CORSMAL Benchmark
for human-robot handover

http://corsmal.eecs.qmul.ac.uk

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The handover task

Start — Human manipulation — Human-robot handover — Robot manipulation — End

Human grasping

...

Robot delivery

The handover task

The handover task

CORSMAL
Collaborative object recognition,
shared manipulation and learning

The handover task

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Collaborative object recognition,
shared manipulation and learning
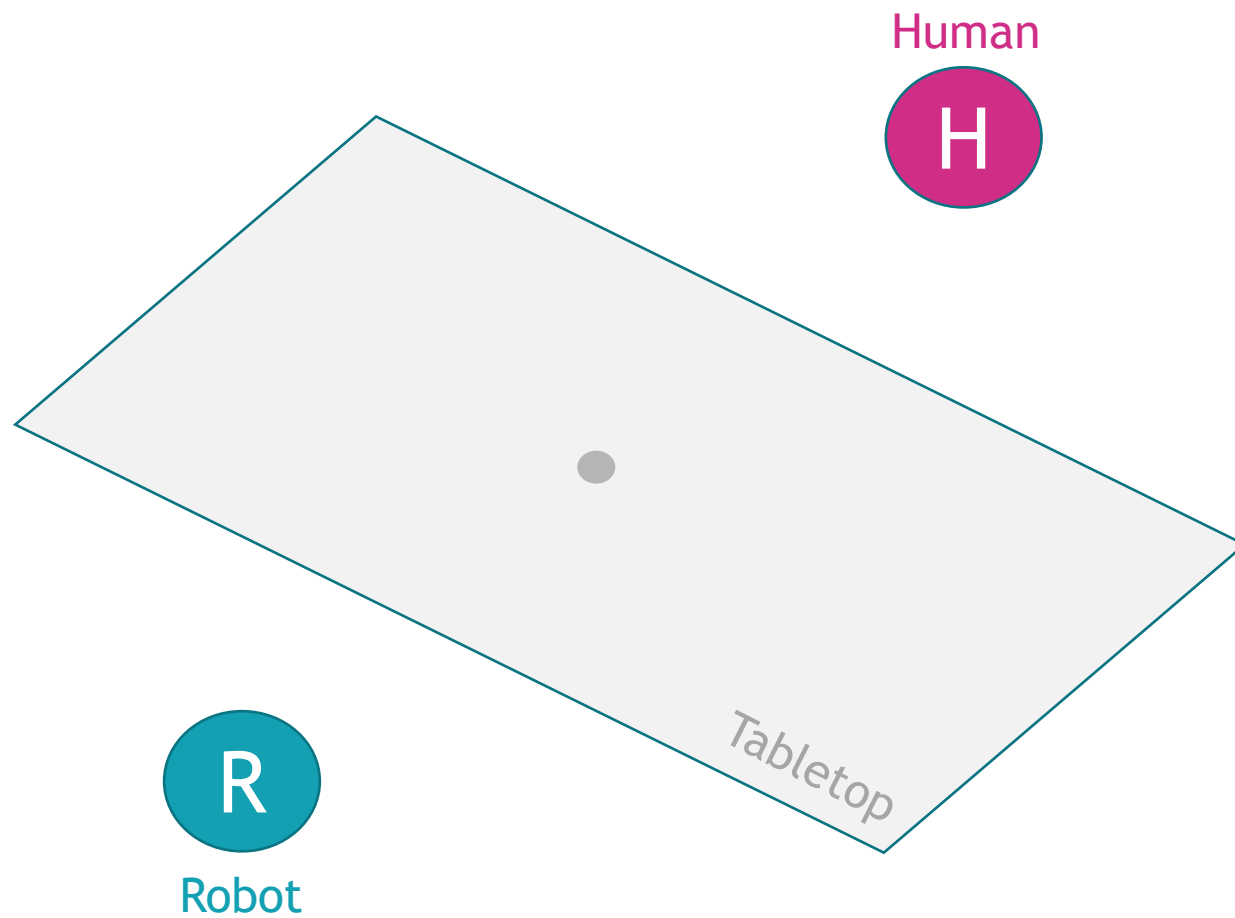
The handover task

