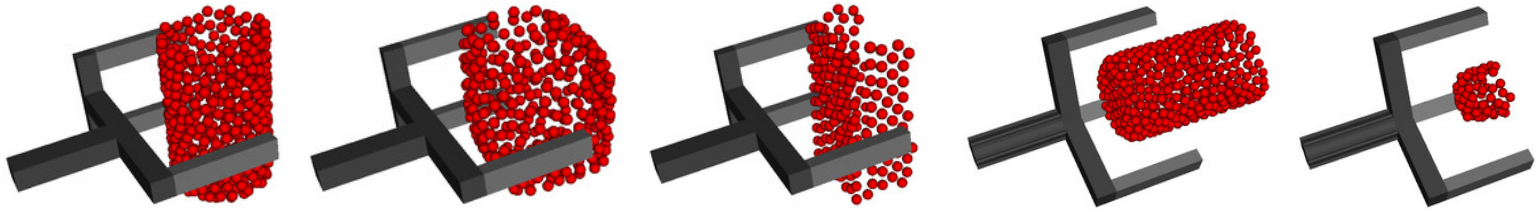
Back to (Partly-) Humanoid Robots



CLMC, USC

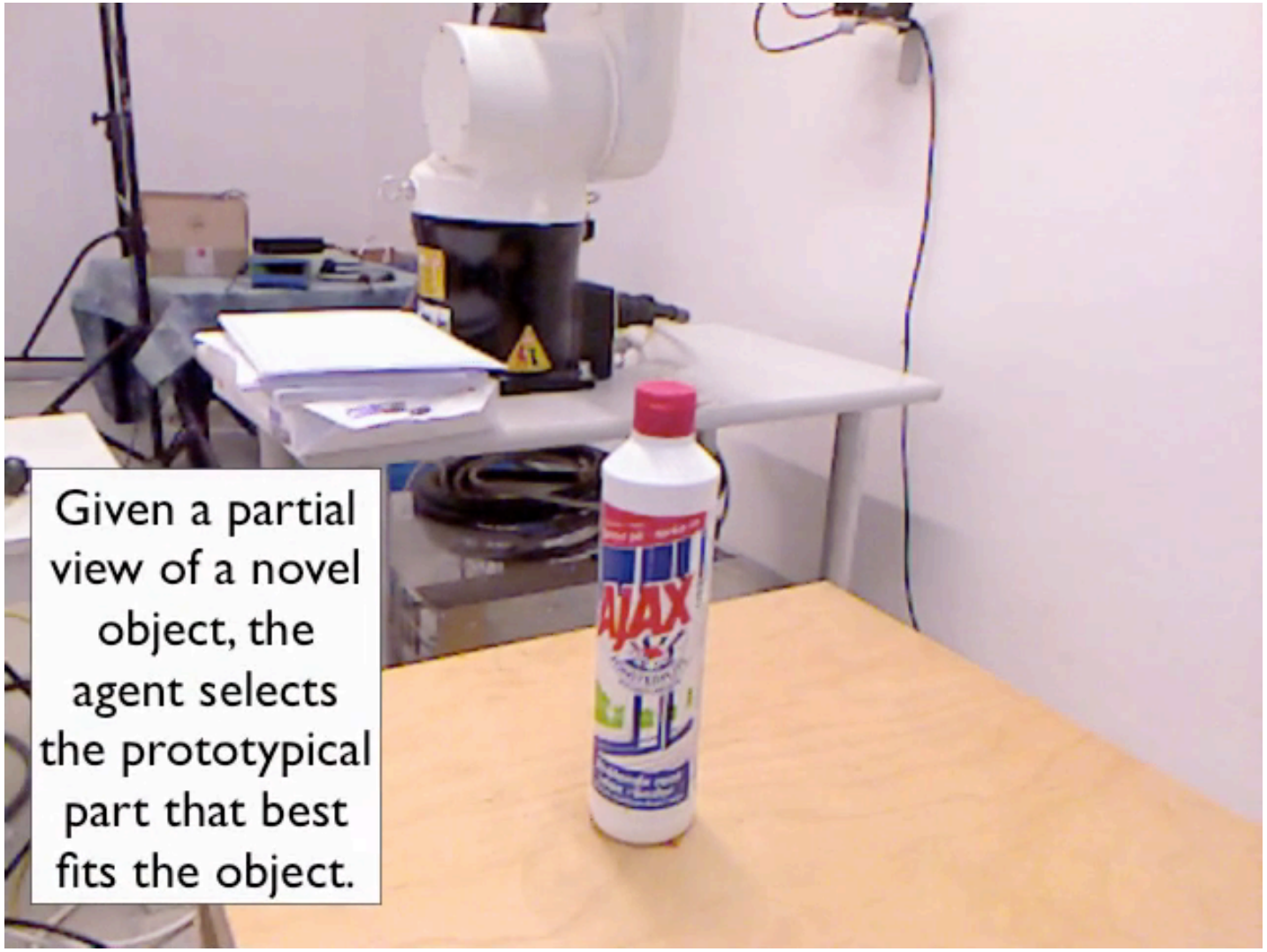
Back to (Partly-) Humanoid Robots





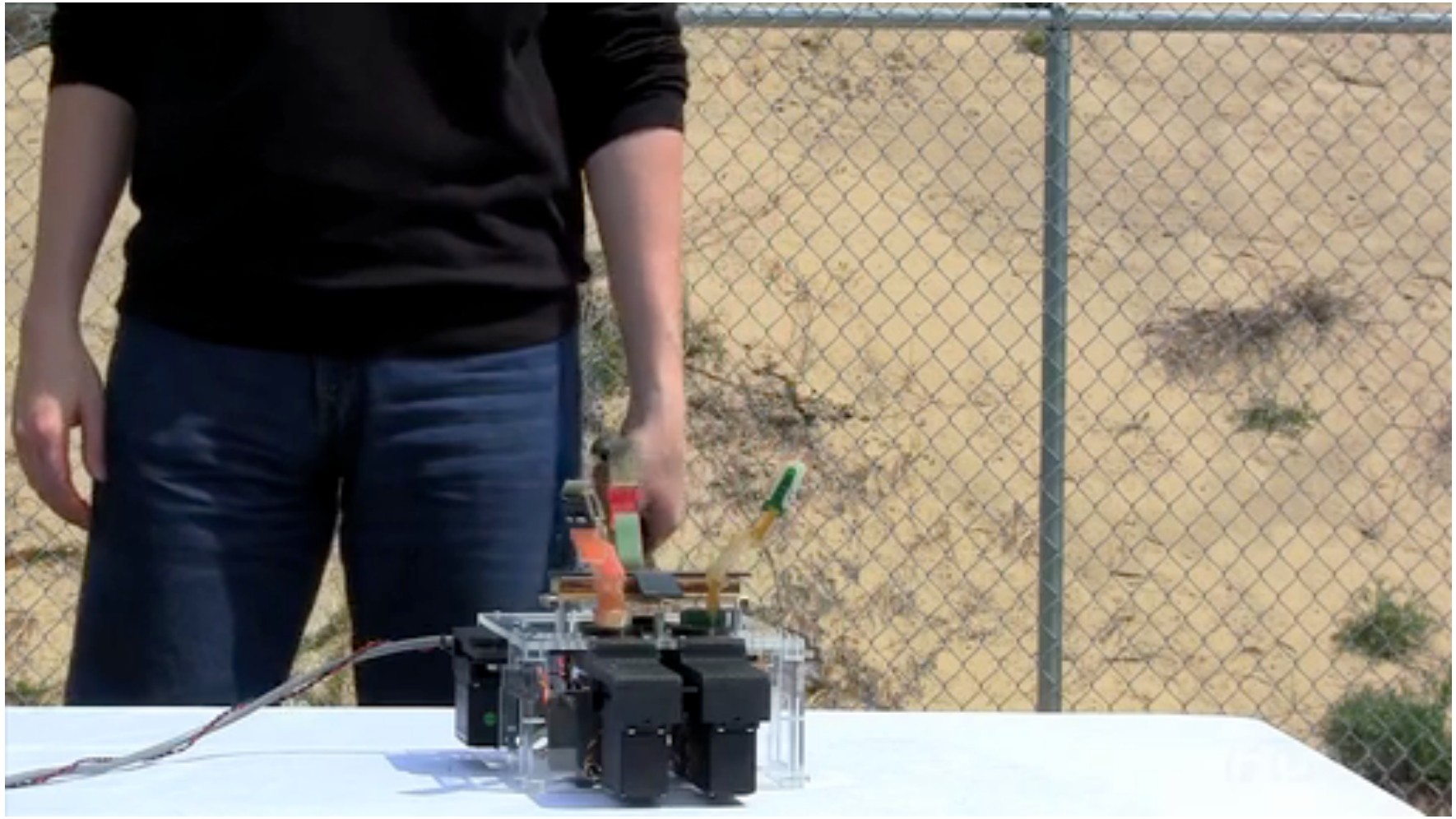
CVAP, KTH

Back to (Partly-) Humanoid Robots



CVAP, KTH

Back to (Partly-) Humanoid Robots



iRobot

Discussion

We have the technology to **build** humanoid robots. Why don't we see more of them in our everyday life?

Mainly, because to date, we do not have a generic way of creating motor skills. Motor skills need to be learned by the robot.

