

Immersive Teleoperation and Task Autocorrection

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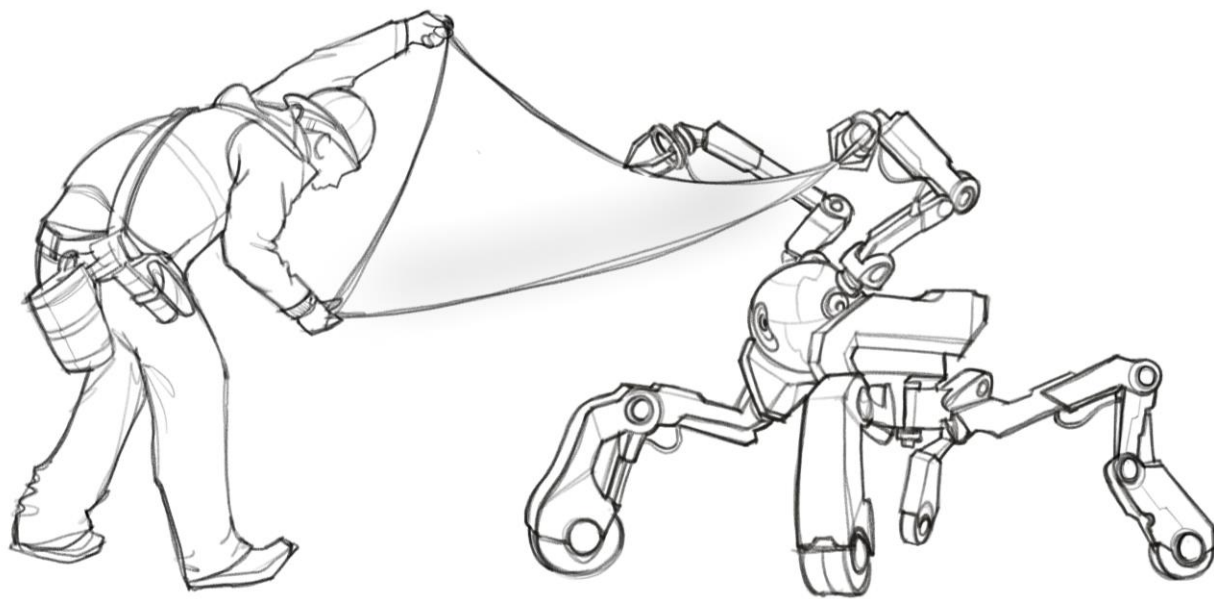


