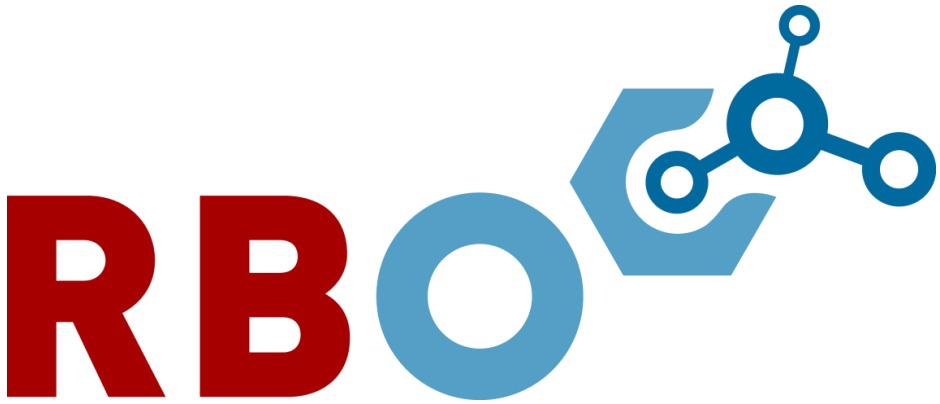

Benchmarking Grasping Before It Happens: The Path Is the Goal

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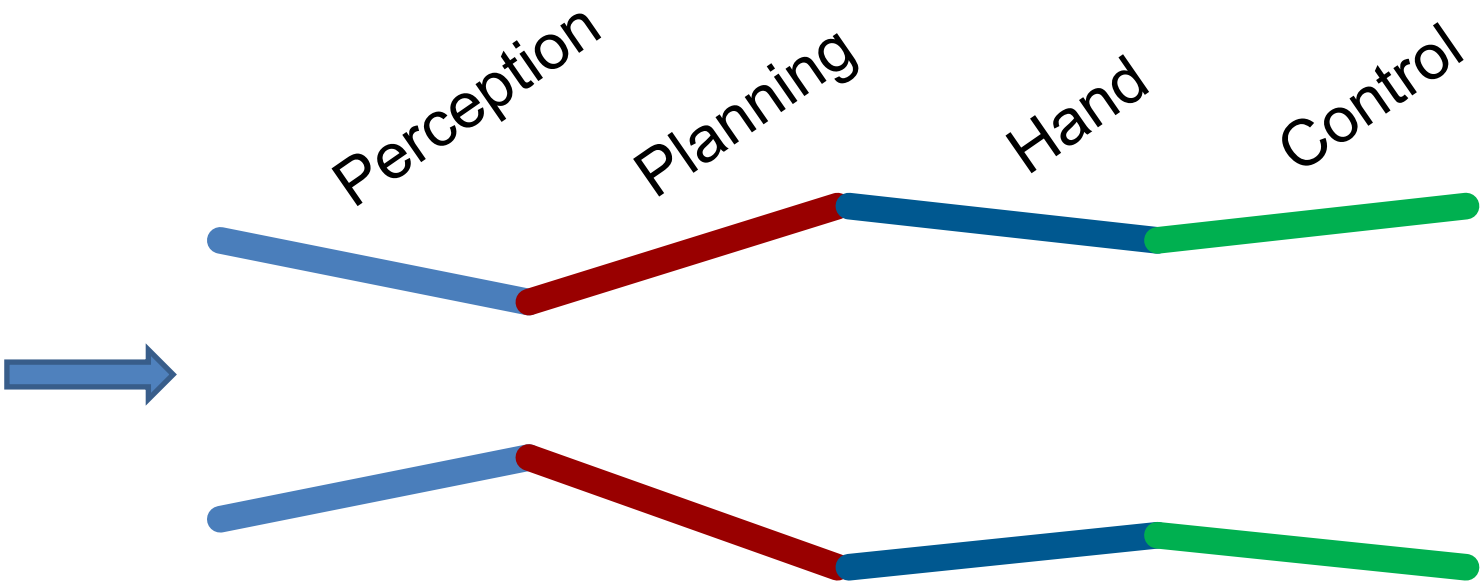
My Theses

- Benchmarking grasping is nearly impossible
- Grasping is a dynamic process, extended over time
- Grasping becomes robust through the exploitation of physical contact between hand/object/environment
- Is the exploitation of physical contact benchmark-able?
- Yes, with morphological computation, but…

Benchmarking: Why and How?