Contents

Basics: SE(3) geometry, sensors, actuators, controllers, kinematics.

Mobile robots: Locomotion, localization, navigation, SLAM.

(**Arms and grippers**: Reaching, grasping, grasp learning.)

Computer Vision: Feature extraction (Edge, Harris), Fitting (Ransac, Hough), Tracking (Kalman, Nonparametric), Object recognition (PCA, probabilistic model)

Objectives

At the end of this course, you will be able to solve the following problems:

1. Extract information from video streams (object/people identity/position, body postures, 3D room and object structures)
2. Infer a useful behavior from sensory data (navigation, grasping; via optimization, machine learning, or control)
3. Generate a set of robot commands that implement the desired behavior.

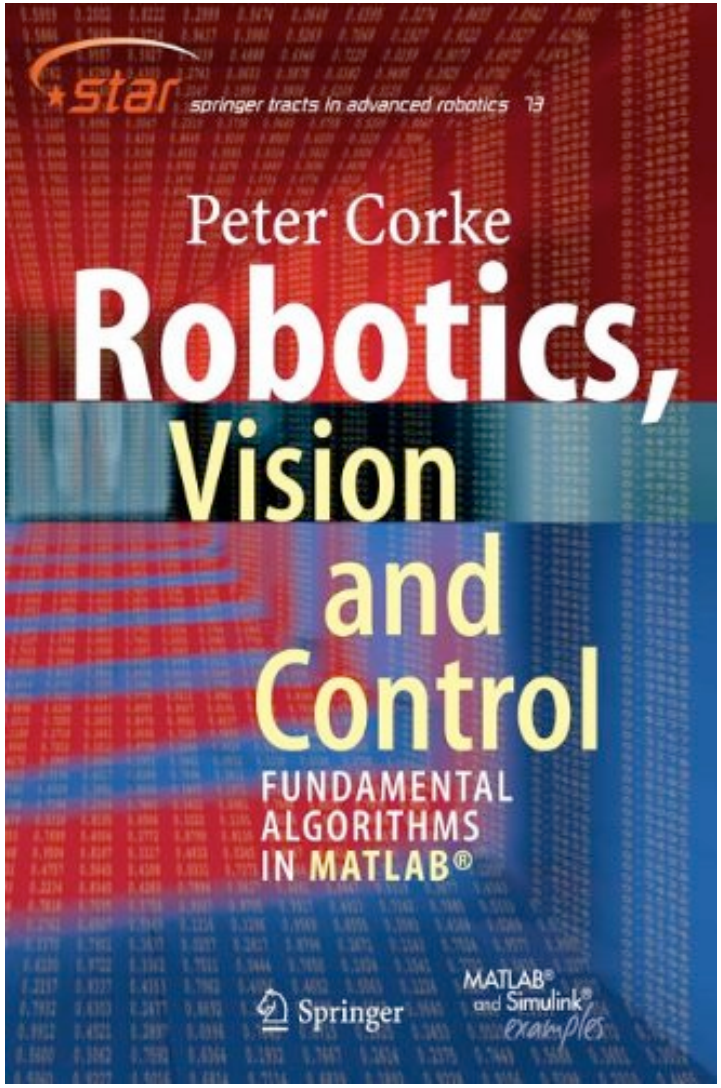
Group Project

You will program a robotic agent that processes images, plans a task based on the image data, and executes a set of motor commands that complete the task.

The robot will be simulated in the V-REP simulator.

Book

The course is based on the book *Robotics, Vision and Control: Fundamental Algorithms in MATLAB*, by Peter Corke, published by Springer in 2011.



http://www.petercorke.com/RVC/

Course Language

Course language will be English.

... why?

- Knowing the proper terminology is essential!
- All robotics literature is in English.

Emails & projects may be written in French.
However, this is not encouraged.

Posts to the forum must be written in English.

Provisional plan (2017)

Feb 9	Chap 1 (L Wehenkel); Chap 2 (A Lejeune)
Feb 16	Chap 3-4 (B Boigelot); Project info (T Cuvelier)
Feb 23	Chap 4-5 (B Boigelot)
Mar 2	Chap 6 (L Wehenkel)
Mar 9	Chap 10 (P Latour)
Mar 16	Project Q&A session (T Cuvelier)
Mar 23	**Group Project: Milestone 1a deadline**
Mar 30	Chap 11 (M Van Droogenbroeck)
Apr 20	Chap 12 (L Wehenkel)
Apr 27	**Seminar: Montefiore Projects**
May 31	**Deadline for submitting final projects**
June	**Project Presentations**
Loc/Time	**R18-B28 8:30 AM**

Plan: Examination & Grading

No Exam!

Group Project:

- Presentation 1: 25%
- Presentation 2: 75%