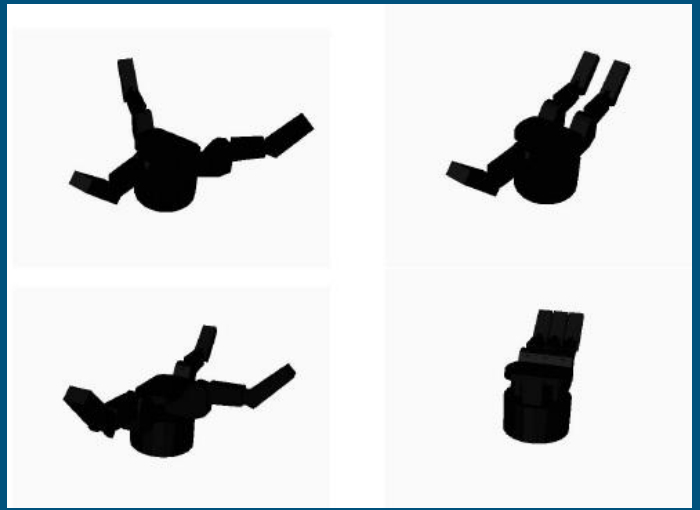
Grasping Objects from Visual Cues
Miller, Detry, Kootstra

Presentation by Malthe & Jerry

Grasping

- To pick up an object using a robotic hand
  - “Amputated”, so it only has two or three fingers