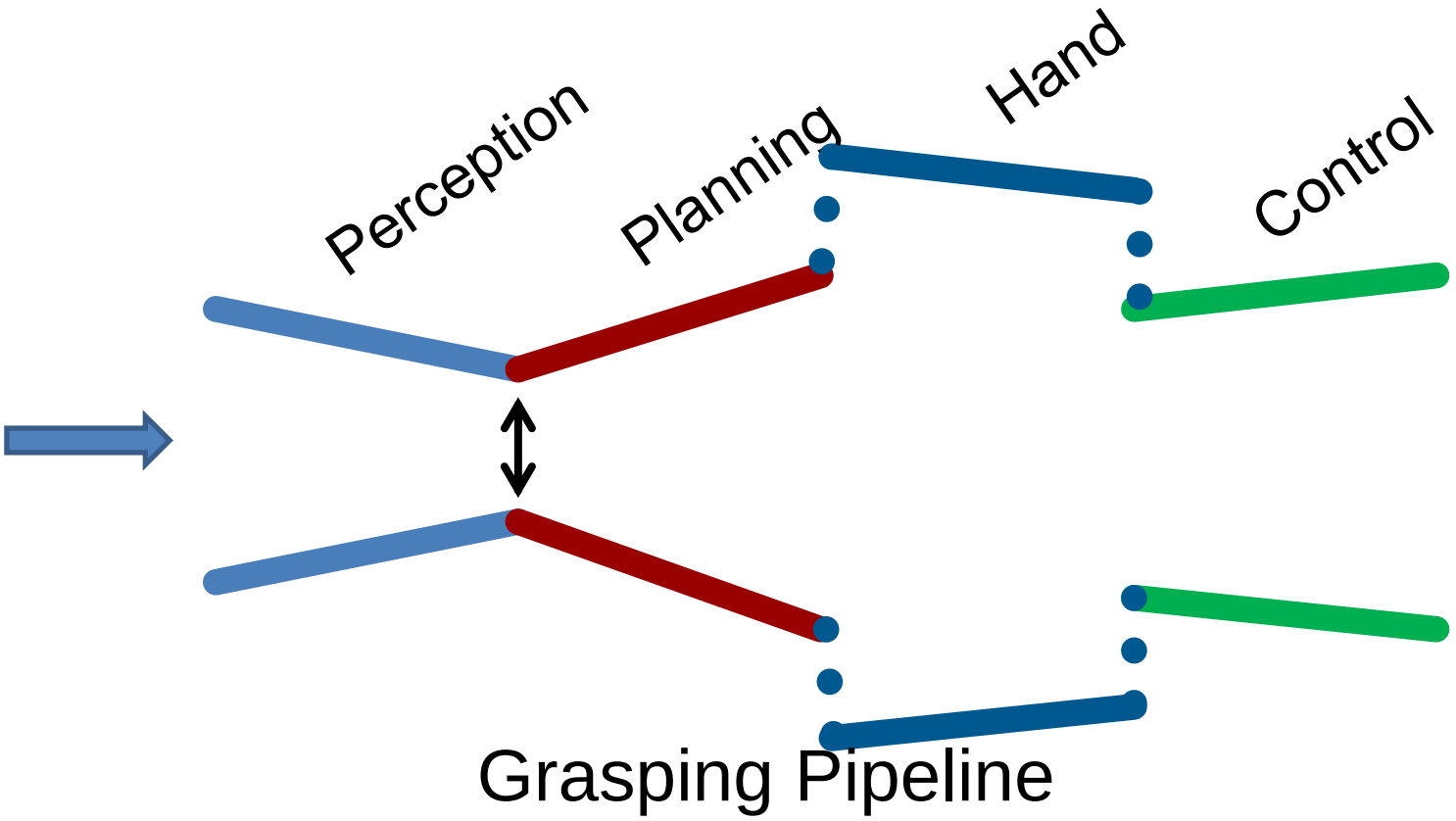


Grasping Pipeline

Do Not Benchmark Robot Hands in the Human Pipeline!

[Image of **chop sticks** removed to avoid copyright issues]

How to Determine the Bottleneck?