CRL

Immersive Teleoperation and Task Autocorrection

The mission:
Assistive robotics

Teach robots to operate alongside people



Teach robots to perform complex tasks



Assistive robotics



Learning from demonstration



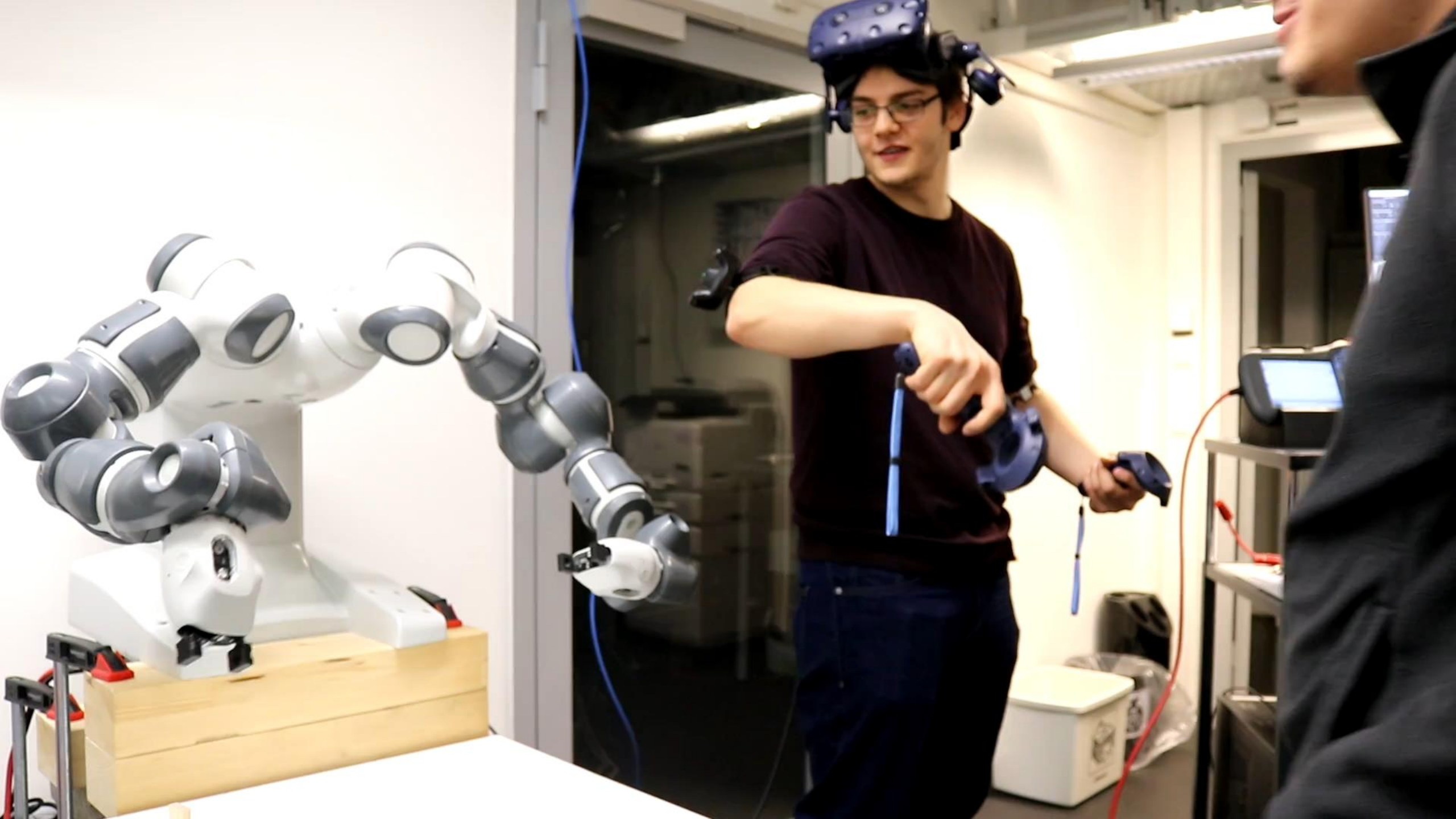
Teleoperation





The hero of our story





The "Avatar" experience

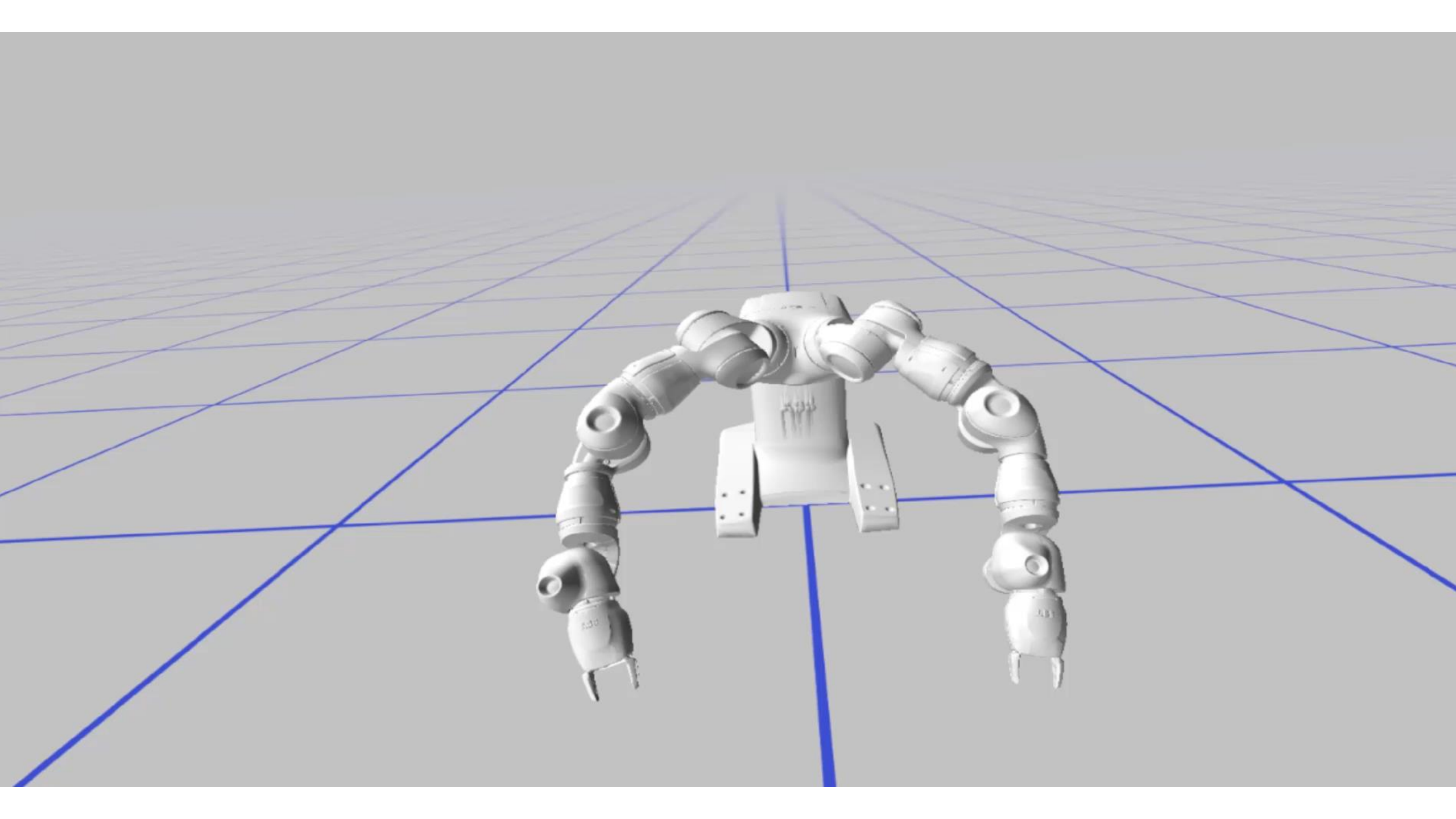


Immersive teleoperation



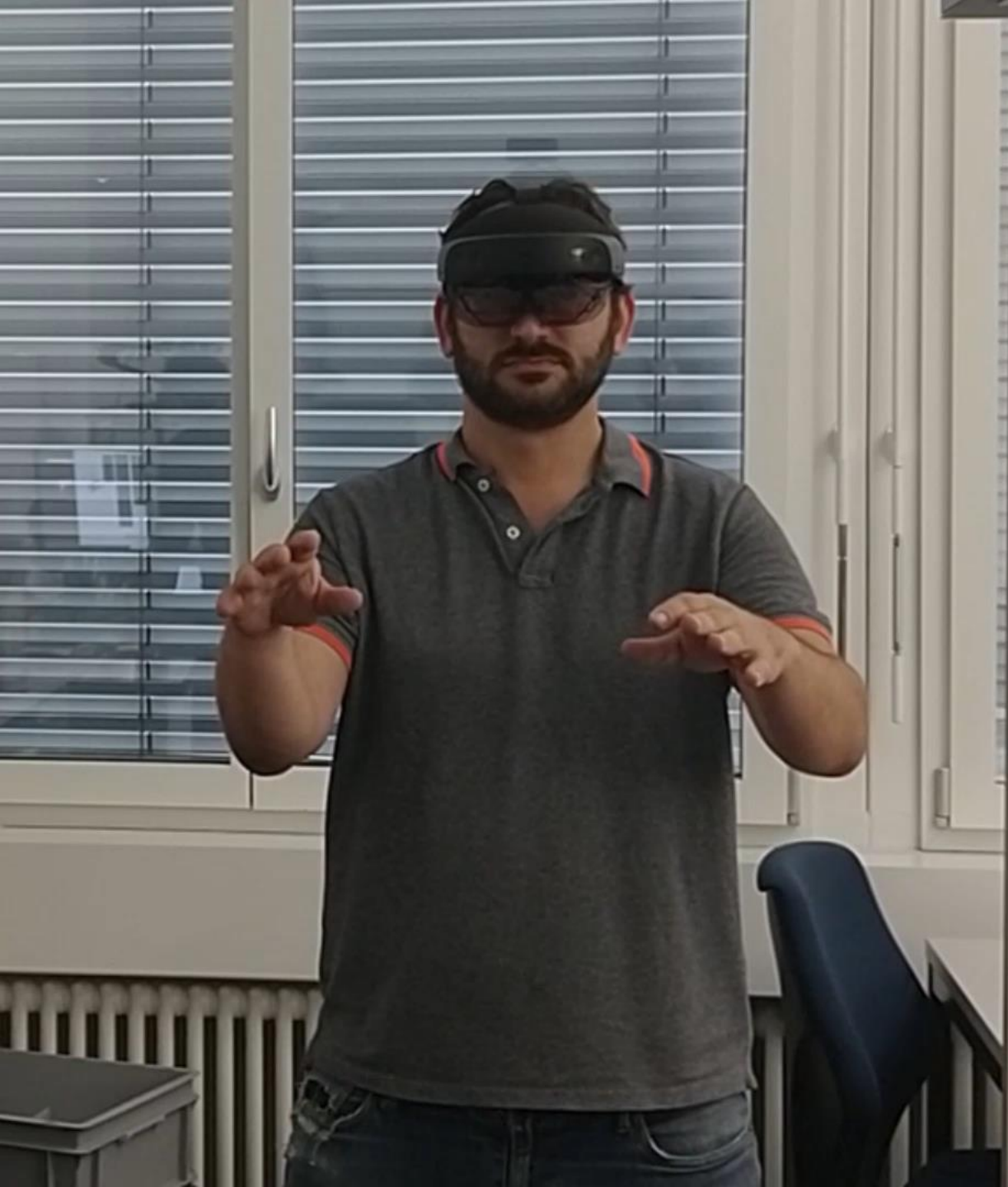
Immersive teleoperation

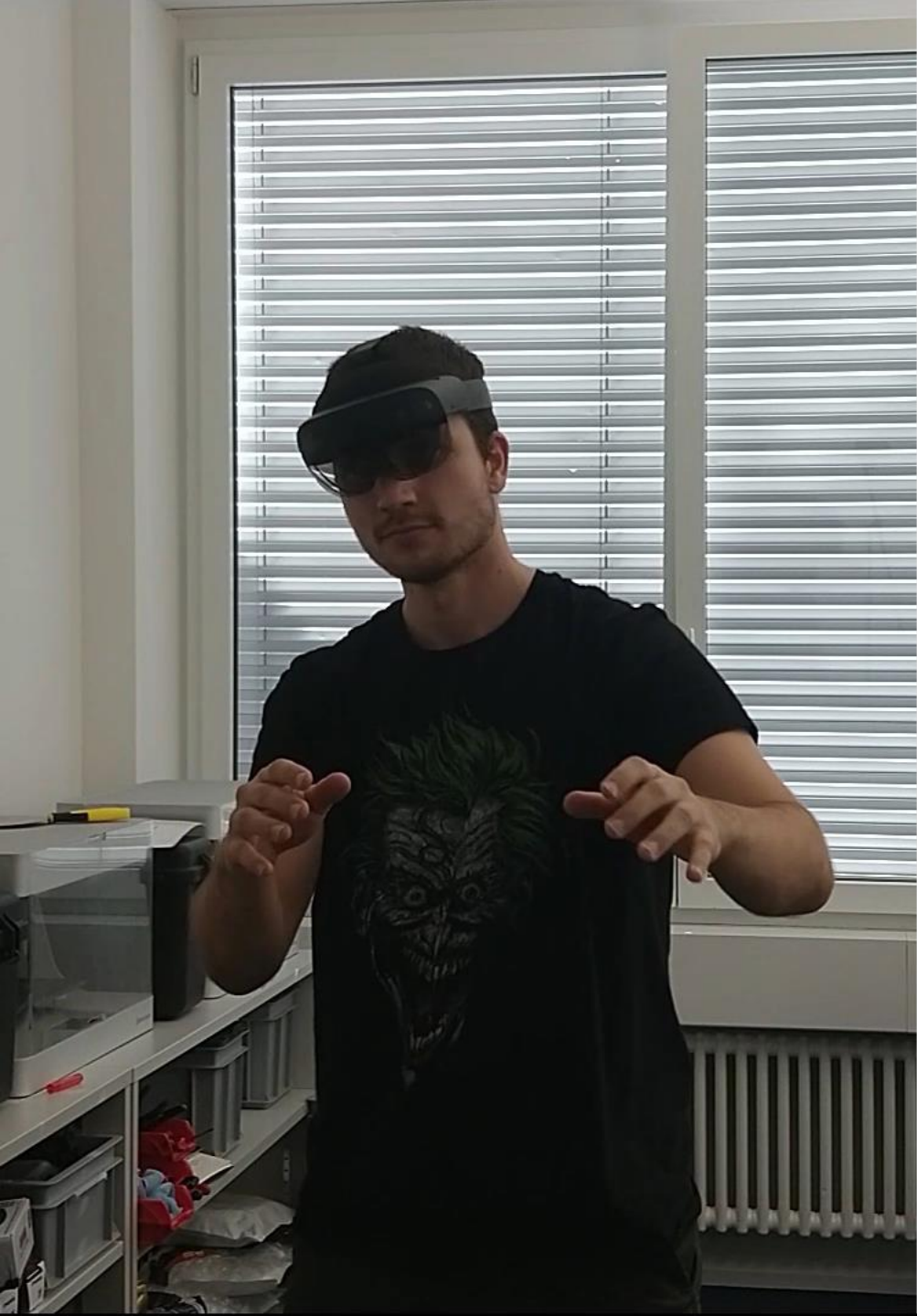


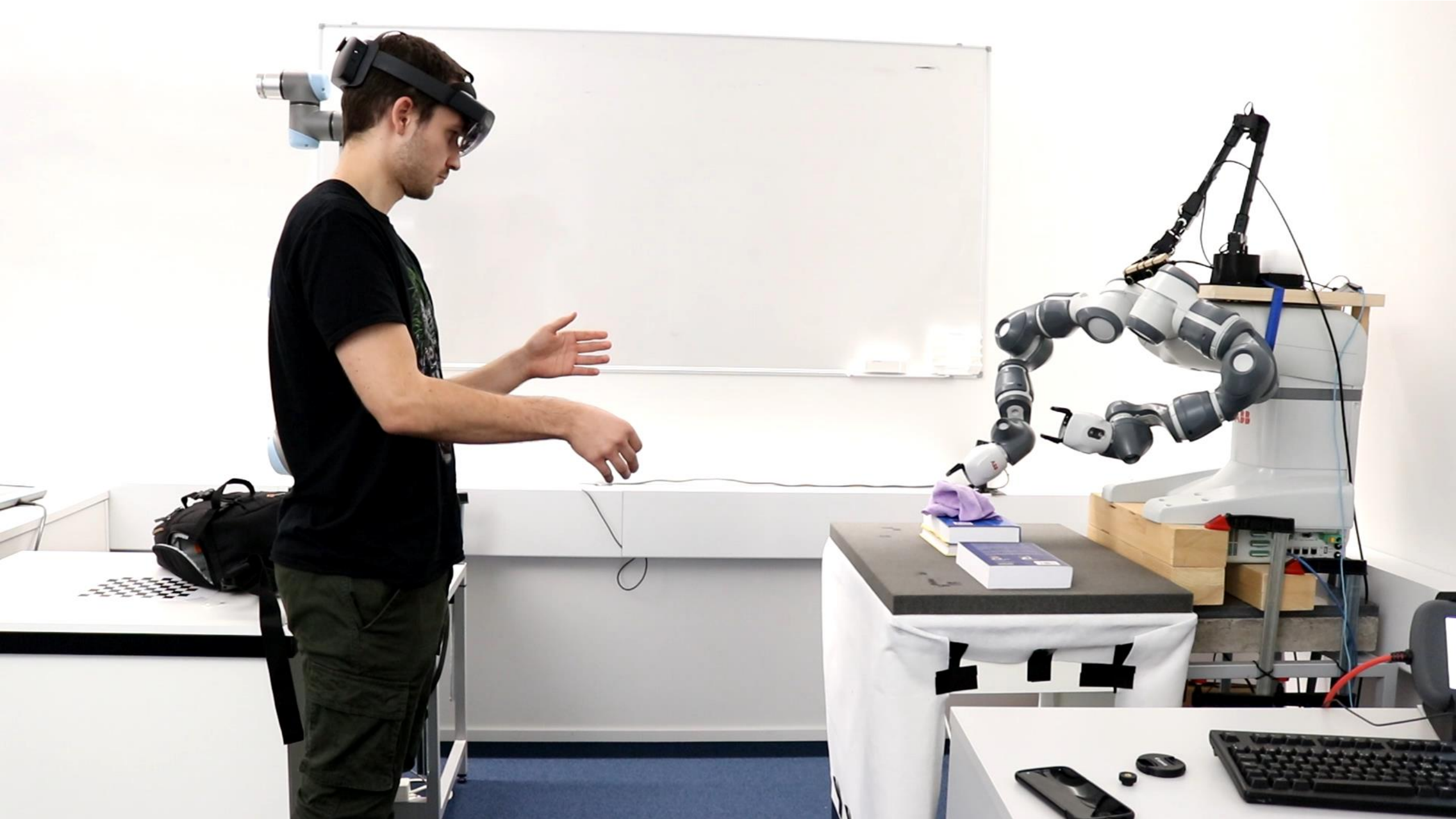


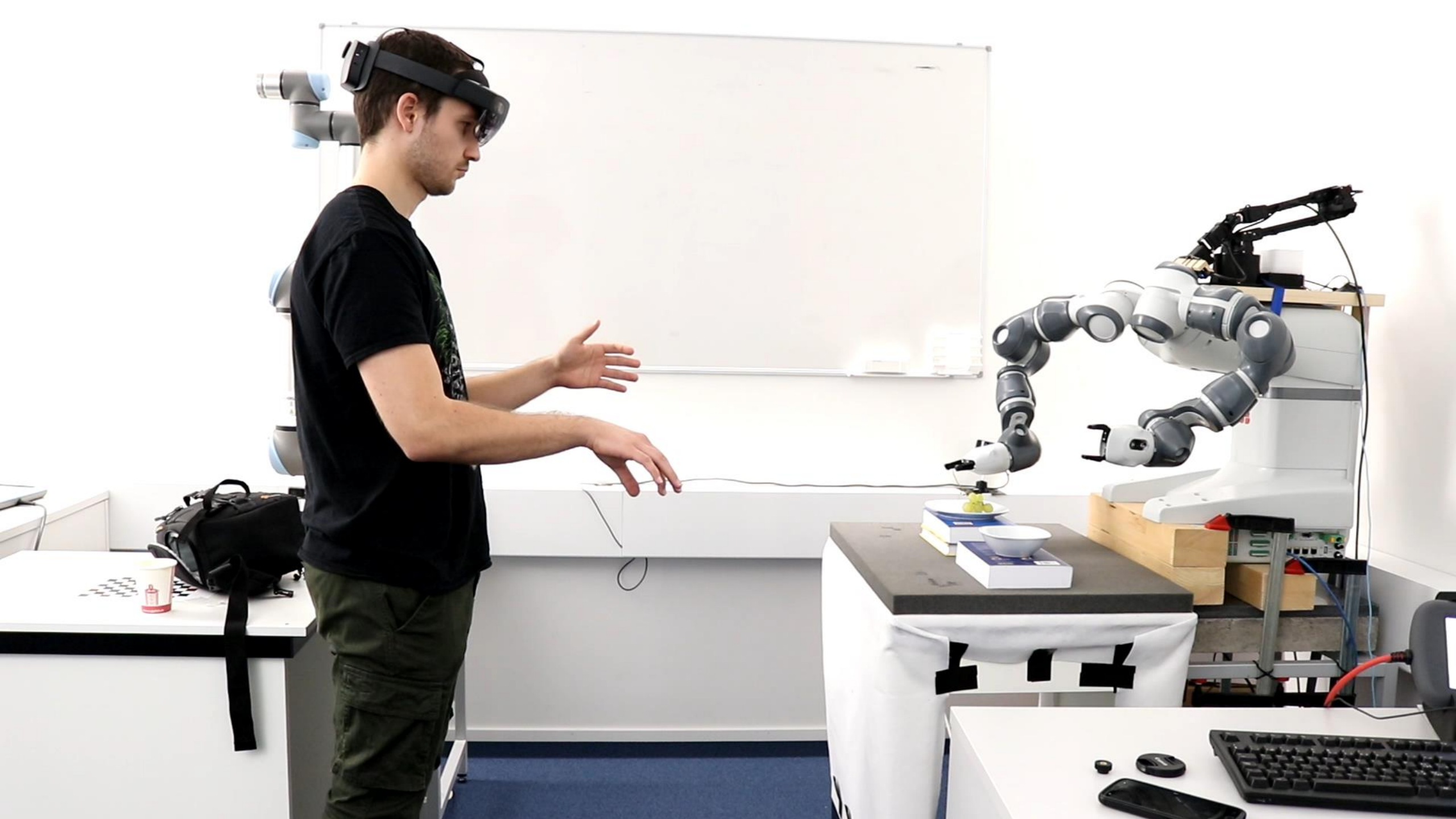






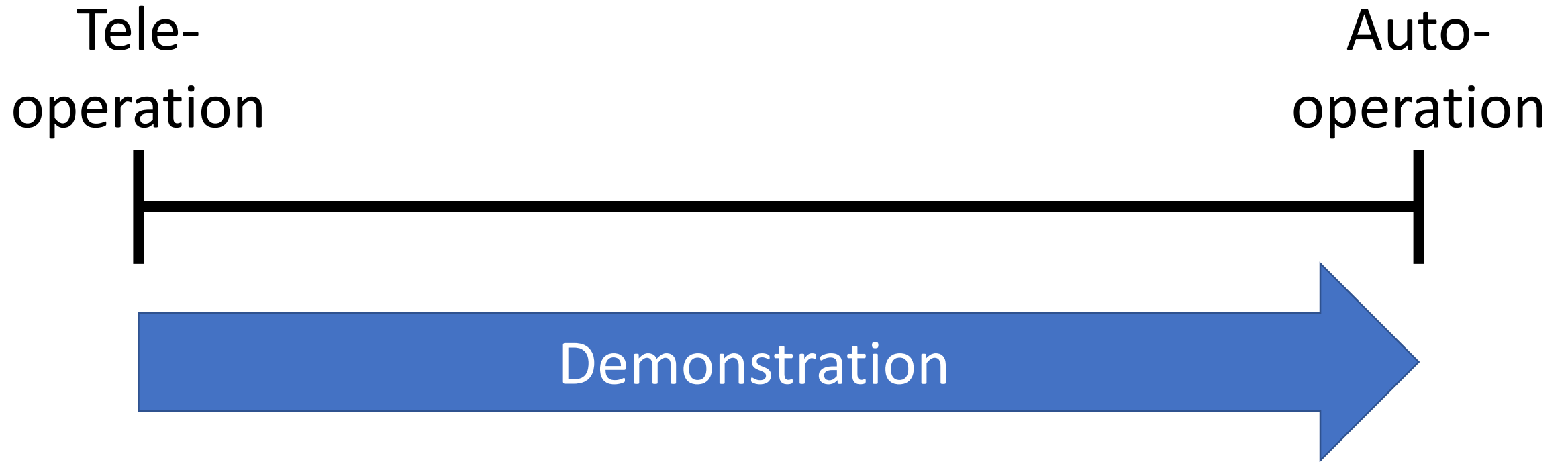








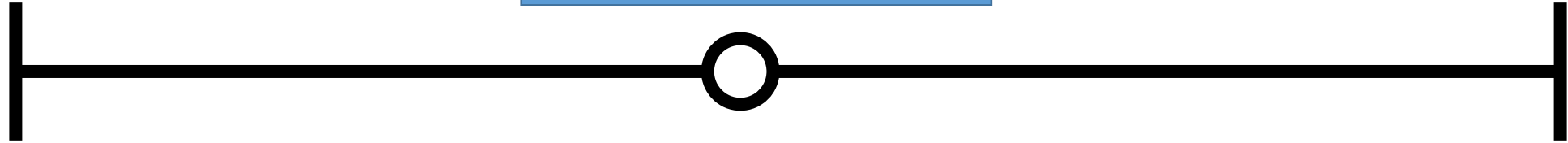