Grasping an unknown object

Human grasp intuitively

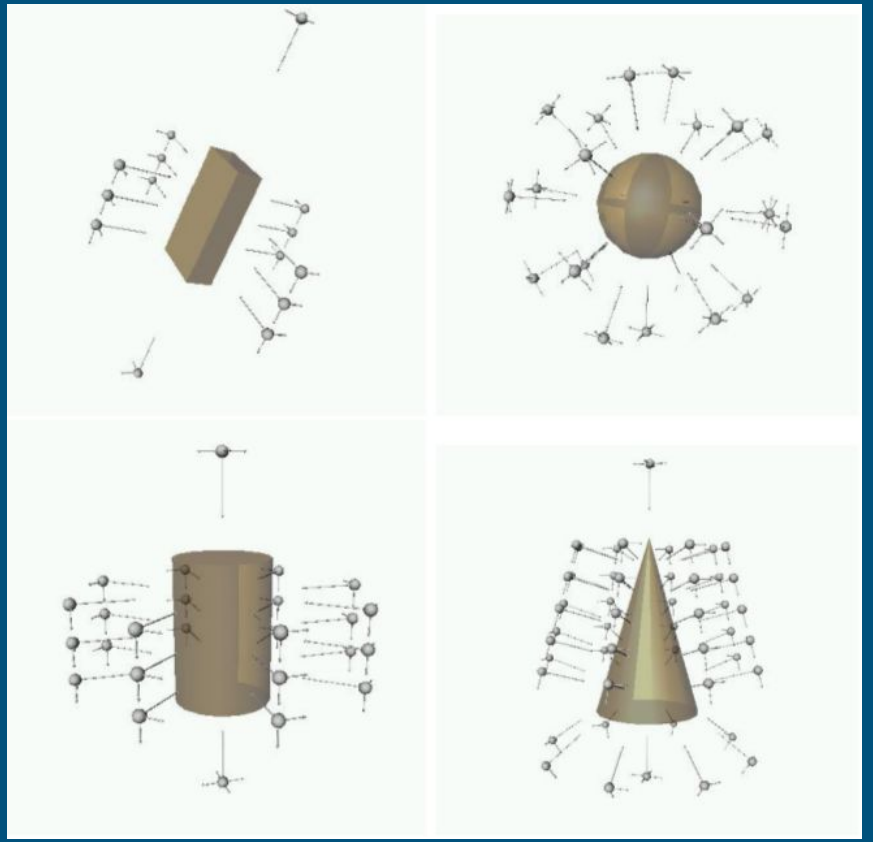
Robot uses simulator

Find the stable gesture

Shape primitives

Biedermann, 36 basic geons

Limited numbers of grasping gesture



Grasp Evaluation

Friction - lookup table

Collision

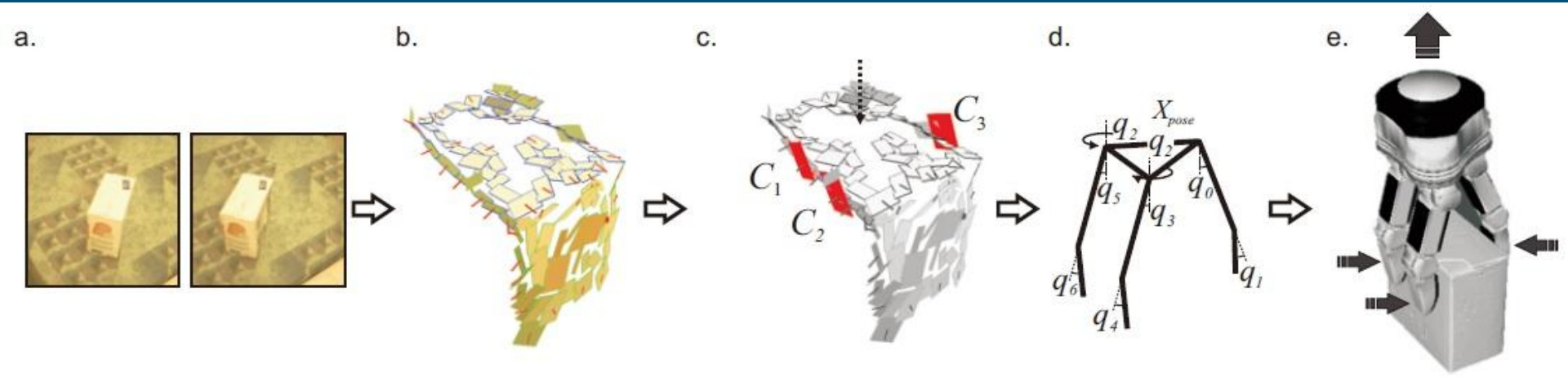
Size of the objects

	Tested grasps	Found F-C grasps	Time	Time / F-C grasp
mug	68	44	248 s	5.6 s
phone	52	35	120 s	3.4 s
flask	128	41	478 s	11.6 s
plane	88	19	200 s	10.5 s

Using edge and surface information

Instead of using primitive shapes

ECV - “Biological-motivated hierarchical vision system”

