ECHORD++

The European Coordination Hub for Open Robotics Development

Universität Bielefeld

COR-Lab
Research Institute for Cognition and Robotics

Carl Cloos
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CoHRoS –
And what can happen in small projects ...

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CoHRoS - Motivation

Motivation:

> programming of highly redundant robot systems

> tedious step-by-step procedure with up to several thousands of key-frames

> application domain: welding of large workpieces

Objectives:

"advancing and simplifying the state-of-the-art programming for highly redundant robot systems"

> develop cooperate human-robot programming procedure
- robot learning from user demonstrations
- assisted interactive teaching

> benchmarking study with experienced application developers
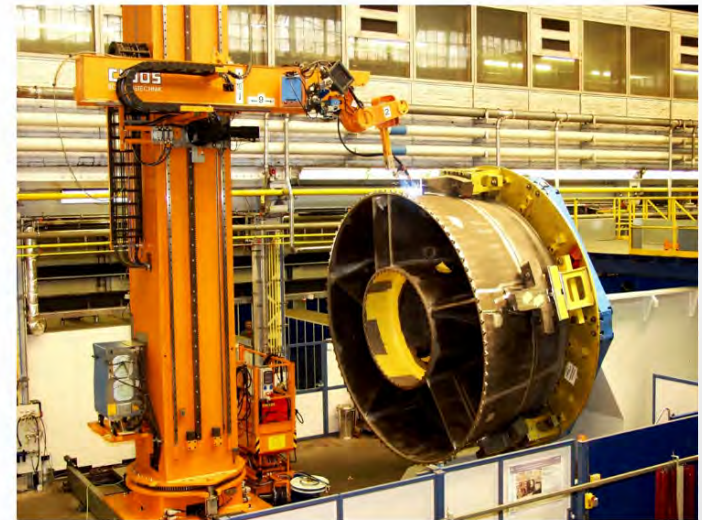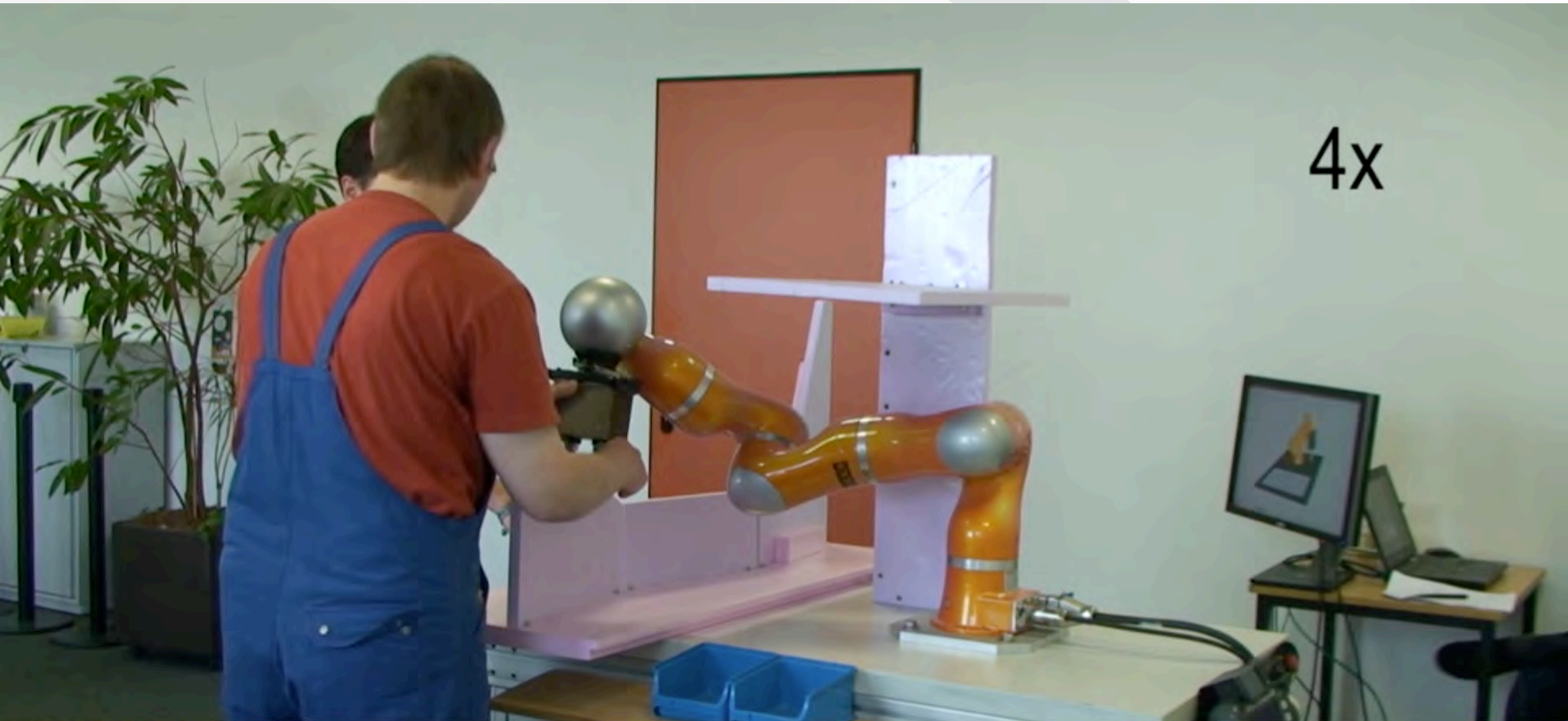
Problem Statement