Assistive robotics



Tele-
operation

Human-in-
the-loop

Auto-
operation



Track human
motions

Determine
task

Task

Autocorrection

Retarget to
robot

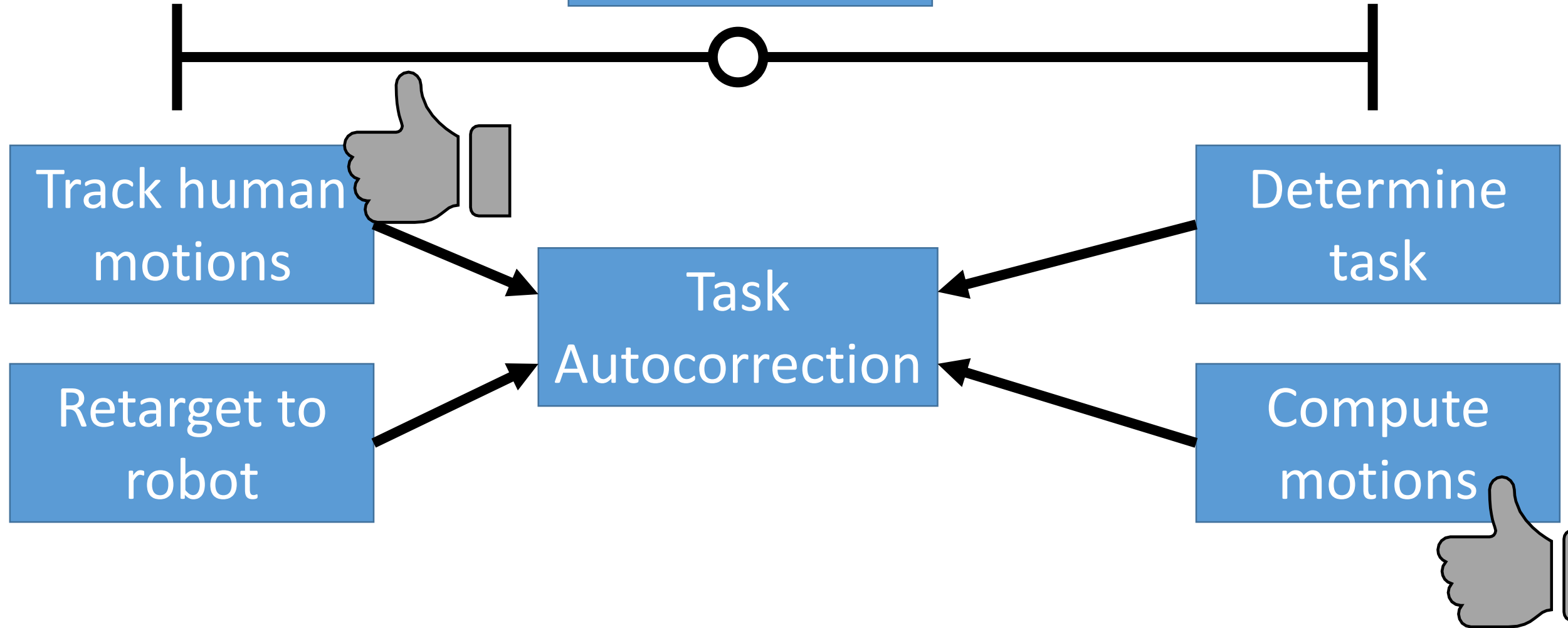
Compute
motions



Tele-
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Auto-
operation





“As far as I know, the universe does not have a desperate need for robot puppeteers...”

Evan Ackerman, *IEEE Spectrum*

“...The usefulness of this research, thankfully, is not constrained to puppets”

A Mid-level Planning System for Object Reorientation

Weiwei Wan¹, Hisashi Igawa², Kensuke Harada^{1,3}, Zepei Wu¹,
Kazuyuki Nagata¹, Hiromu Onda¹, Yamanobe Natsuki¹, and Yasuyo Kita¹