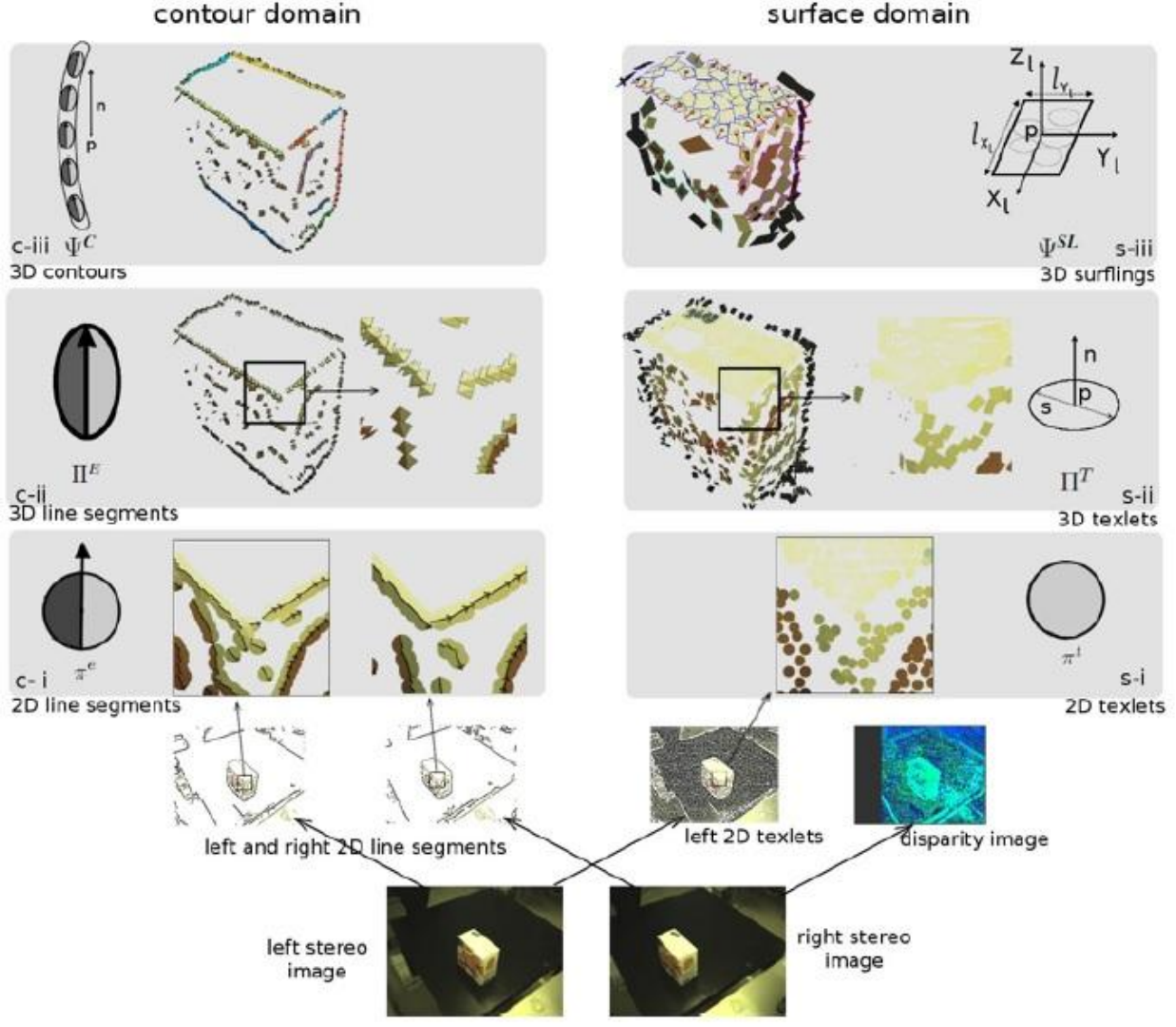


ECV system

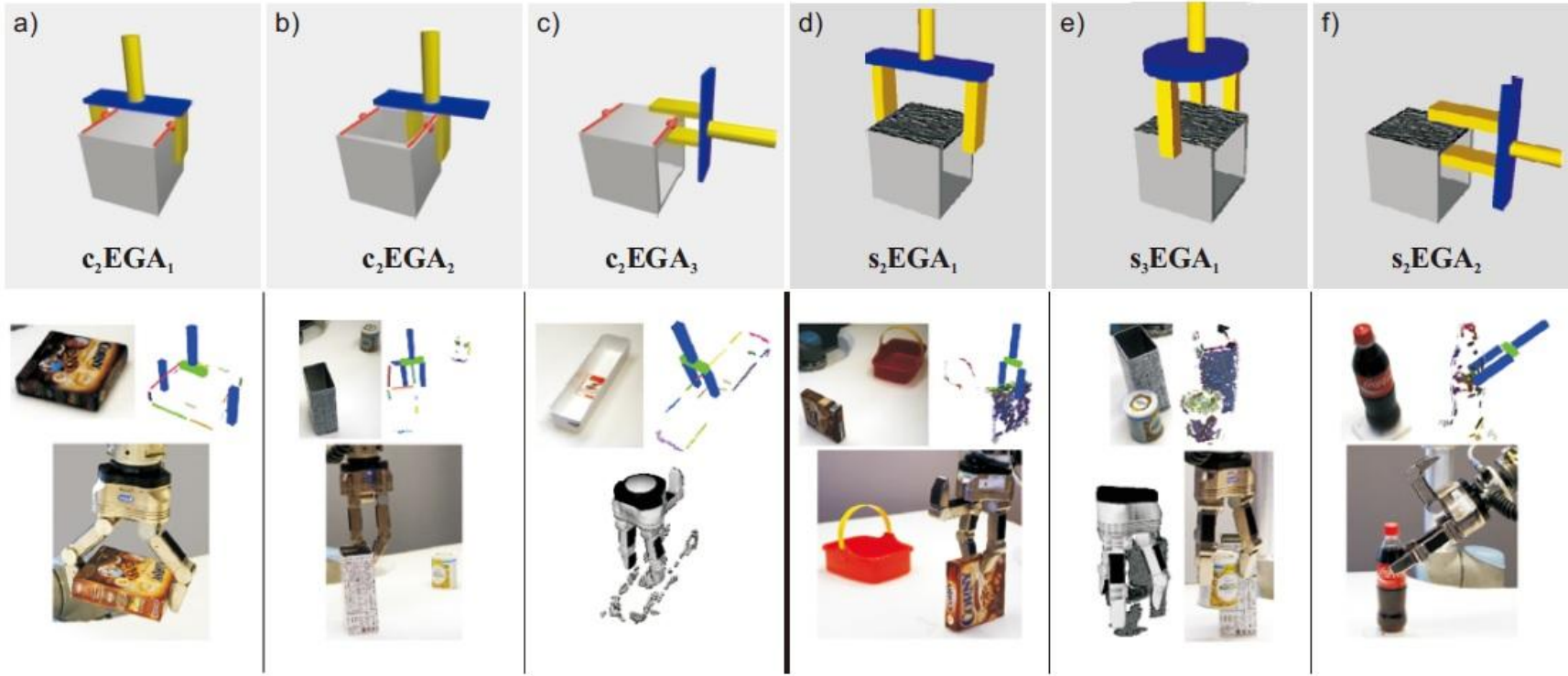
Hierarchical system

Contour detection

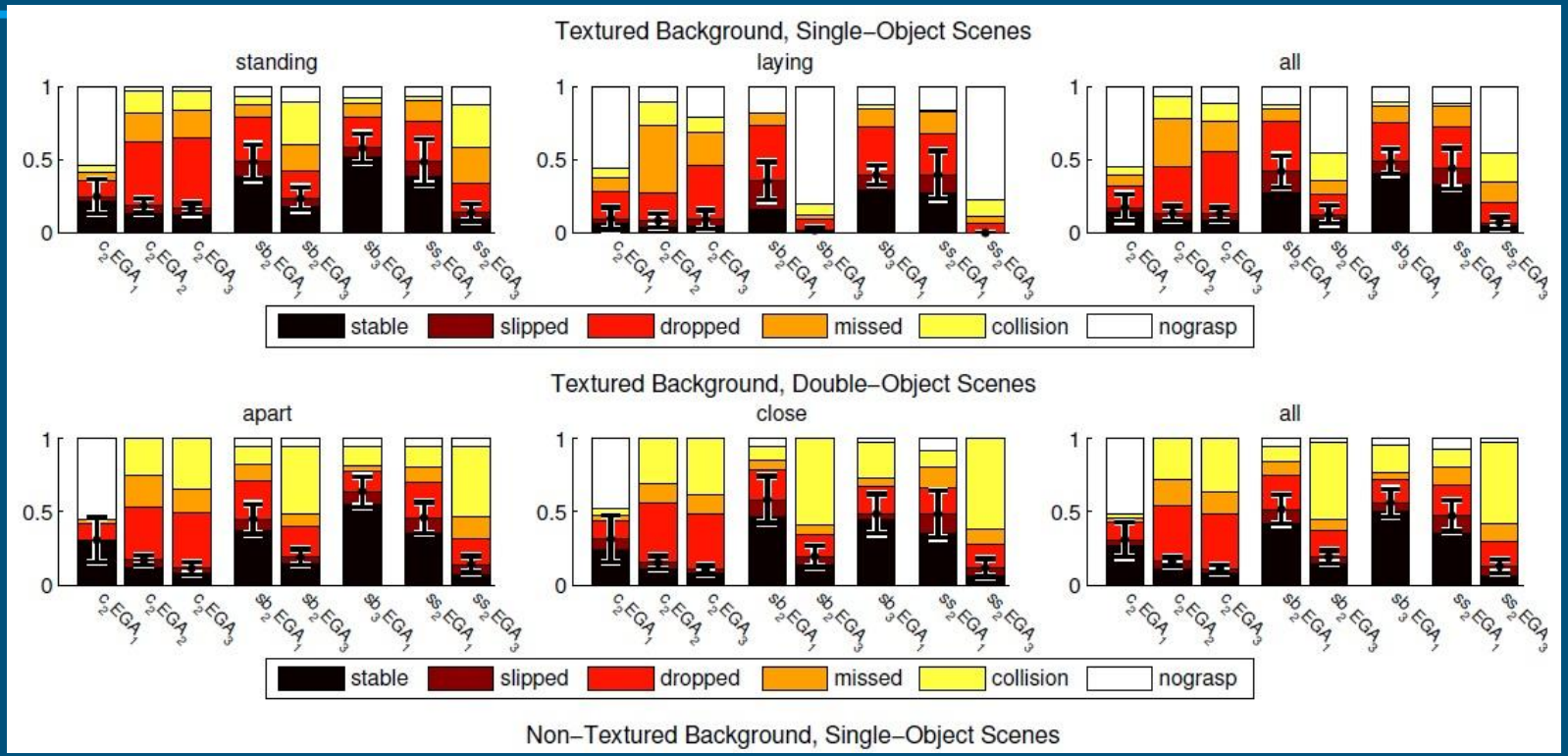