CORSMAL
Collaborative object recognition,
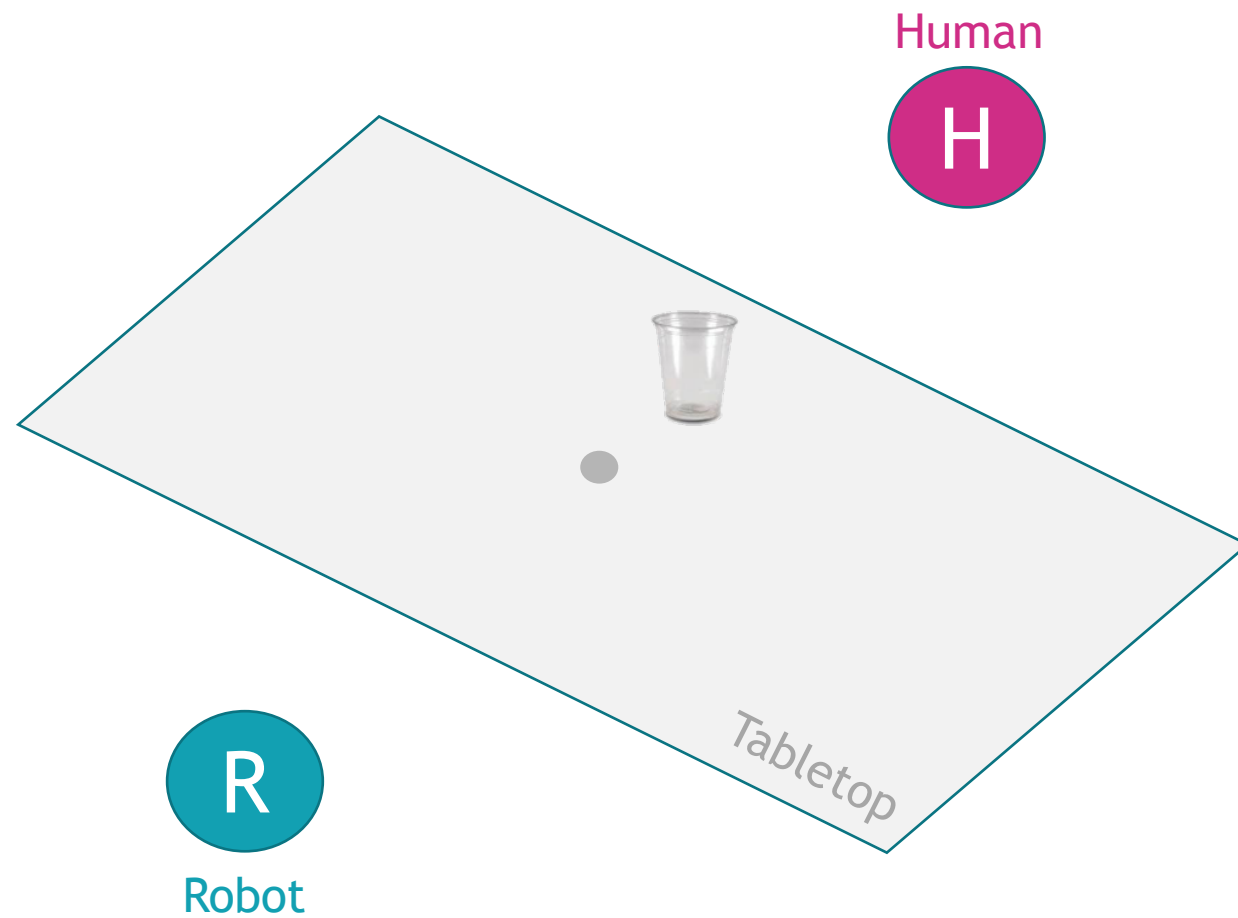shared manipulation and learning

Challenges

Previously <u>unseen</u> object instance (shape, material, mass, and filling variability)