¹The Manipulation Research Group, National Inst. of AIST

²Hokkaido Research Organization

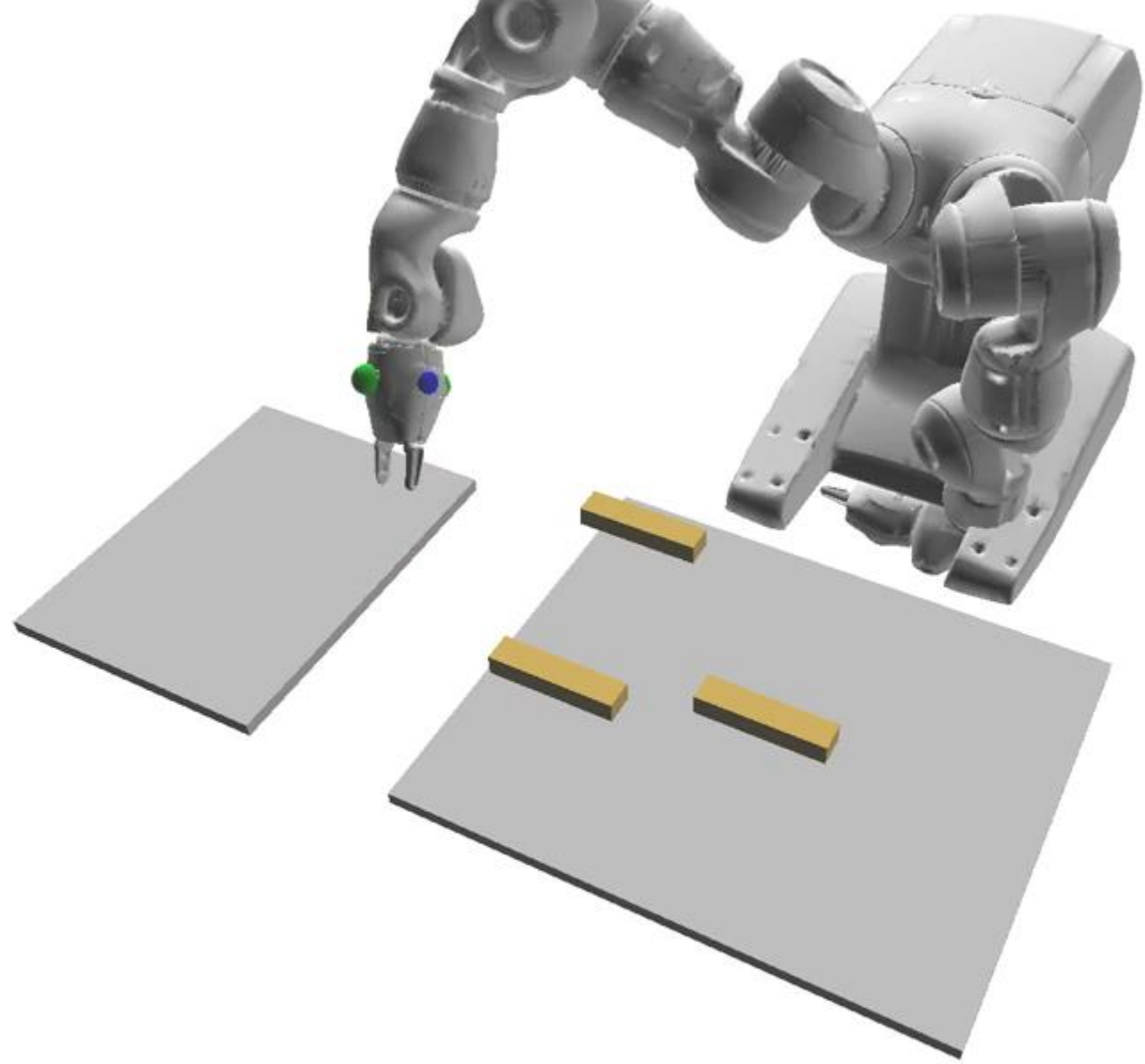
³Osaka University

Target:



Double hand-over

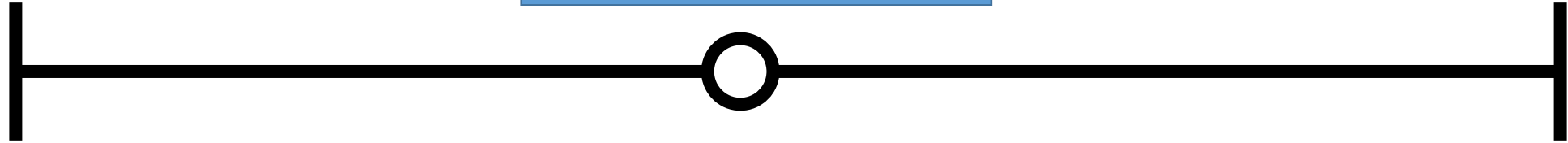




Tele-
operation

Human-in-
the-loop

Auto-
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Track human
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Determine
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Task