Surface detection



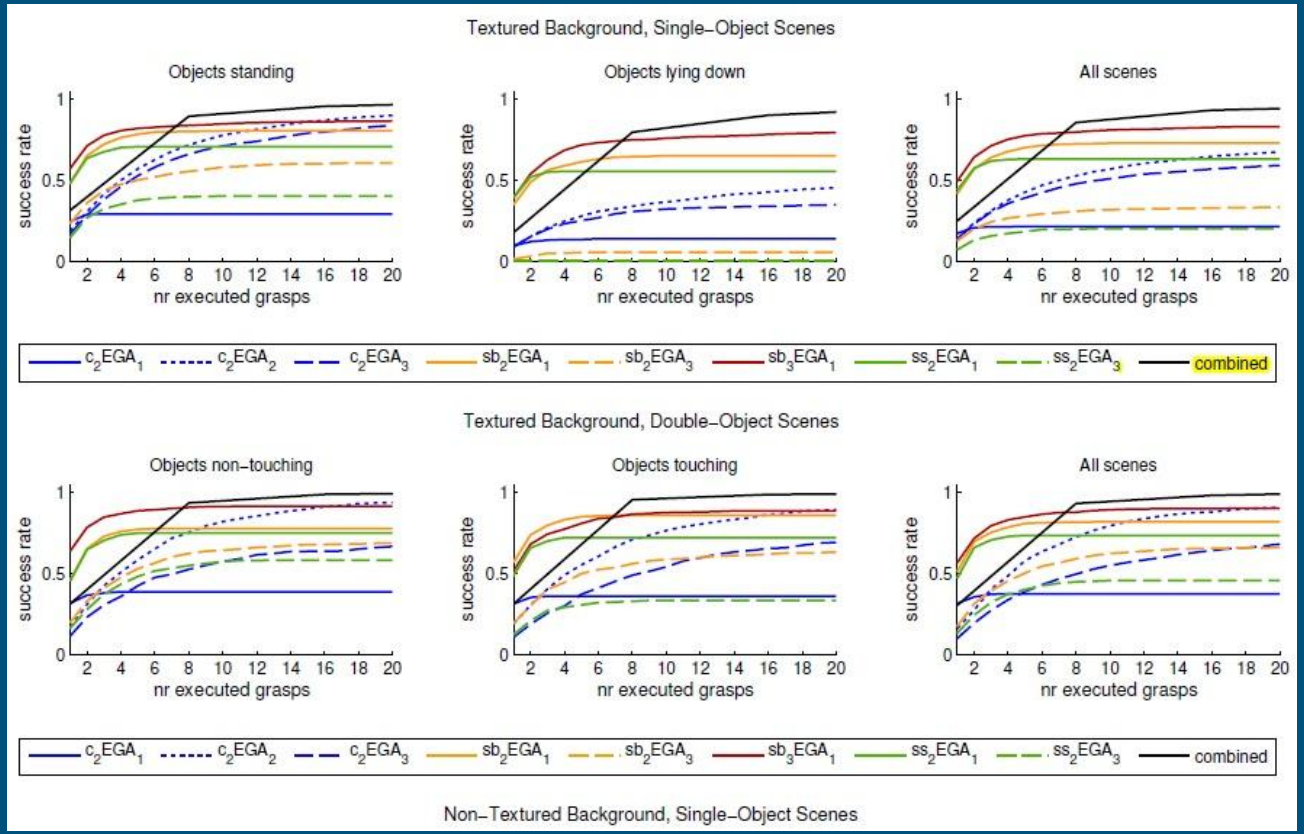
Elementary Grasping Actions



Experiment


Textured Background, Single–Object Scenes
standing
laying
all
1
0.5
0
stable
slipped
dropped
missed
collision
nograsp
Textured Background, Double–Object Scenes
apart
close
all
Non–Textured Background, Single–Object Scenes