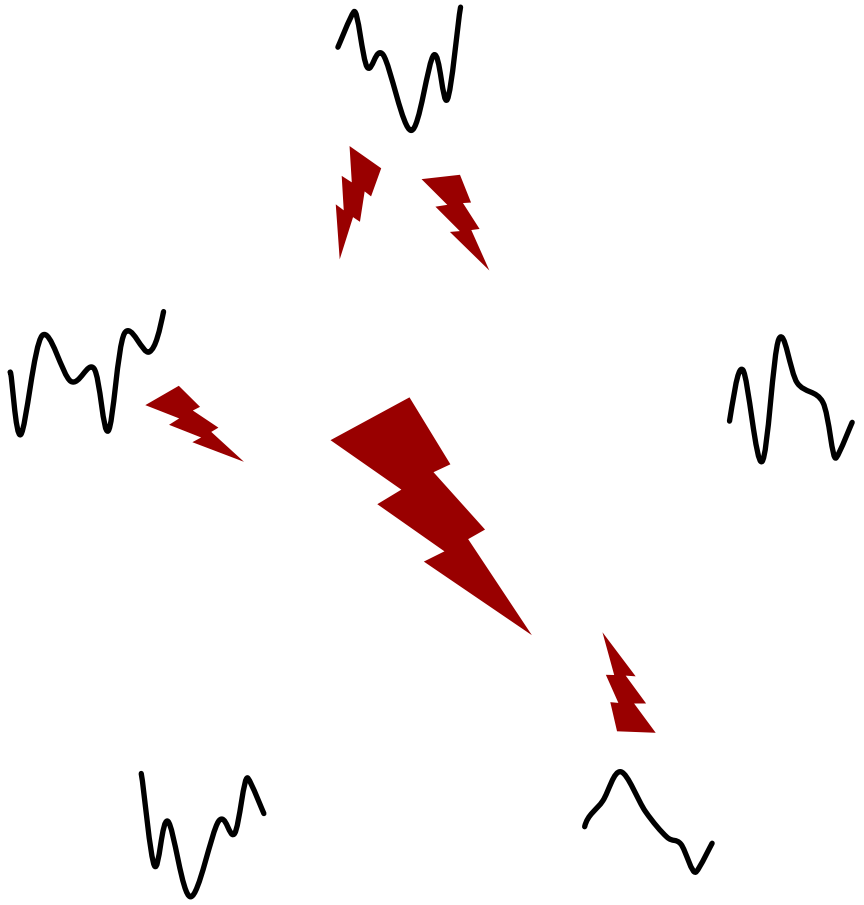
Benchmarking Hands

from Markus Grebenstein's PhD Thesis