... the recorded trajectories deviate a lot from the target.

FlexIRob@HARTING
A user study on
physical human-robot interaction

CoHRoS - Demonstrator/ prototype

Portal
- 3 prismatic joints (x,y,z)

Results:

> simulation of a 6+3 DoF CLOOS robot system

> Cartesian + nullspace control with all axes included

Qirox QRC350
- 6 revolute joints (A1 - A6)

Robot system
- 9 degrees of freedom
- treated as one kinematic chain

What we (did not) achieve

✔ Scalable method for teaching & learning redundancy resolution

✔ User-friendly interaction scheme

✔ Novel method to bootstrap training data semi-automatically

✔ Simulated realistic application scenario

✔ Real world prototype with commercial platform

✔ Qualitative evaluation by experienced Cloos workers

But the project was originally more ambitious:

☹ Real world evaluation in realistic application

☹ User study with Cloos' programmers

☹ Quantitative evaluation of benefit

☹ Long shot: Full integration into Cloos' robot controllers

☹ Most „Industry"-KPI not evaluated

What happened ? Lessons part 1: CoHRoS

- Cloos main responsible person left after 1/3 project

- No chance to change partners

- Not enough expertise at Cloos to replace PI

- Replacement was completely overloaded

- It took about ½ year to get back on track …

Lesson:

- Small projects depend on single persons

- There is not enough time to adjust

- Particularily in SME,
  expertise may be very shallow

**=> Small projects are intrinsically
    risky people-wise**

Lessons part 2: organization ECHORD++

- Other issues:

  - Expectations for PR exaggerated

  - KPIs exaggerated

  - ECHORD on the edge to subsies

  - all responsible persons of CoHRoS left their places within 3 months after experiment finishes
  => **never change evaluation measures and schedule ex-post**

Lesson: have realistic expectations !

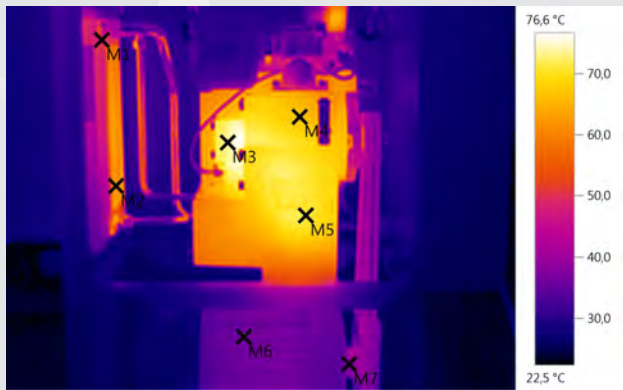 - small projects are small with small workpower and often low priority

Digression:BMBF leading edge cluster in it's owl

## „Intelligent Technical Systems" Ostwestfalen-Lippe

- **Regional cluster of Industy/Academia**

- **Duration 5 years**

- **Funding: 40 Mio EUR/BMBF + 60 Mio EUR regional industy in projects**

- **Large portfolio of projects**

- **Special format:** *„Transfer projects"*

  - **one partner from academia/industry each**

  - **up to 8 Month**

  - **budget only for academia**

  - **budget up to 50.000 EUR**

- **overall already > 120 projects (> 30@Bielefeld University)**

Lessons part 3: it happened in other small projects ...

heat camera image

compressor

- **When the sales interfere:**

  - Hardware, you should work with, may be sold to customers
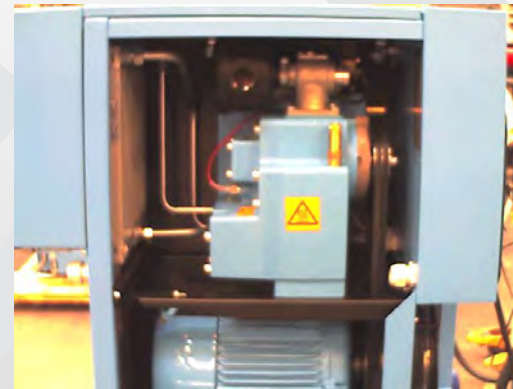
Presentation @ Hannover fair

Lesson: small projects rank low !