Experiment

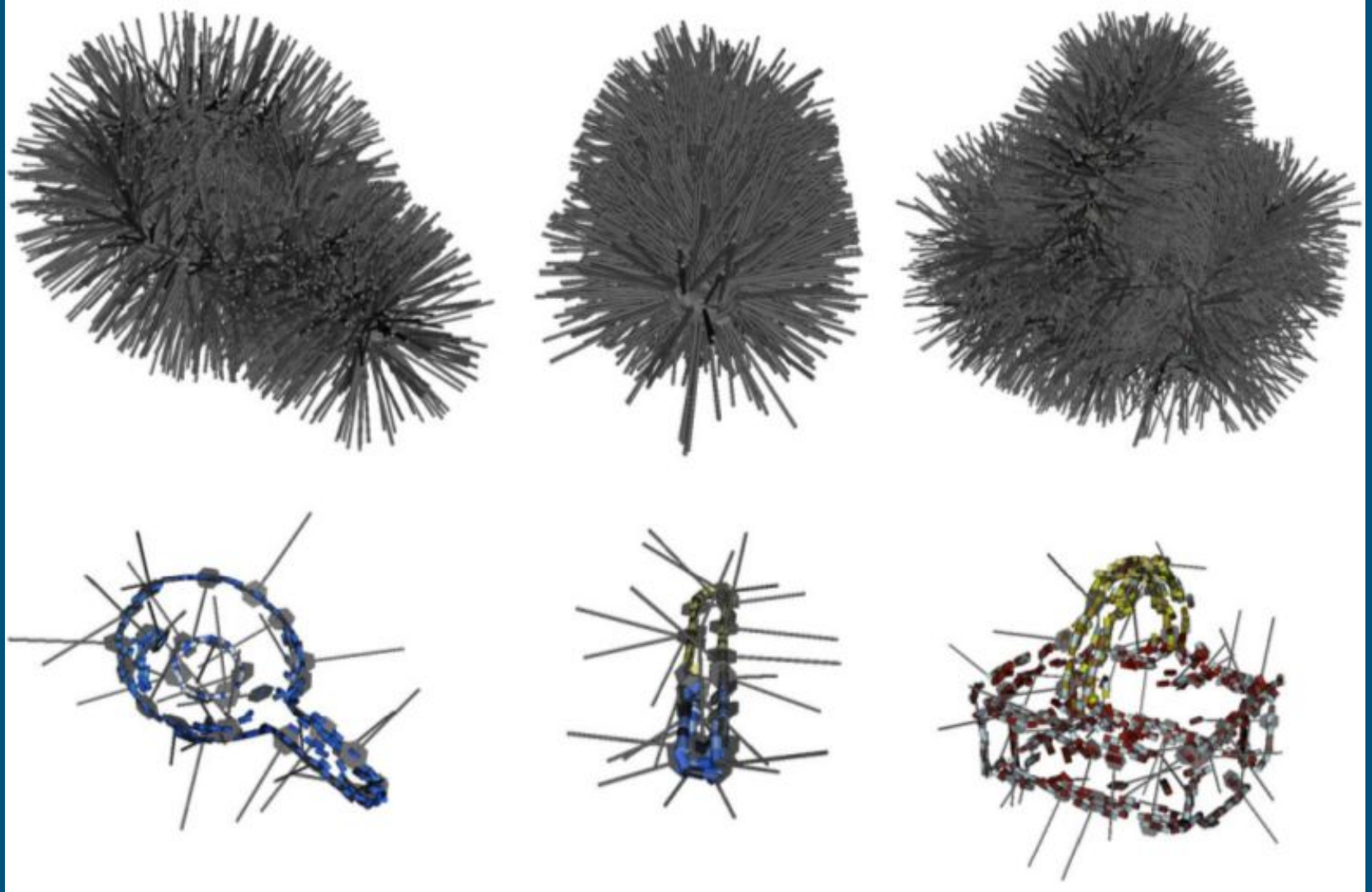

Textured Background, Single–Object Scenes
Objects standing
Objects lying down
All scenes
success rate
nr executed grasps
c2EGA1
c2EGA2
c2EGA3
sb2EGA1
sb2EGA3
sb3EGA1
ss2EGA1
ss2EGA3
combined
Textured Background, Double–Object Scenes
Objects non–touching
Objects touching
All scenes
Non–Textured Background, Single–Object Scenes

Detry et al

Autonomous learning experience

- Find, pick, (hold,) drop

Building Probability density



Pro

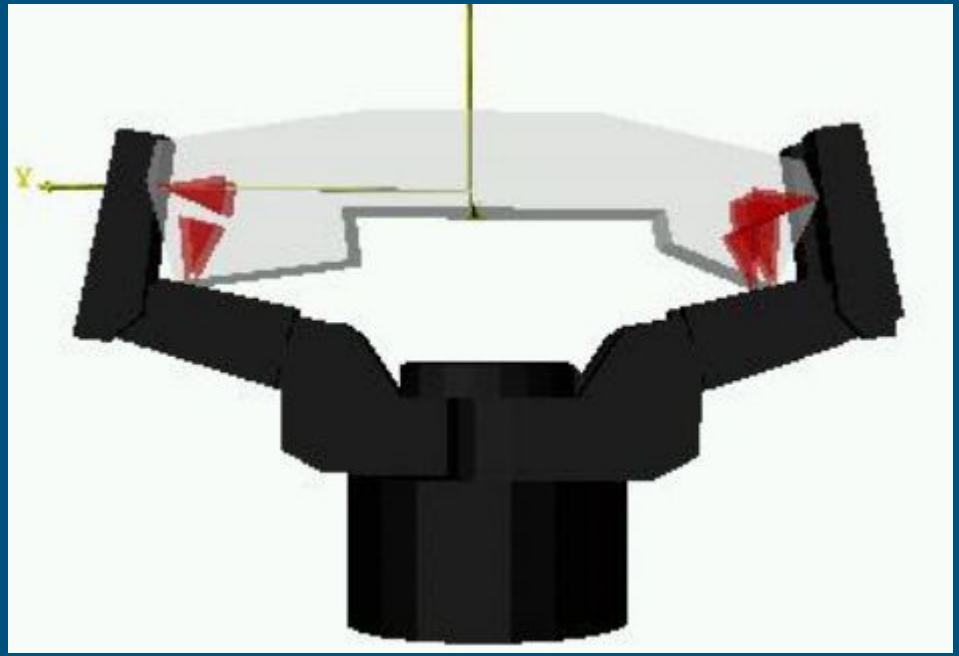
- “Any” object
- Can handle planar boundaries
- Statistics
- Object based; occlusion not a problem
- Can find unintuitive grasps
- Model fits robot morphology

Con

- Builds database - can’t be used for bin picking
- Takes long time to build DB
- Object based; objects which share parts need different models

Miller: Good grasp

Miller: Good grasp



Pro

- “Any” object
- Can be used by robot
  - Constrained environment

Con

- Slow to compute grasps
  - Not good for industry
- Doesn’t take obstacles into account when closing grasp
- Relies on DB of object

Comparison

	Miller	**Kootstra**	**Detry**
How does the system know how to grasp?	“Just knows”	Knows from the surface and edge information	Learns through repeated testing
Time constraint?	Need time to calculate the best gesture	Data processing, but optimised	It takes time to build database
Implementation possibilities?	Picking known objects	Picking unknown objects on a surface	Learning how to pick unknown objects