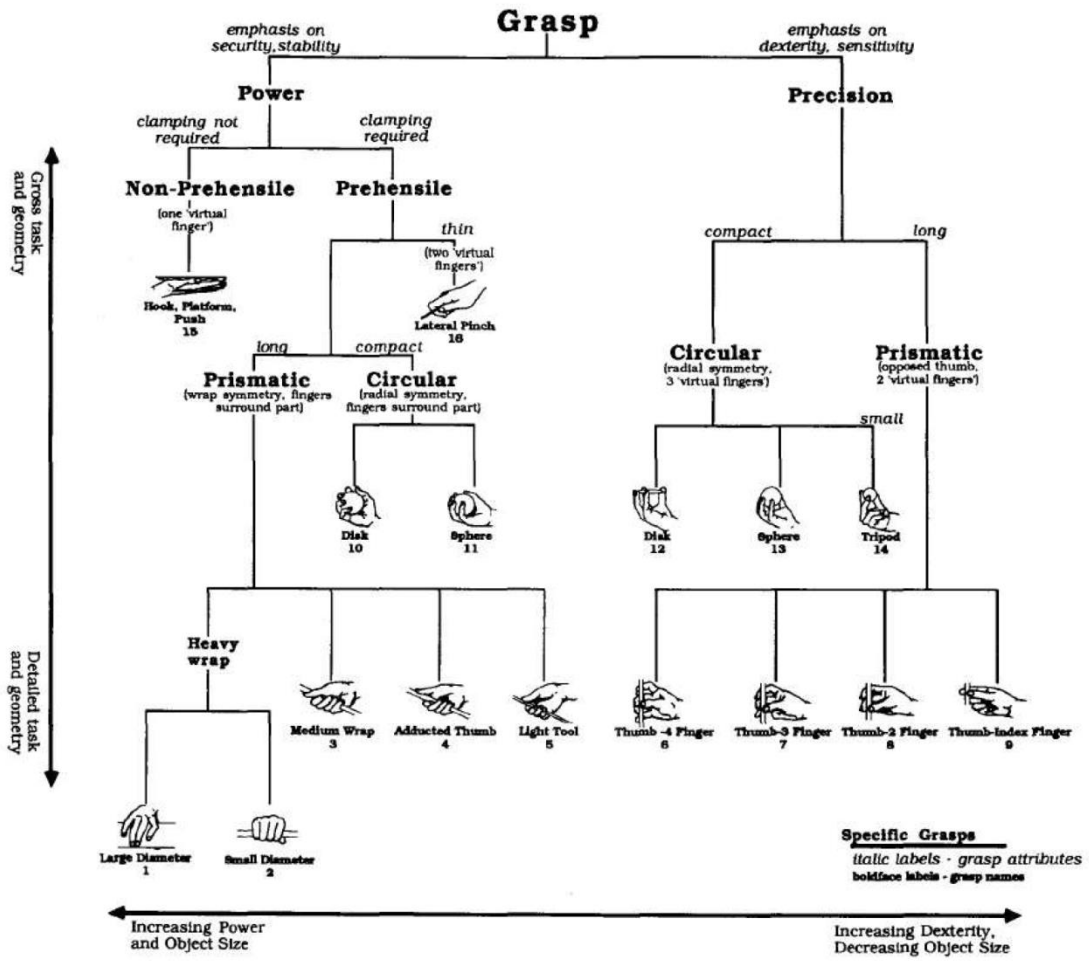
Benchmarking With Tools

Benchmarking Tasks

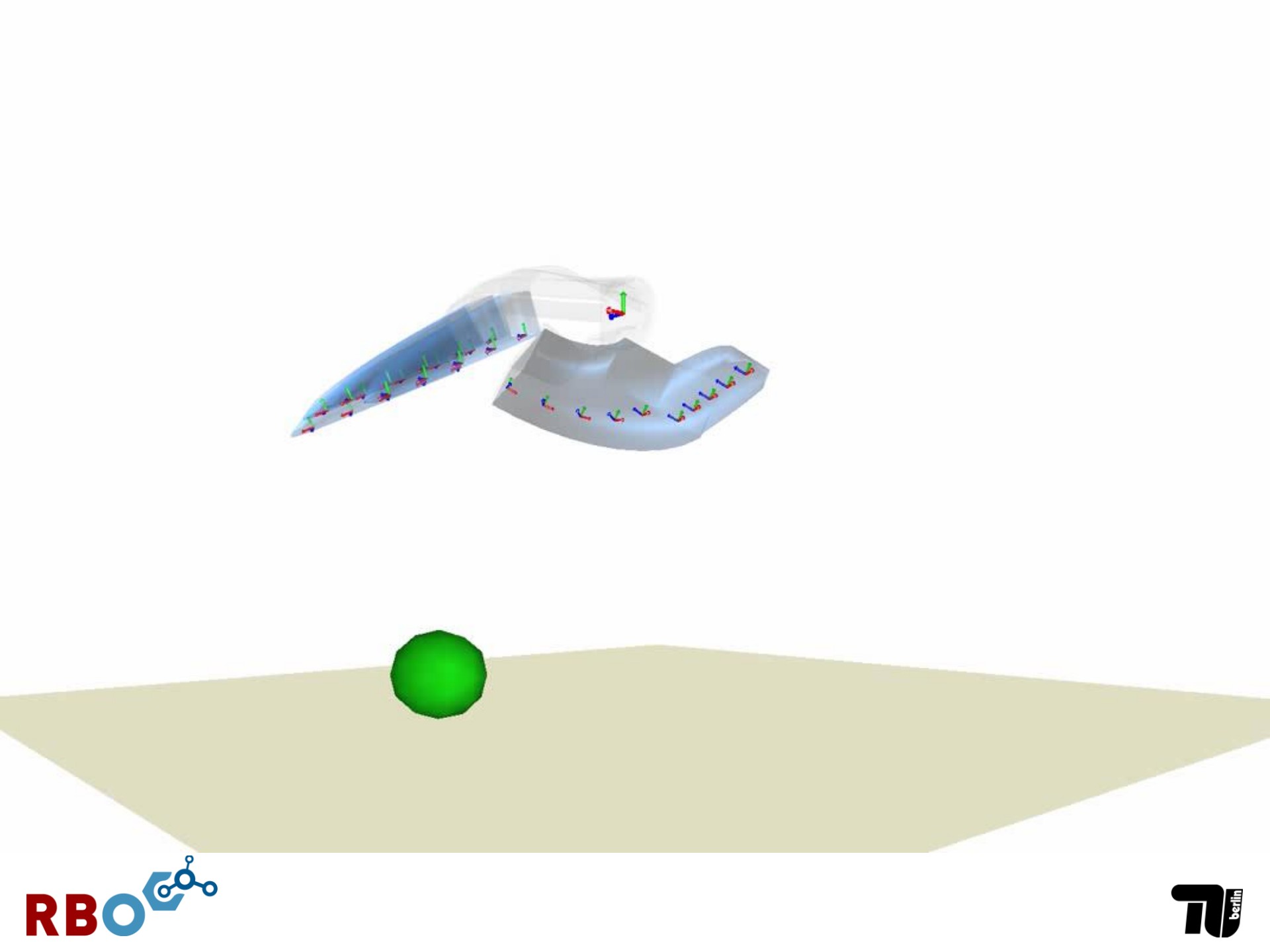