Lessons part 3: it happened in other (small) projects ...

- **When the fair interferes:**

  - everybody works on the demonstrator, nobody cares for your project

  - Or: you are asked to help with the fair demonstration
    (of course not really connected to the project)

Lesson: know when the main faires take place !

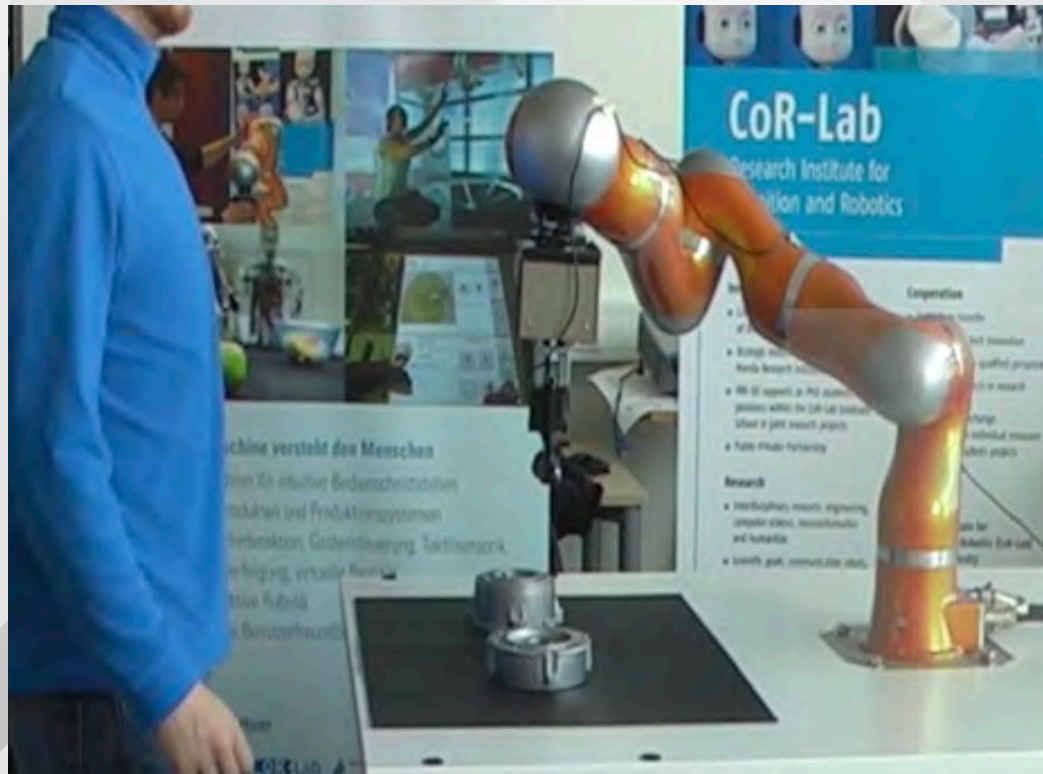# Lessons part 3: it happened in other small projects ...

- **When the boss was enthusiastic but did not know ... :**
  - the neccessary data does not exist
  - the effort to create that data is grossly underestimated

Lesson: companies often do not know their processes (well)

Lessons part 3: it happened in other small projects ...

- **When the promised sensor doesn't exist:**

  - the reason may be Fraunhofer and you replan the whole project

Lesson: be prepared to be VERY flexible

Lessons part 4: it happened in other large project(s)

AMARS Adaptive Modular Architectures for Rich Motor Skills

SEVENTH FRAMEWORK PROGRAMME

Some lessons on impact & transfer:

Did we plan it ? *No. But we seized opportunities.*

Did the workplan foresee the results ? *Mostly not !*
 (*not walking COMAN, not DSL language, not catching objects in flight, not to find out that we are quadrupeds at birth, not transfer of interaction capabilities, ...*)

Can you plan it ? *I don't think so. But provide opportunities.*

Why did it work ? *People. (As Gisela Eickhoff).*

Why often not ? *People. Management capacity.*

We tried many NOT successful things !