Autocorrection

Retarget to
robot

Compute
motions



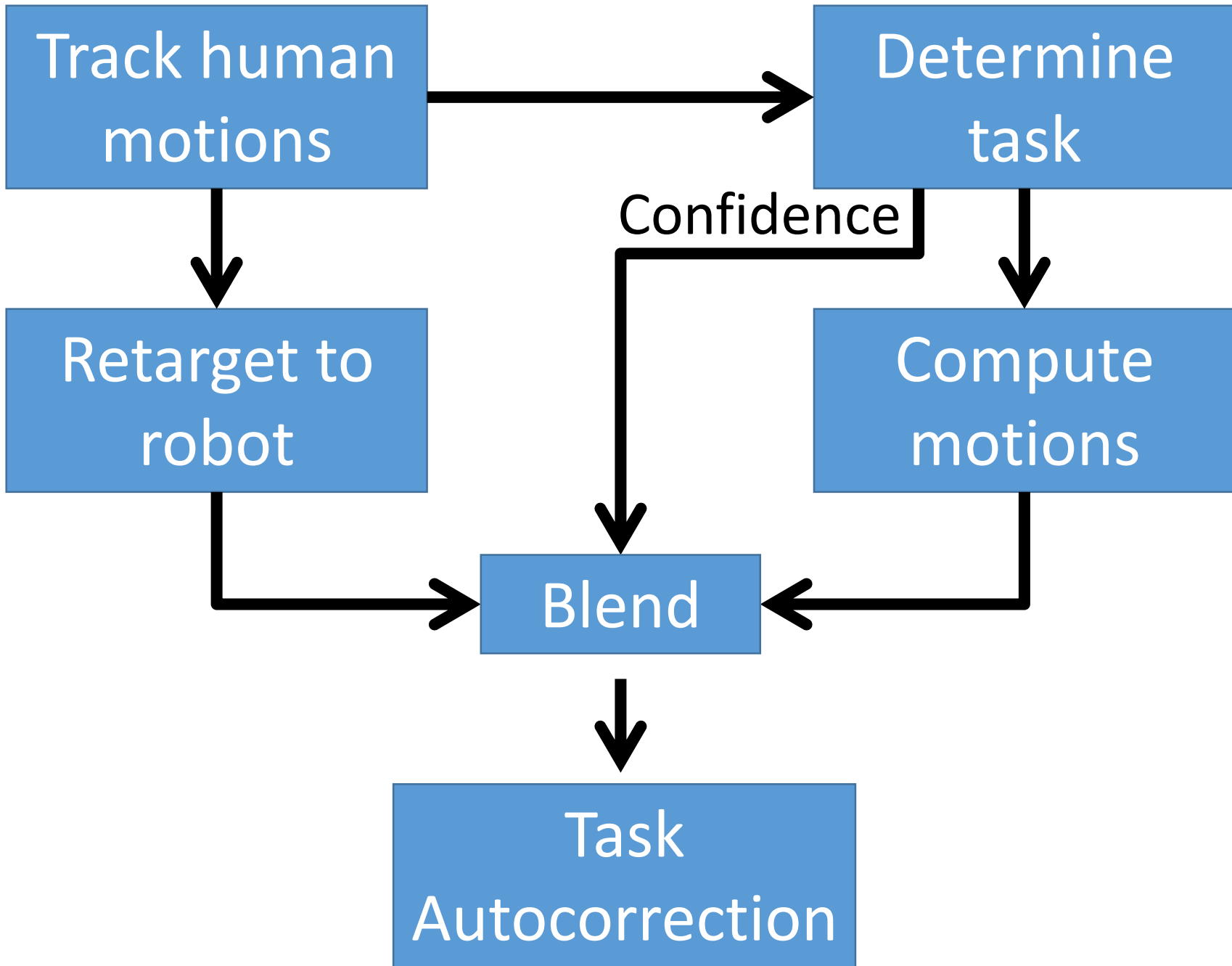
Track human
motions

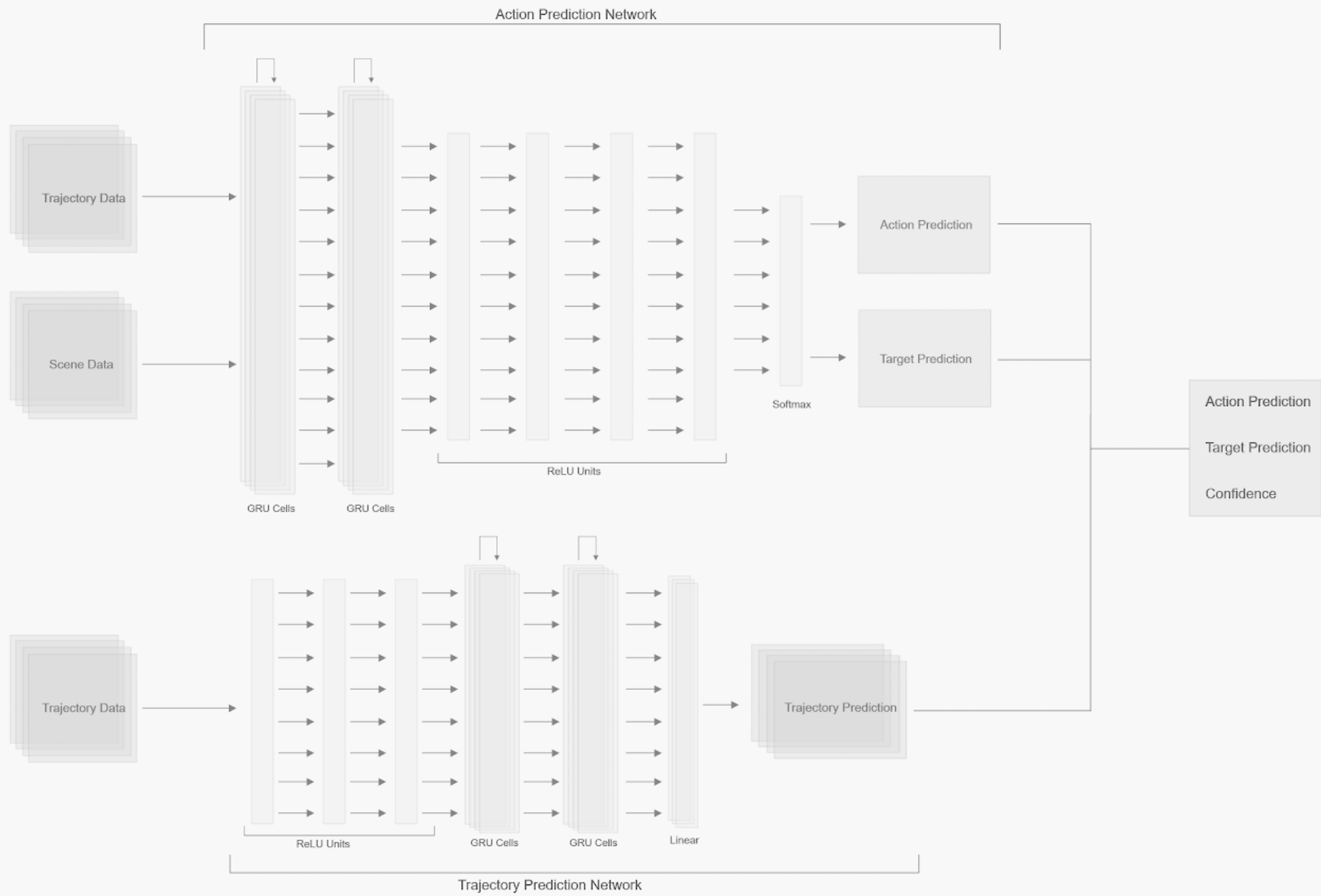
Retarget to
robot

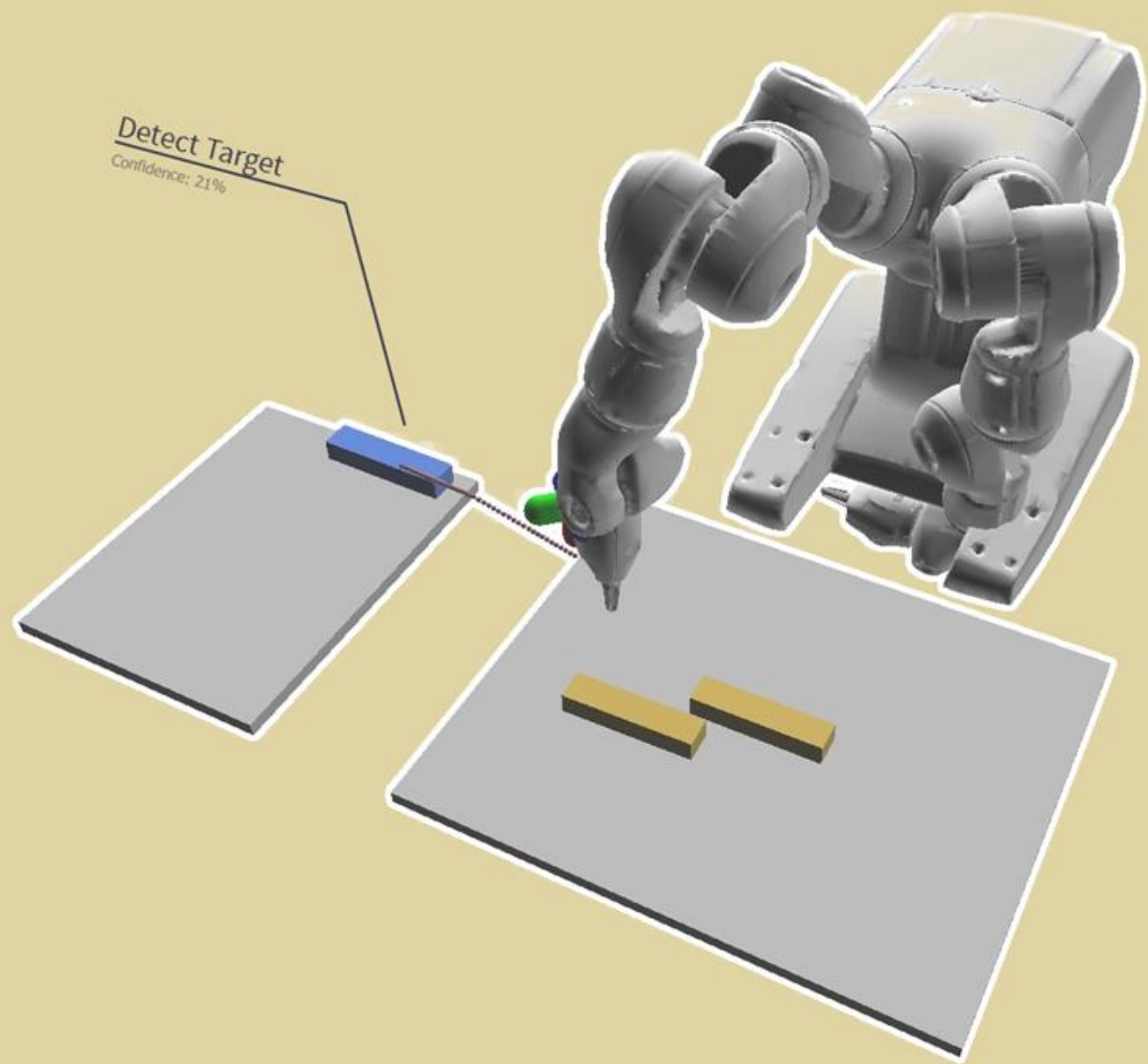
Task
Autocorrection

Determine
task

Compute
motions

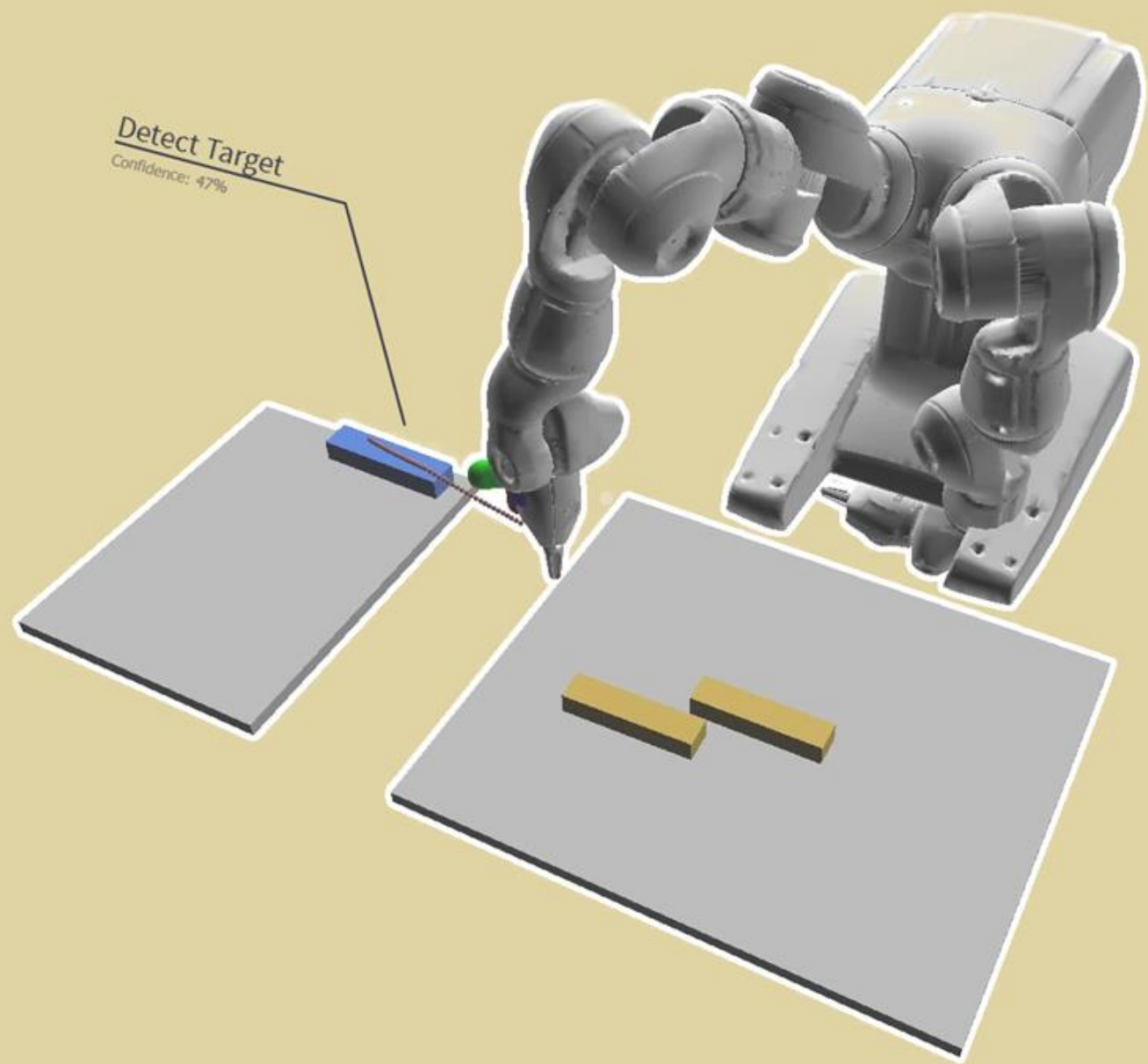