Curse of Interaction



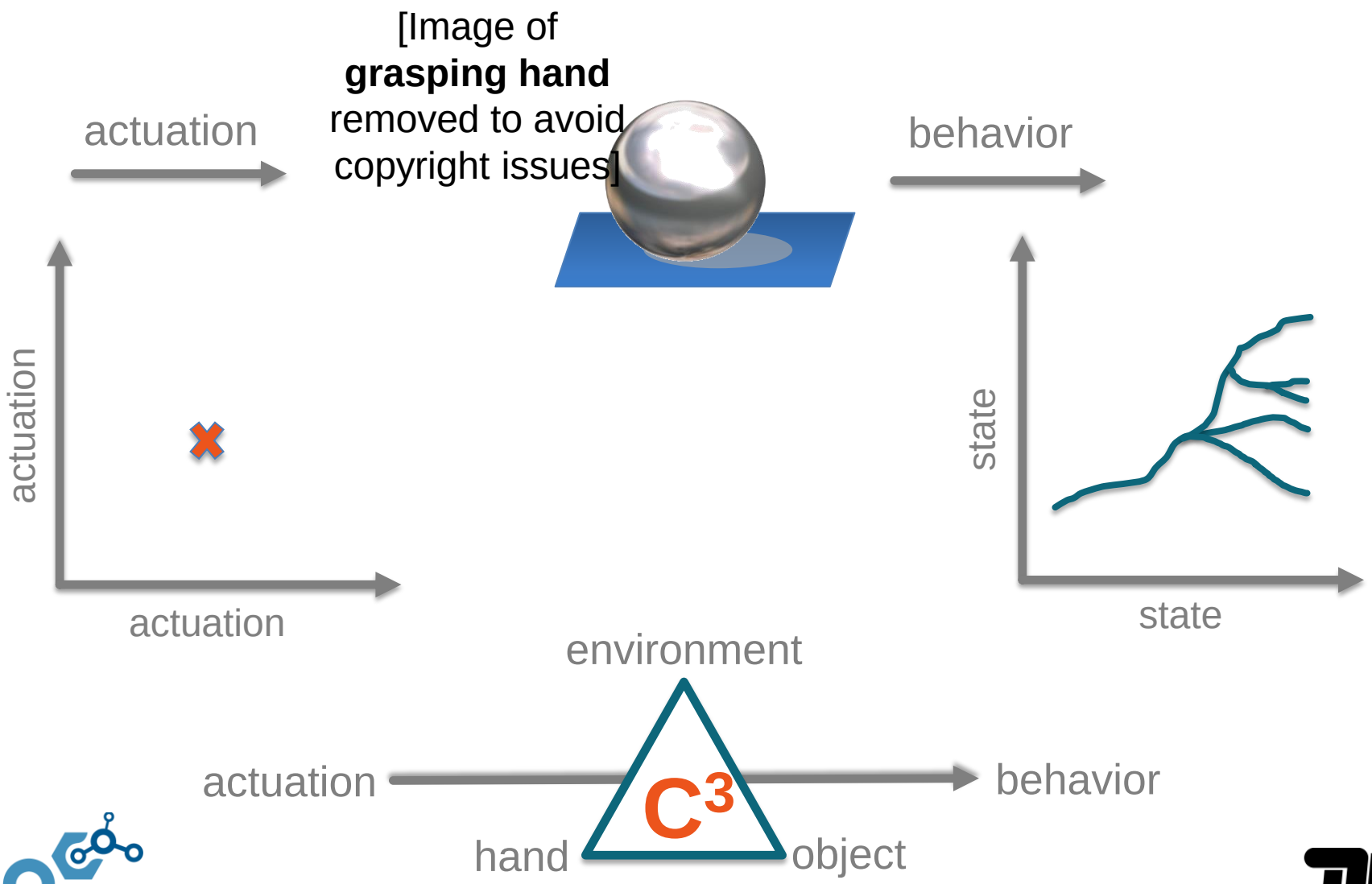
Grasp Taxonomies, Quality Metrics



[Cutkosky]