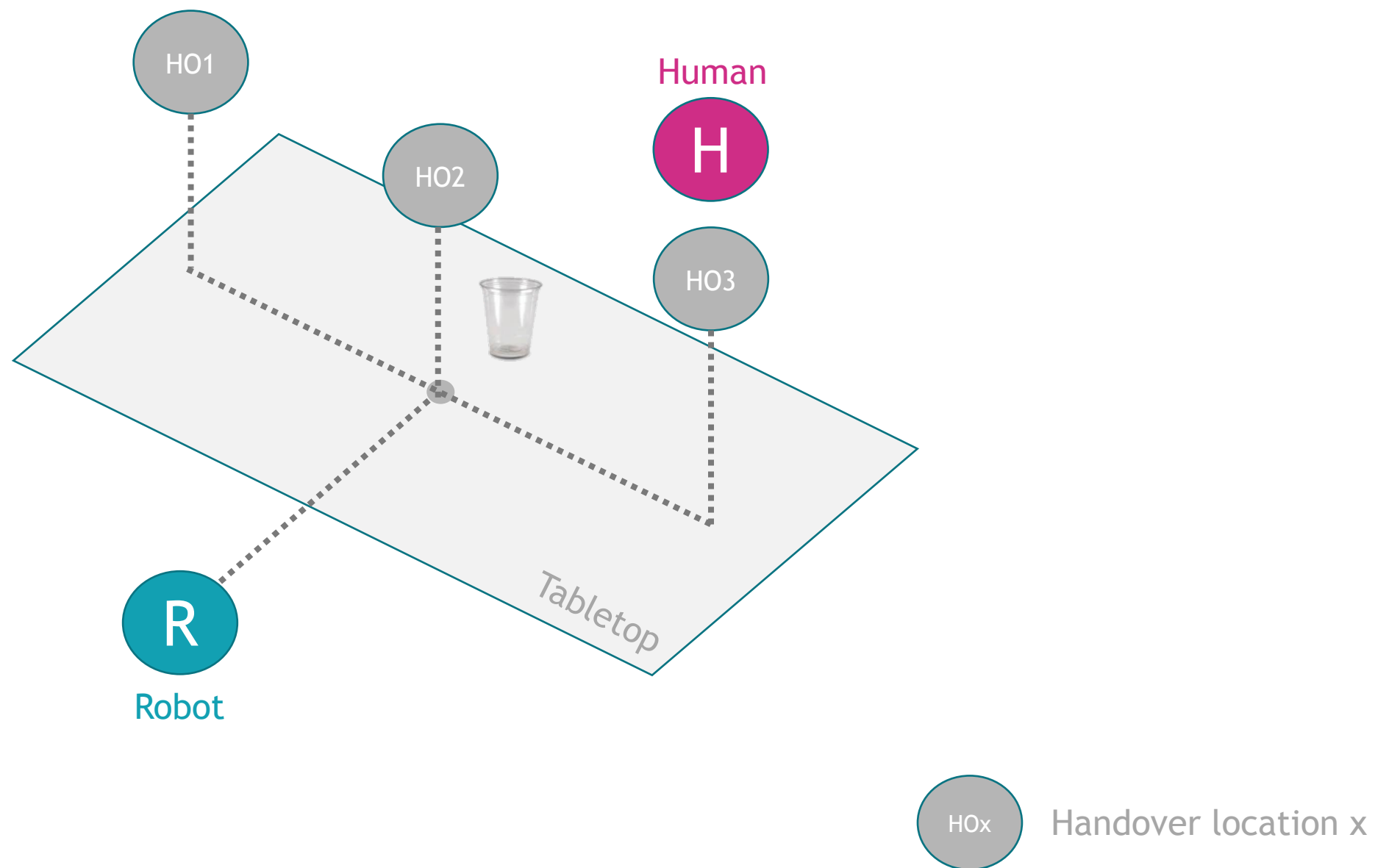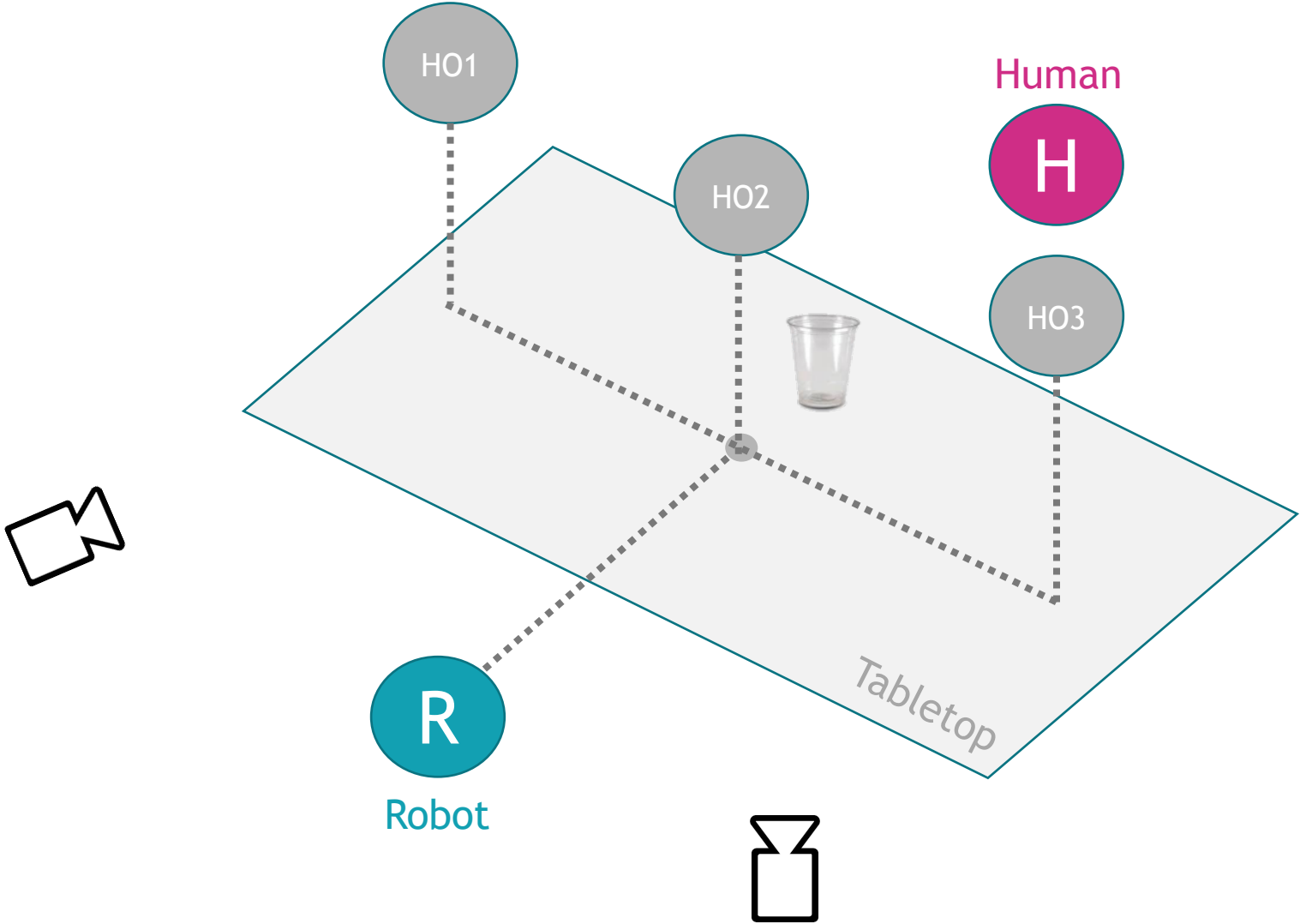<u>Variability</u> in grasp type and handover location