Detect Target

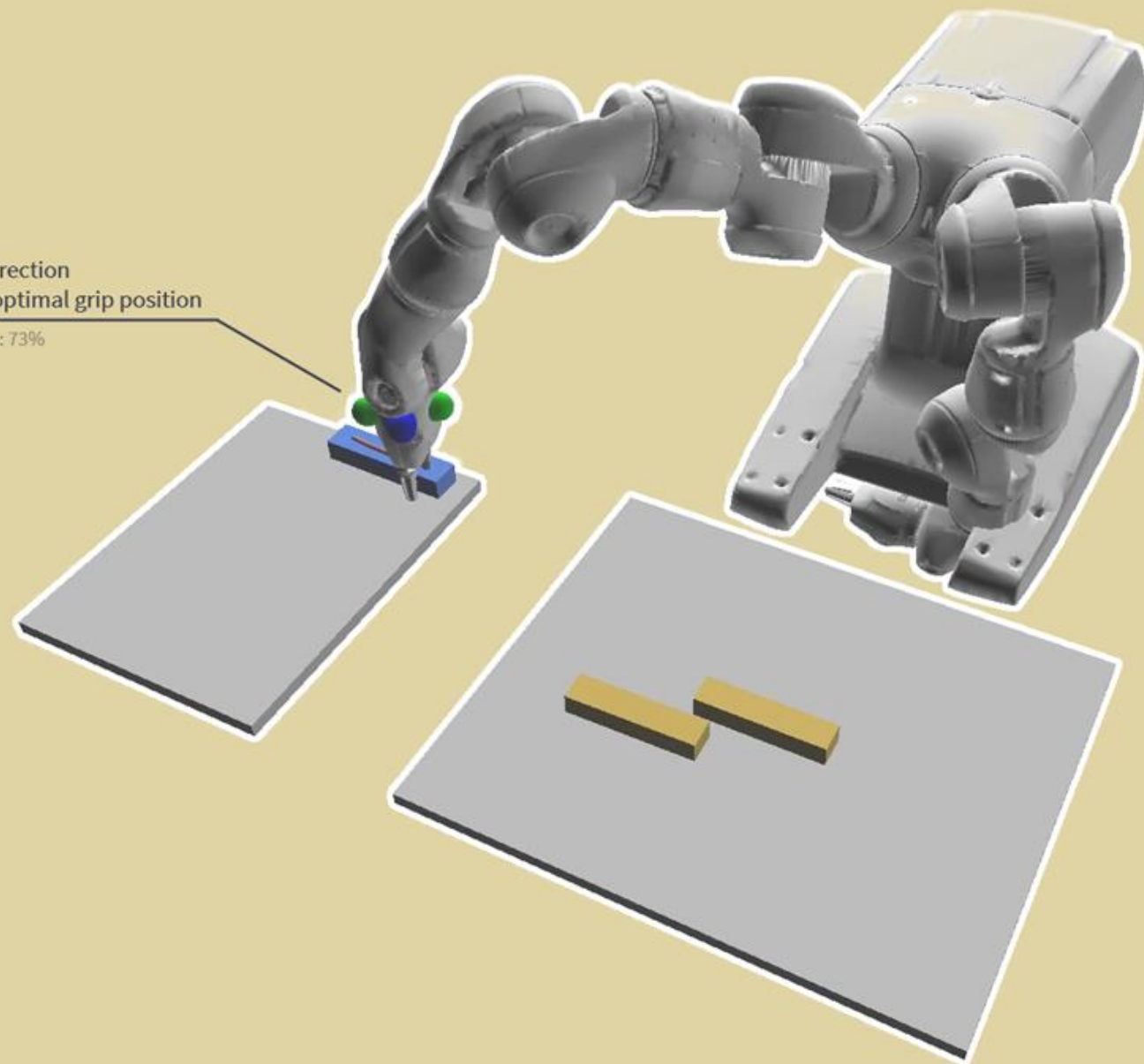
Confidence: 21%



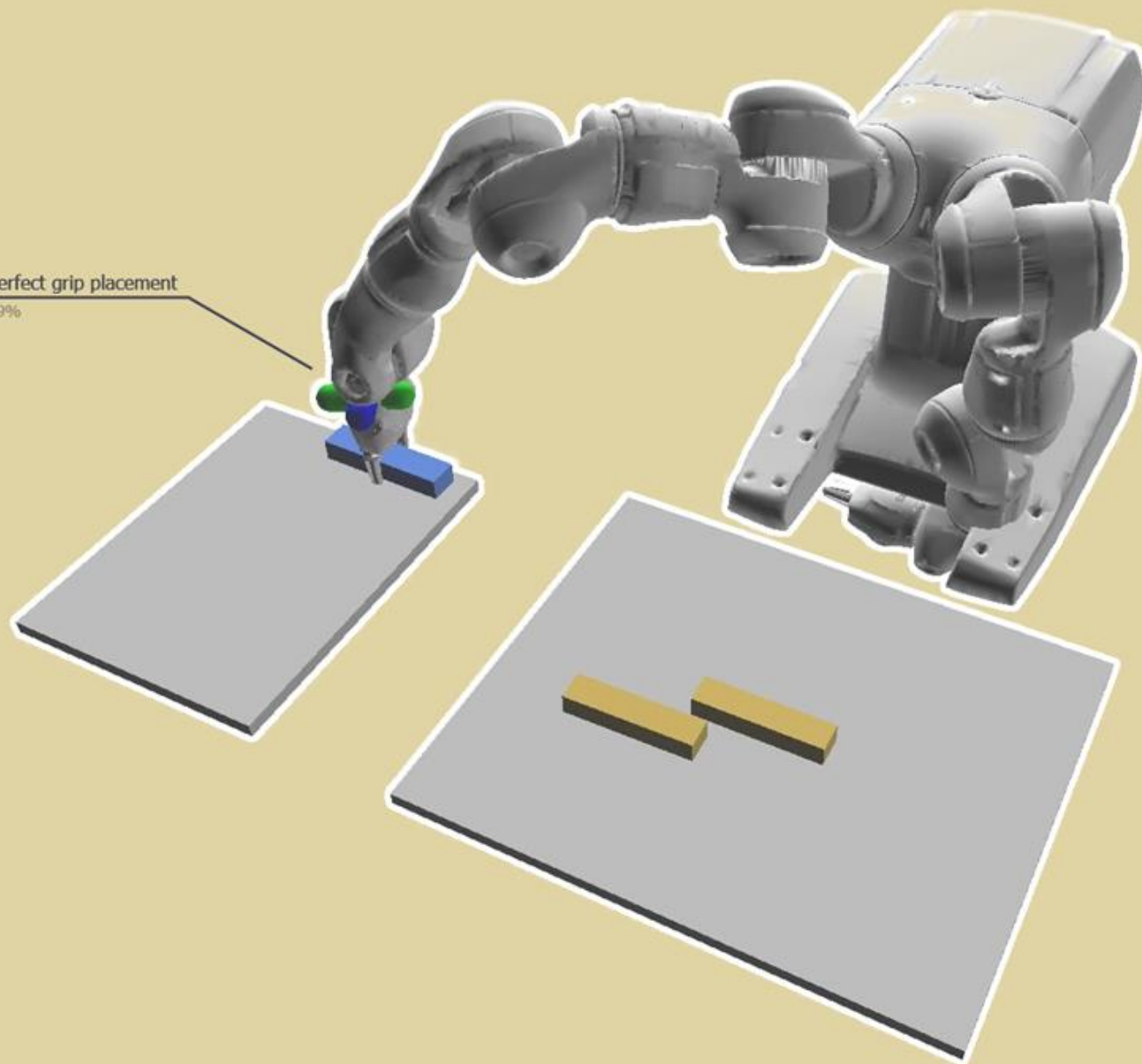
Detect Target

Confidence: 47%

Slight correction
towards optimal grip position
Confidence: 73%

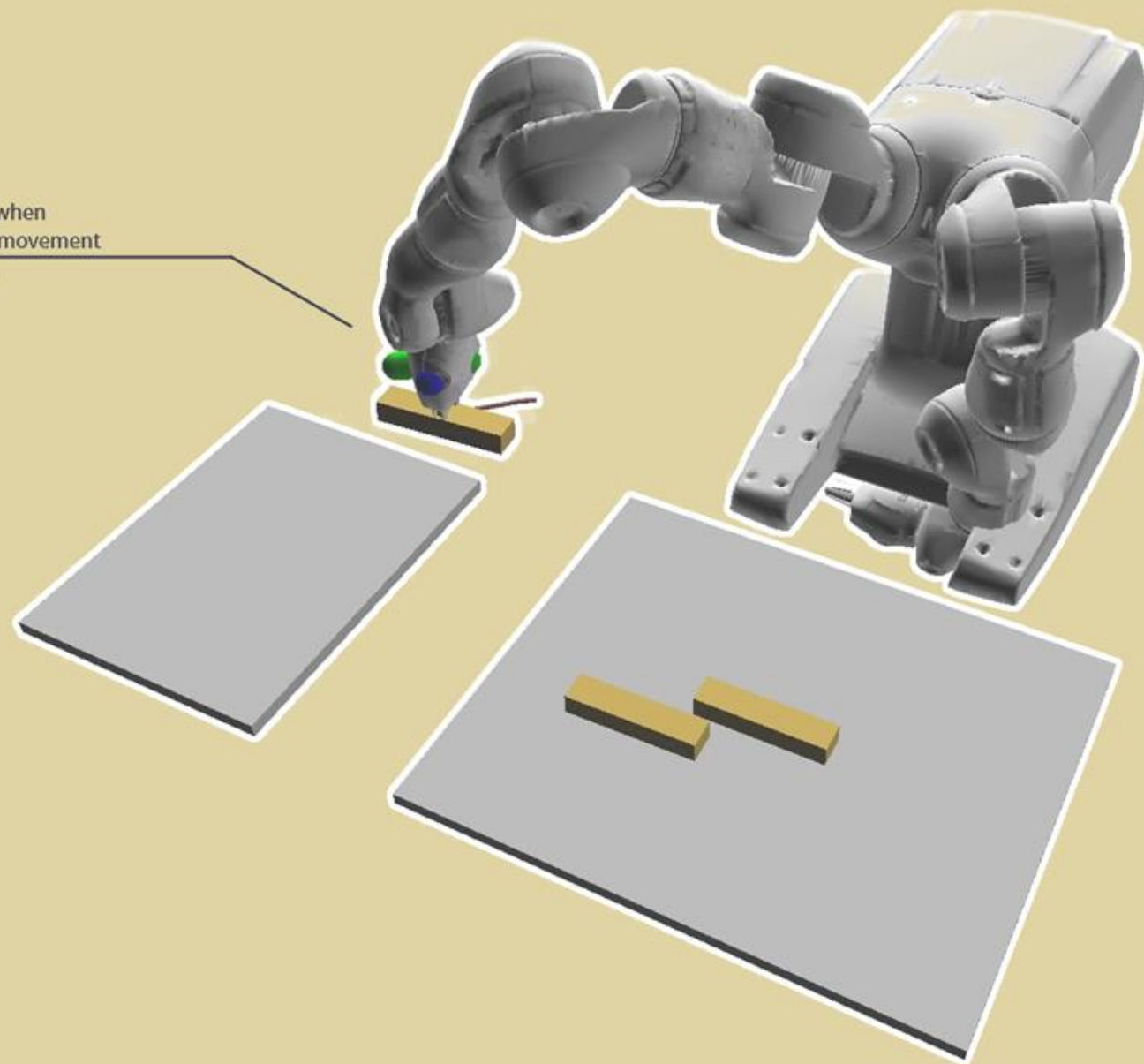


Correct with perfect grip placement
Confidence: 99.9%