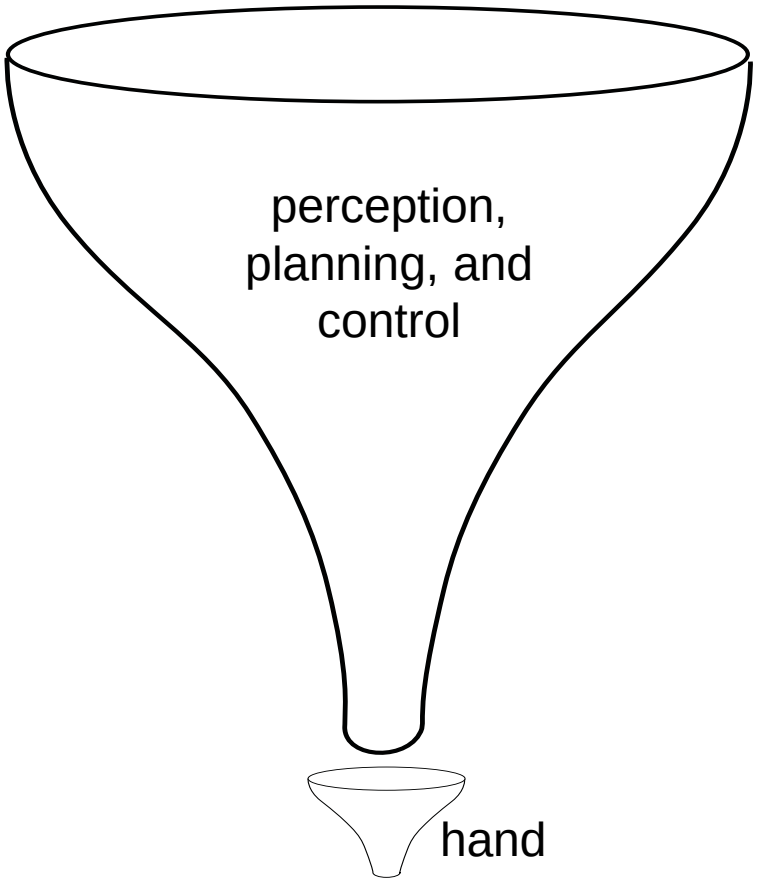


Effect of Actuation Differentiated Through ECs

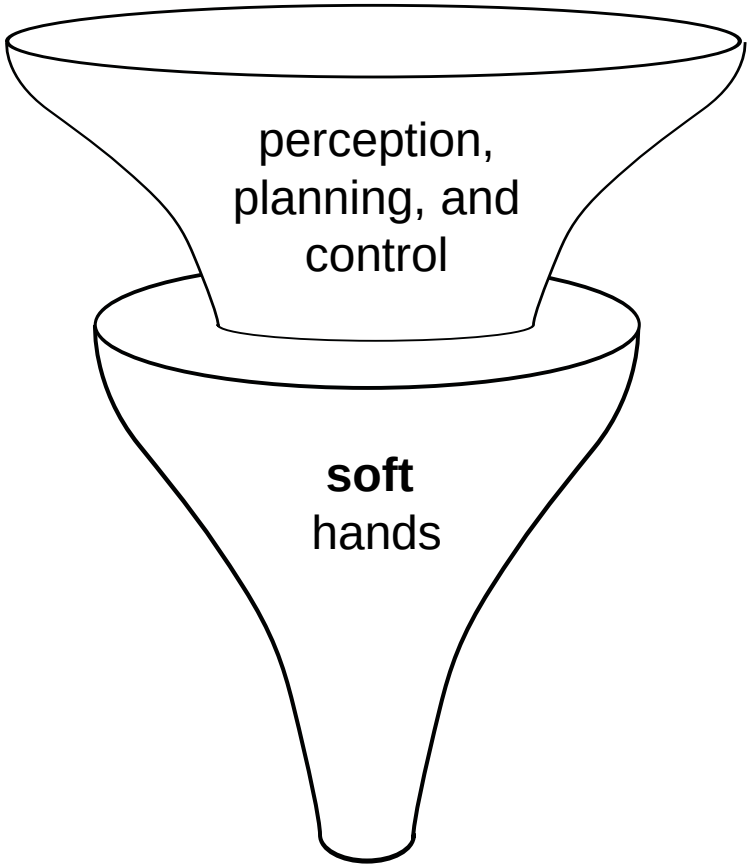


Soft Grasping and Soft Manipulation

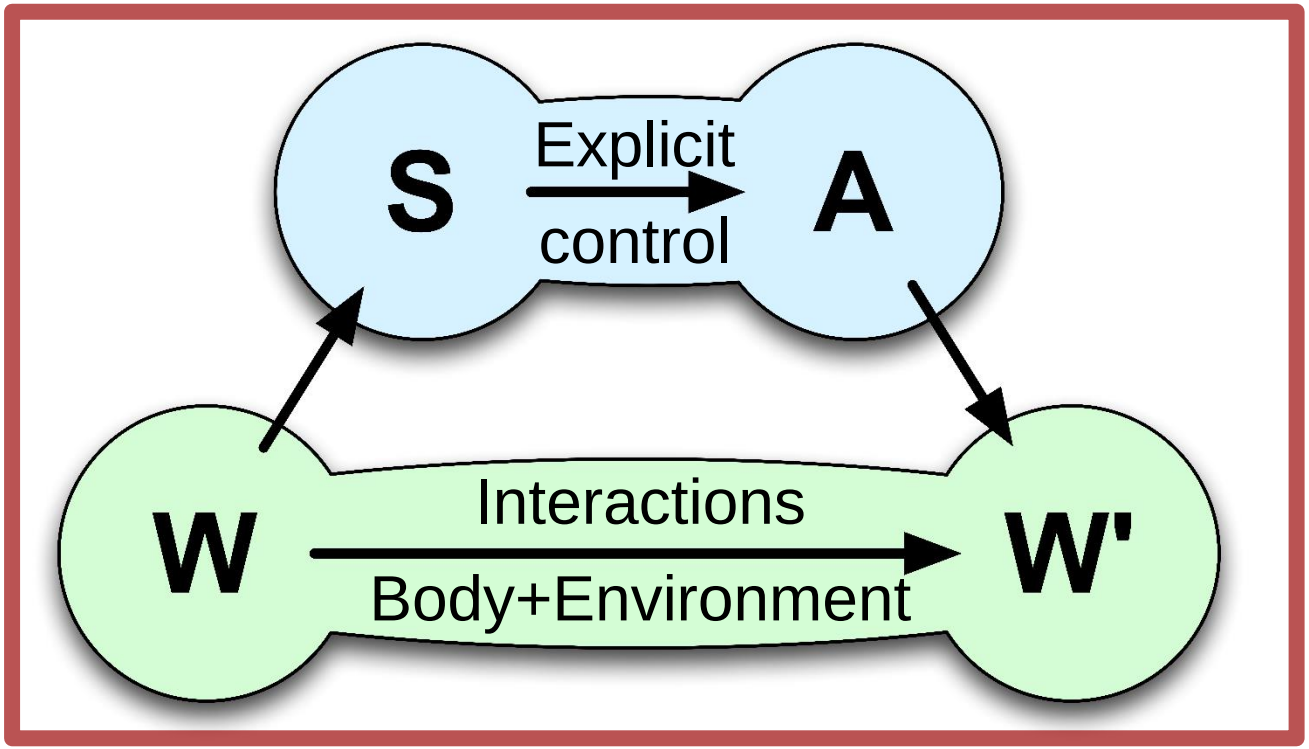
Little use of constraints = difficult?