The setup

Human

H

Tabletop

R

Robot

The setup

The setup

The setup

HO1

HO2

Human

H

HO3

Tabletop

R

Robot

Sensing:
- up to two cameras
- [optional] force sensors
- [optional] tactile sensors
- [optional] proximity sensors

The objects

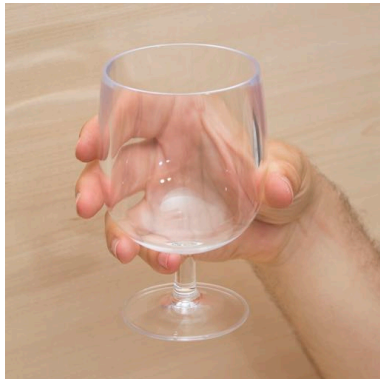| Deformability | High | Medium | Medium | None |
| Transparency | Medium | Low | High | High |

Grasp types

Bottom

Top

Natural

Level of difficulty

The benchmark: summary

4 objects: cups

2 filling levels: empty or 90% of the cup capacity (rice)

3 human grasp types: bottom, top, natural

3 handover locations: left, in front, right of robot

4 human subjects

Total: 4 x 2 x 3 x 3 x 4 = 288 unique configurations

Evaluation scores

Vision

Object dimensions
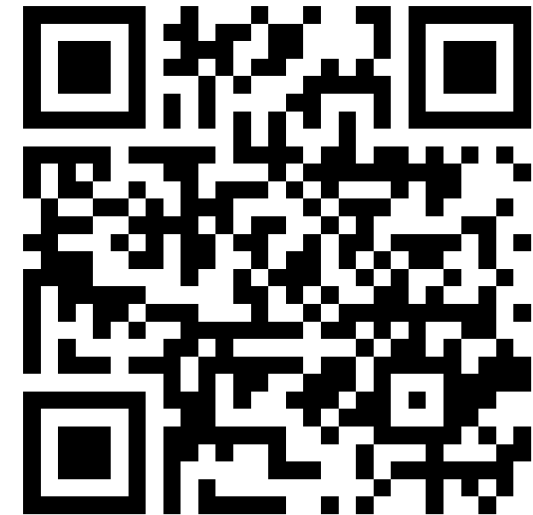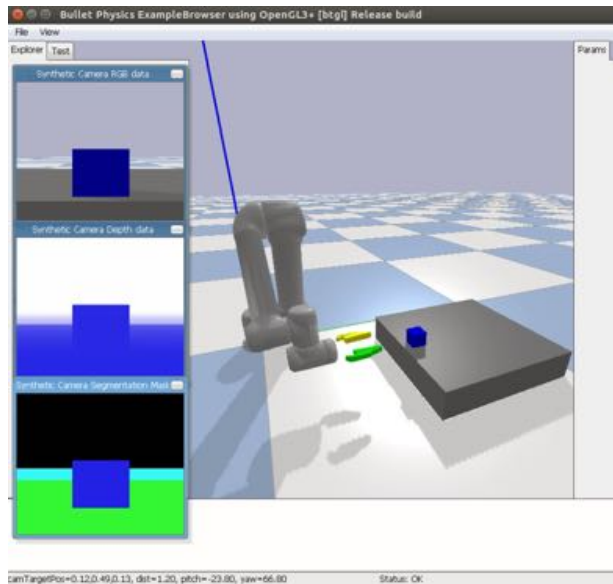Object fullness
Object mass

Robotic

Human-hand predict.
End-effector pose
Object mass

Global

Delivery location
Spilled filling
Handover time

Conclusions

- Benchmark for dynamic human-robot handovers
  - Interpretable evaluation scores
  - Vision+robotics baseline code
  - Online challenge – enter the competition!

- Simulator (coming soon)

http://corsmal.eecs.qmul.ac.uk/benchmark.html

R. Sanchez-Matilla, K. Chatzilygeroudis, A. Modas, N. Ferreira Duarte, A. Xompero, P. Frossard, A. Billard, A. Cavallaro
Benchmark for Human-to-Robot Handovers of Unseen Containers with Unknown Filling
IEEE Robotics and Automation Letters, April, 2020