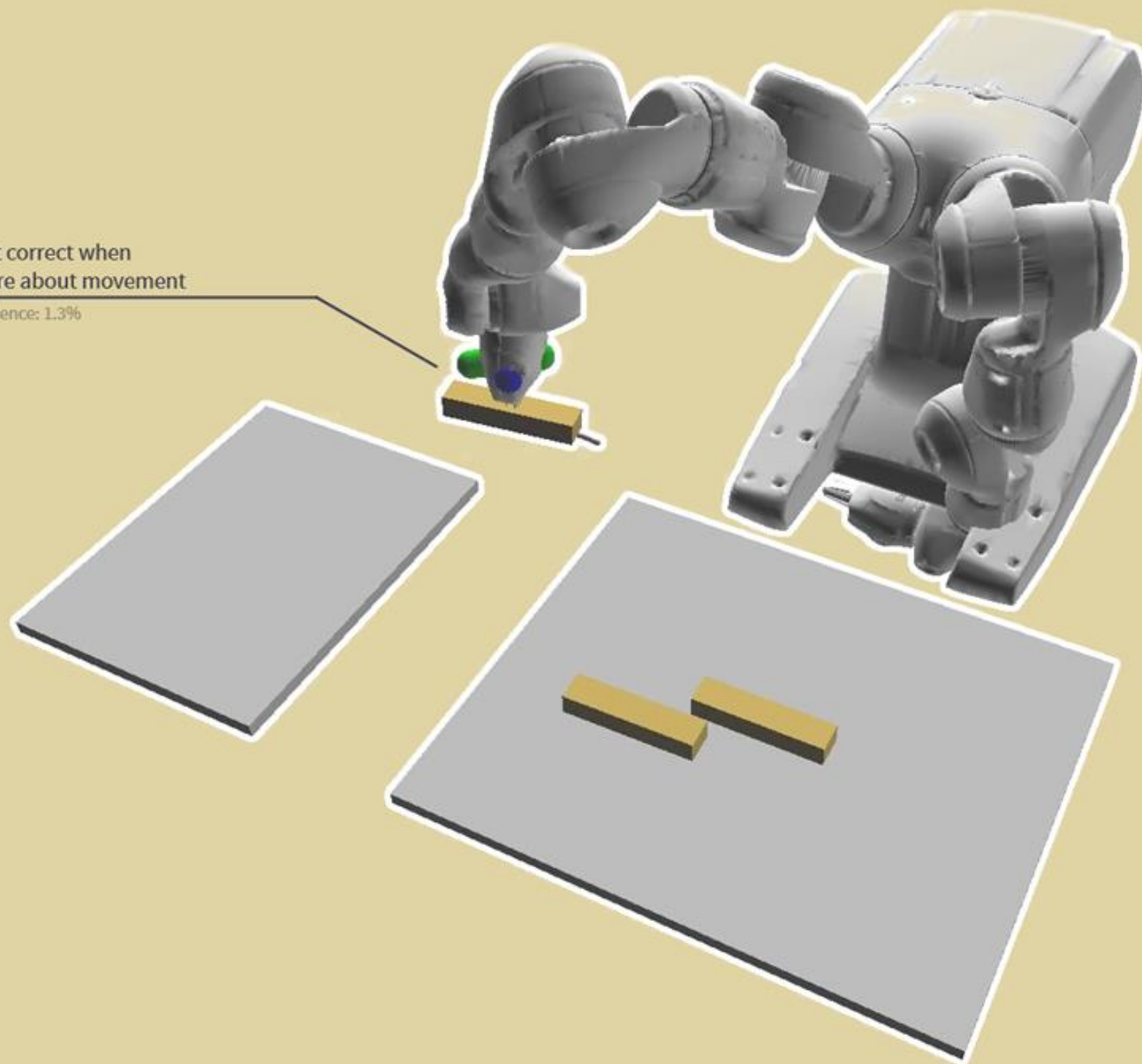


Don't correct when
unsure about movement

Confidence: 1.3%

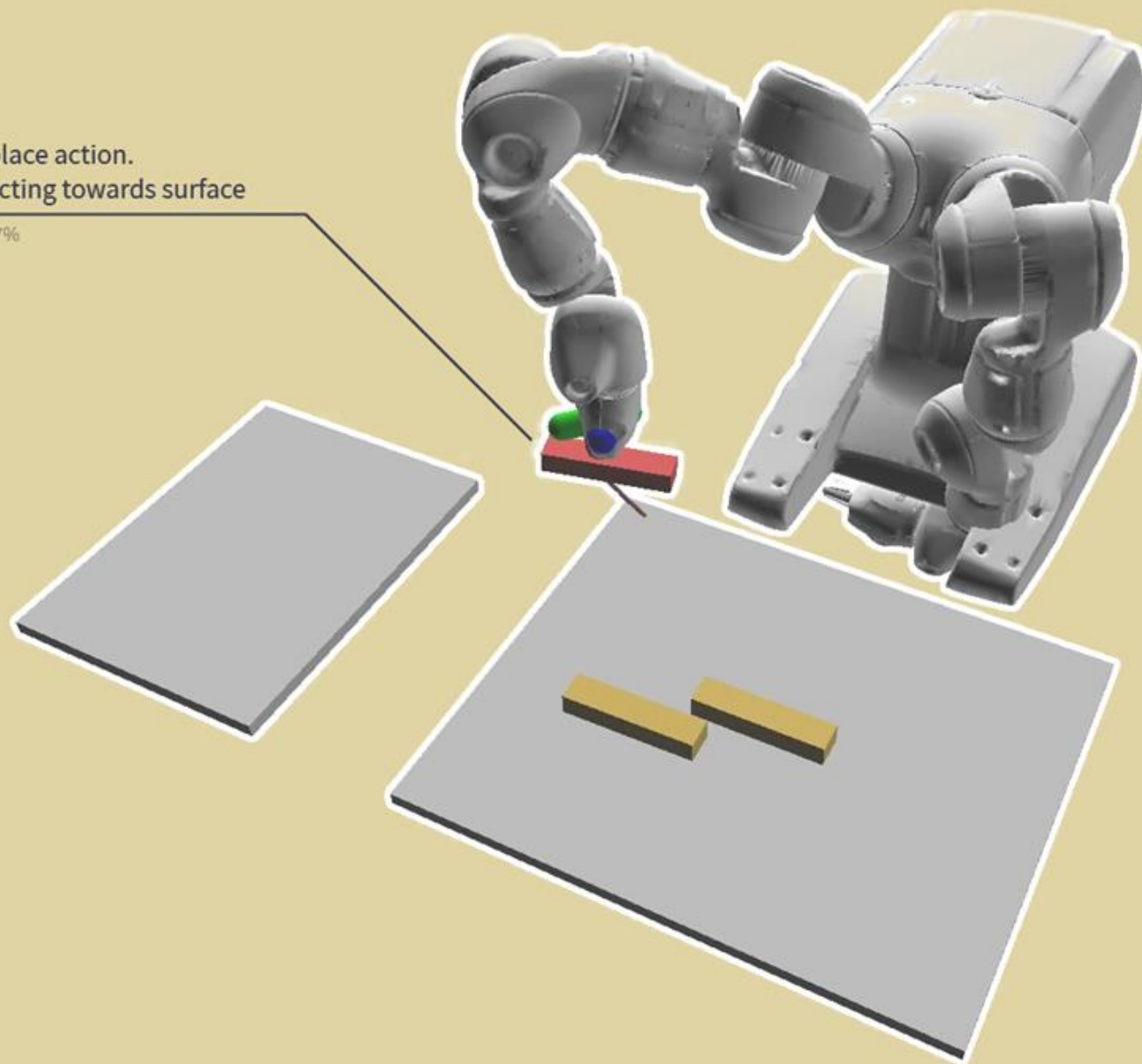


Don't correct when
unsure about movement
Confidence: 1.3%



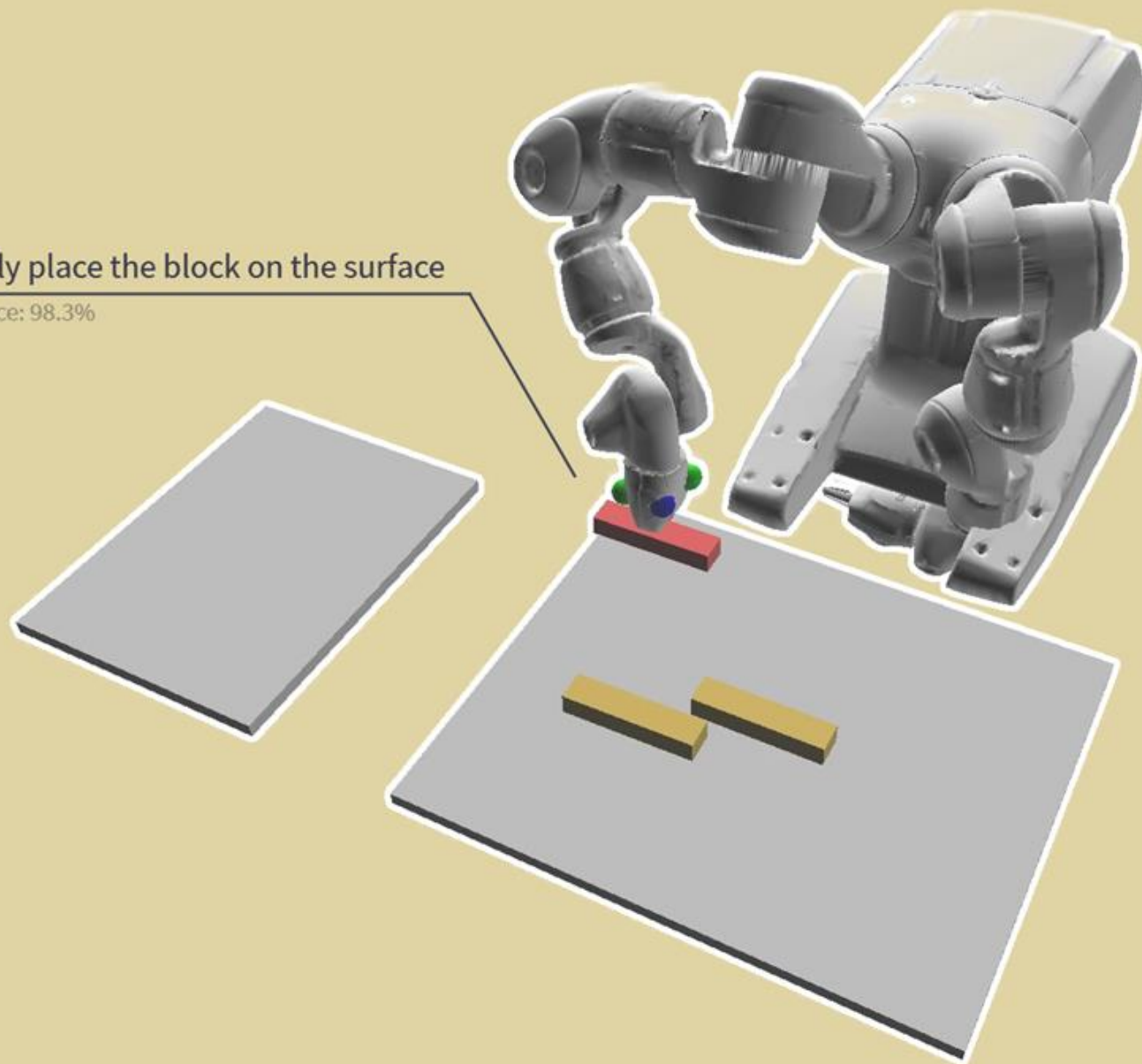
Detected place action.
Start correcting towards surface