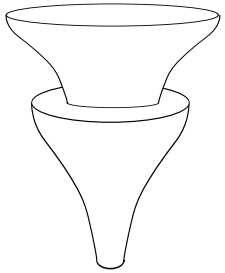


Extensive use of constraints = robust?



Measure of Morphological Computation [Pfeifer & Bongard 2006]

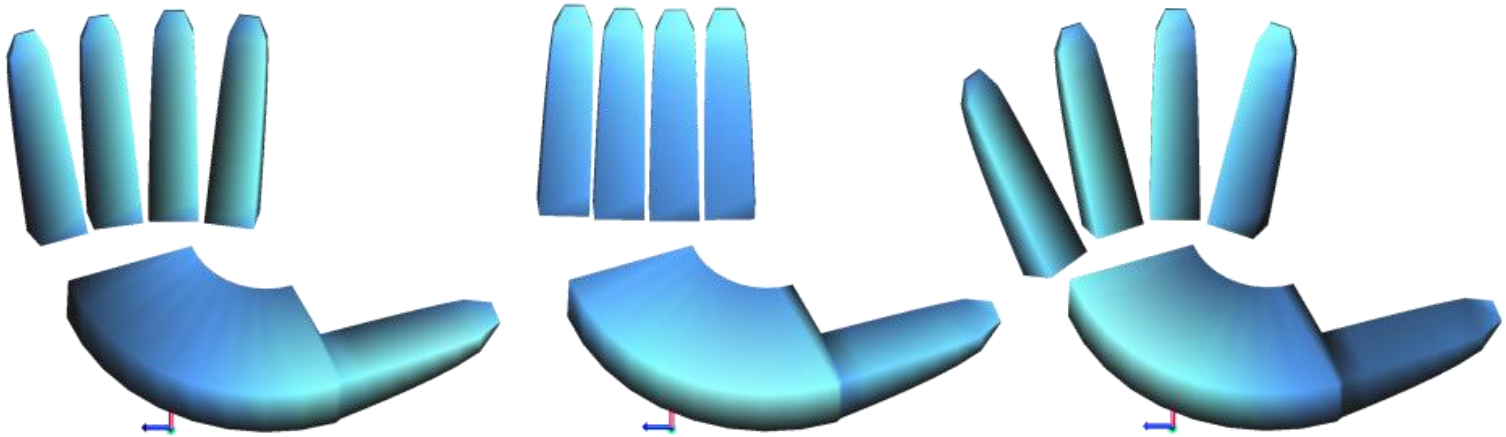


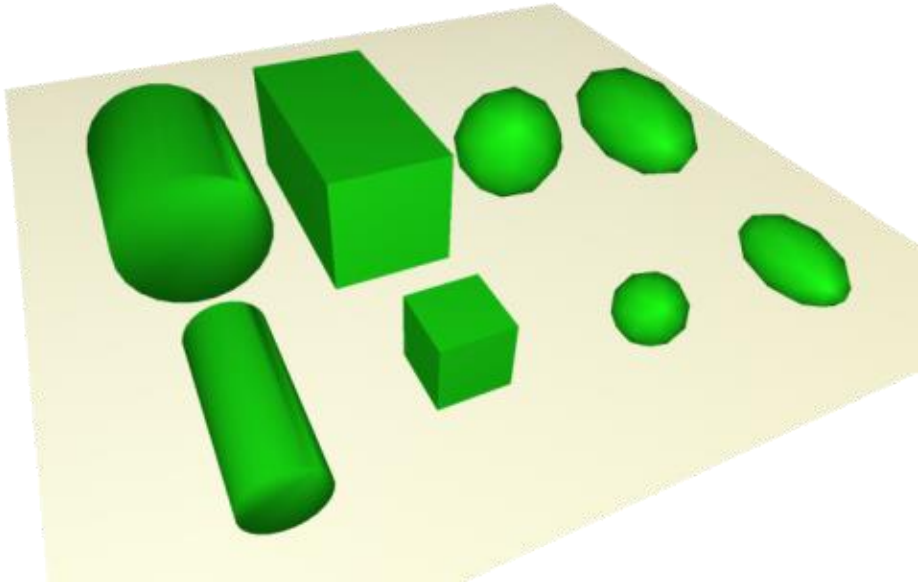


$$\mathrm{MC}_{\mathrm{MI}} = I(W';W) - I(A;S)$$

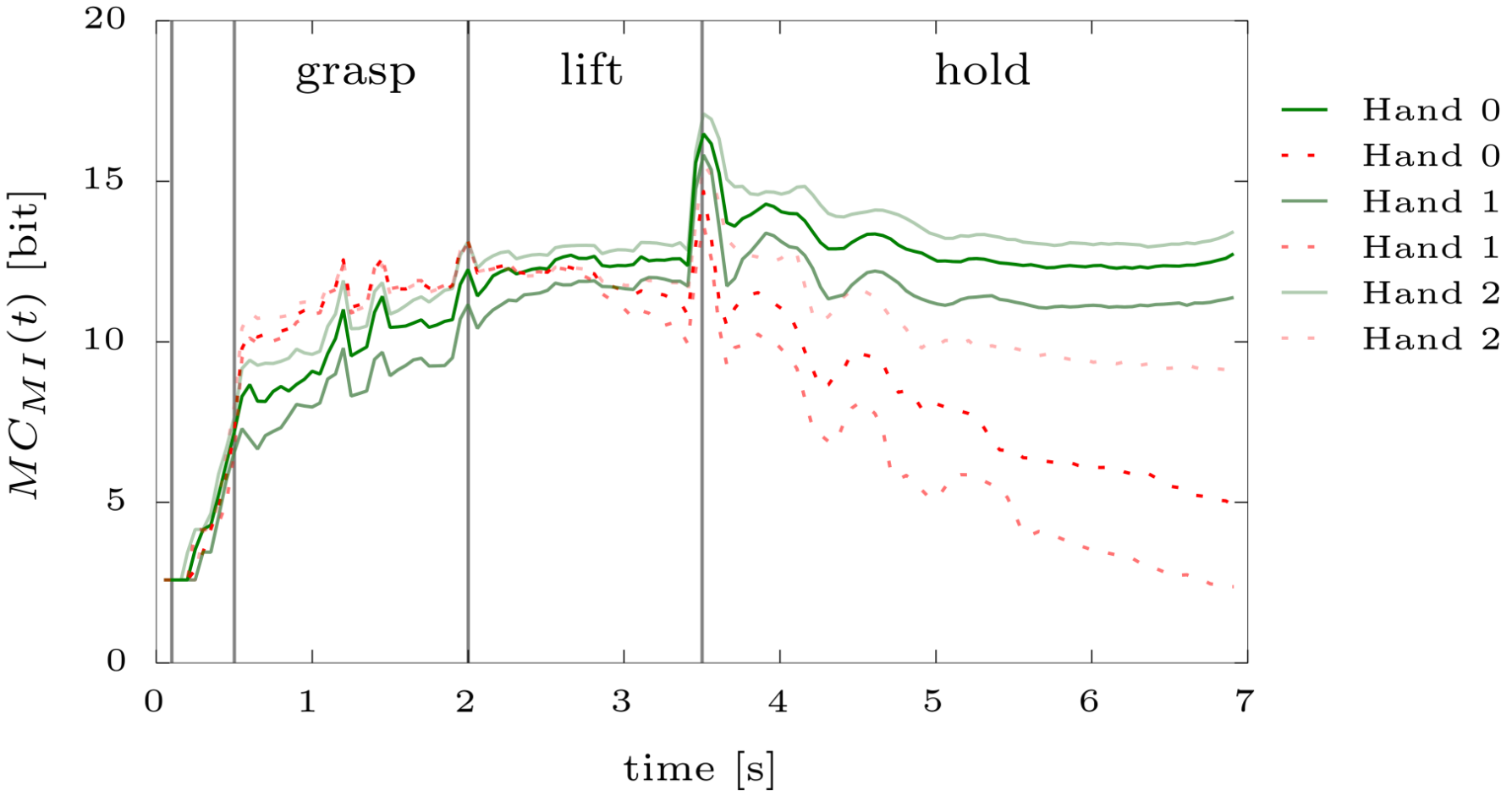
[Zahedi & Ay 2013]

Experiments

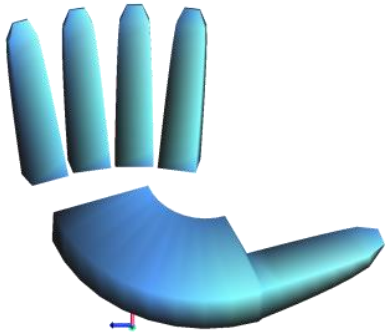


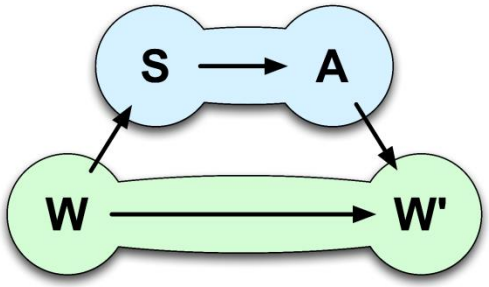


First Results with MC_{MI}



Benchmarking Morphological Computation





- MC reflects success/ effectiveness of ECE
- Explicitly includes control!
- Still depends on task, hand, objects, perception, planning
- Search for the most appropriate measure is on

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SOFT MANIPULATION
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