Confidence: 67%

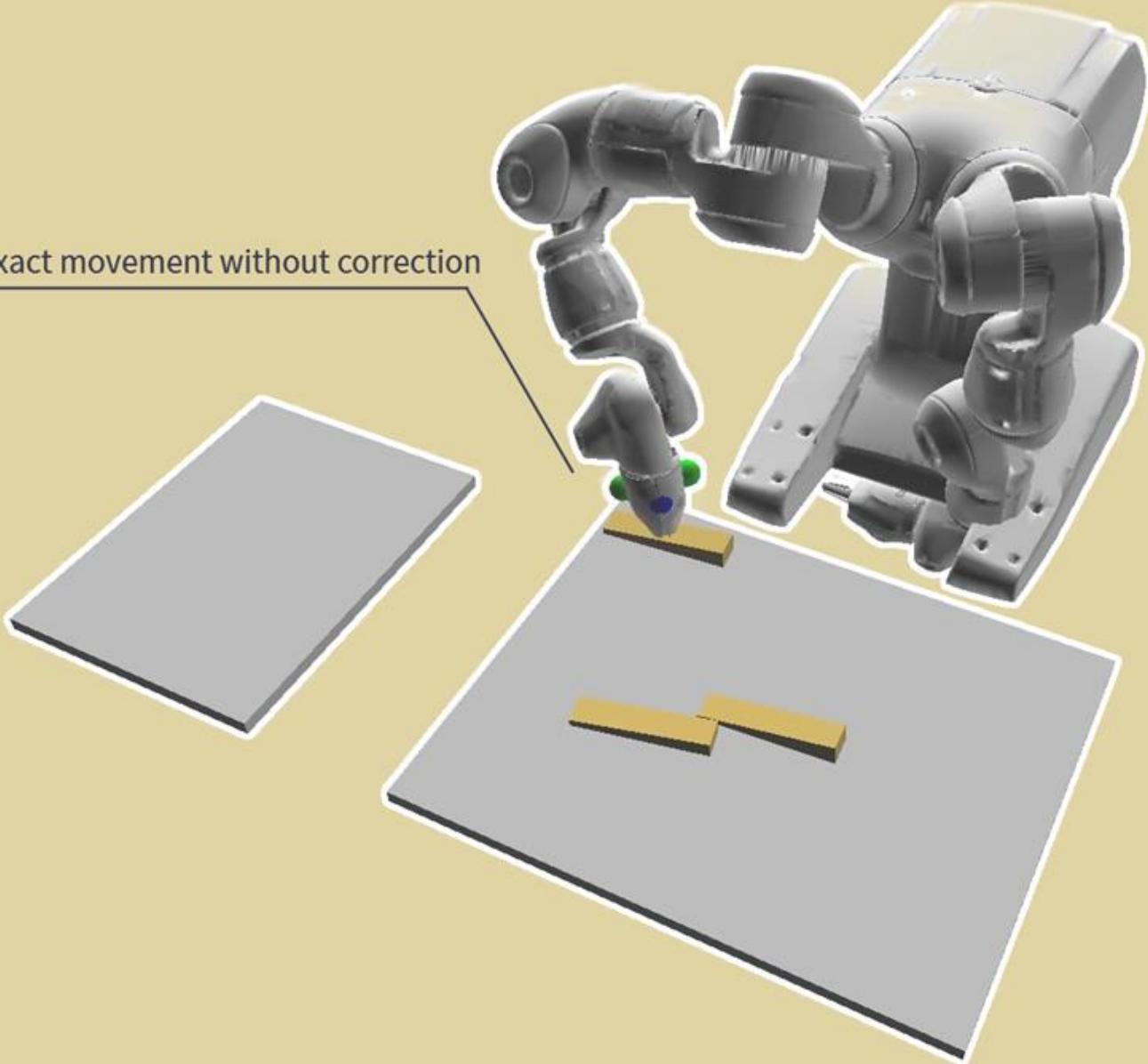


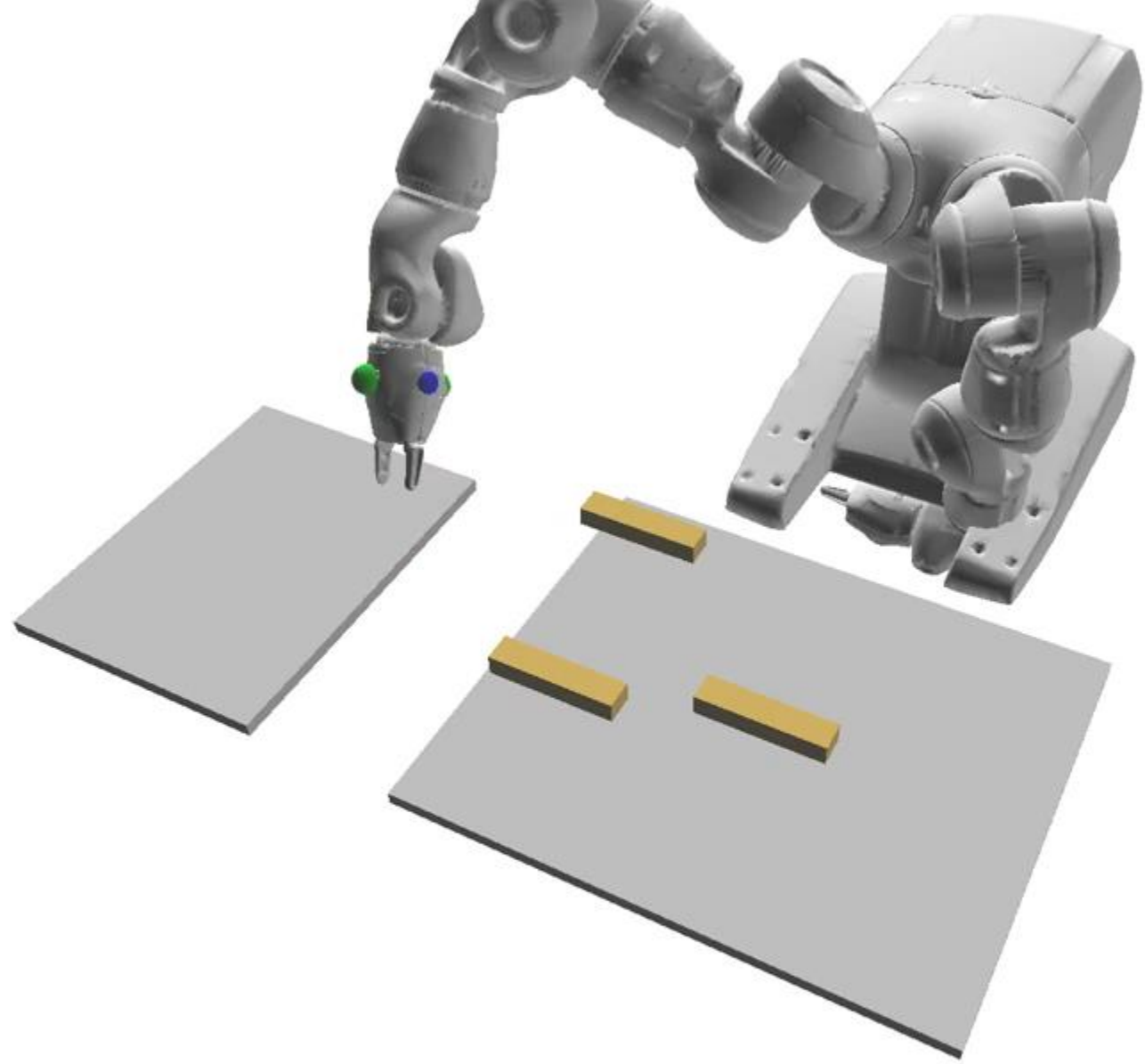
Perfectly place the block on the surface

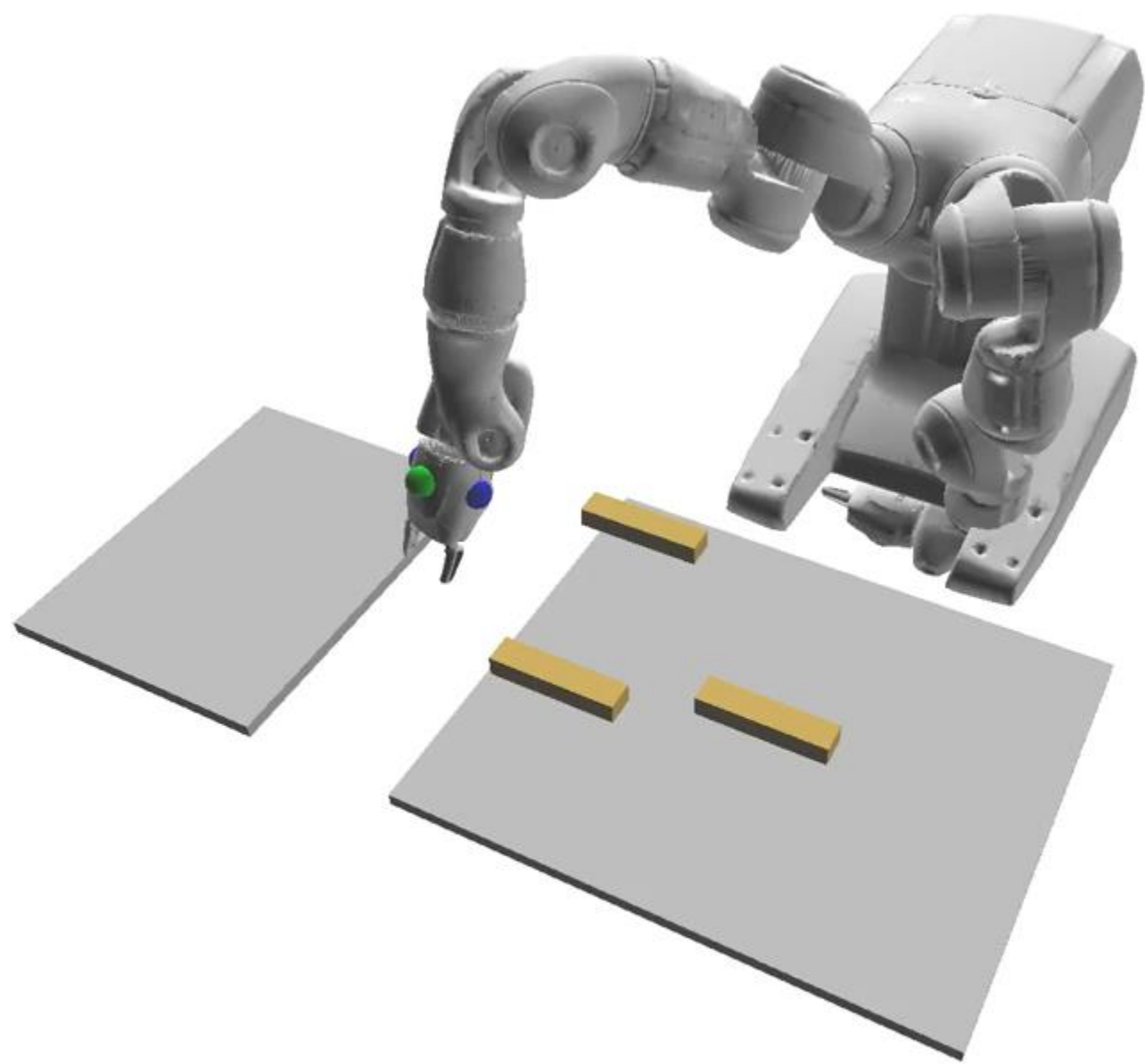
Confidence: 98.3%



Same exact movement without correction

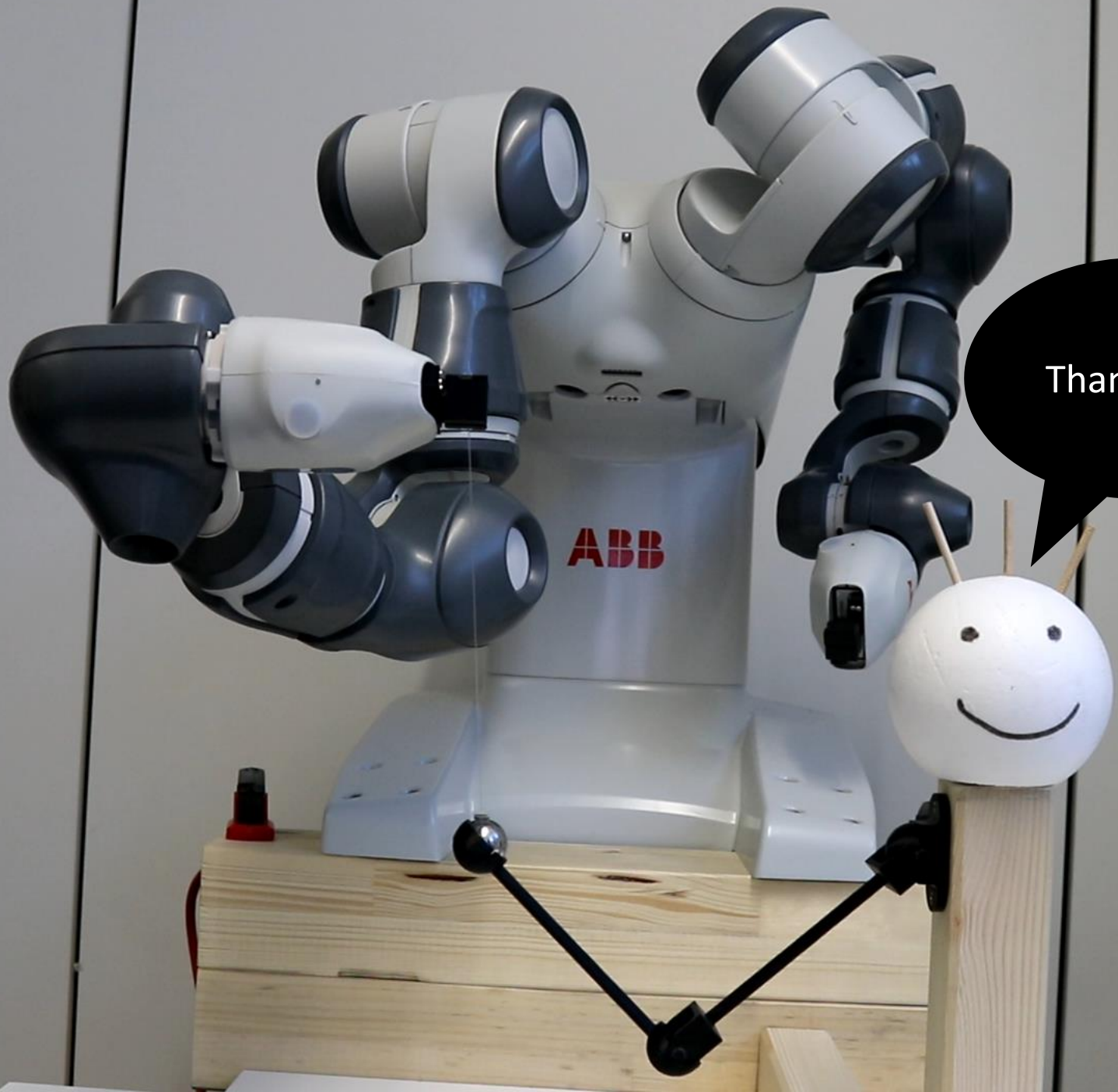






Next time

- Better retargeting
- More immersion
- Robotic hands?



ABB

Thank you!