

***To be announced***

Georgi Stojanov

The American University of Paris

PROSECCO Network Meeting, Feb 21-23, El Escorial

# A Developmental Robotist walks into a Computational Creativity meeting...

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# Applying Computational Creativity Approaches to Developmental Robotics

Georgi Stojanov

The American University of Paris

[www.aup.edu](http://www.aup.edu)

# My research background

- Developmental robotics
- Computational models of the Piaget's notion of schema and stages
- Skill and knowledge transfer by analogy

# Overview

- What do **Developmental Roboticists** do?
- What do **Computational Creativity people** do?
- What **we have been trying to do?**
  - Bipin Indurkha, AGH University, Poland
  - Frank Guerin, Aberdeen University, Scotland
  - Claudia Roda, The American University of Paris
  - Blerim Mustafa, University of Skopje, Macedonia
- How?

February 16 – 21, 2014, Dagstuhl Seminar 14081

# Robots Learning from Experiences

## Organizers

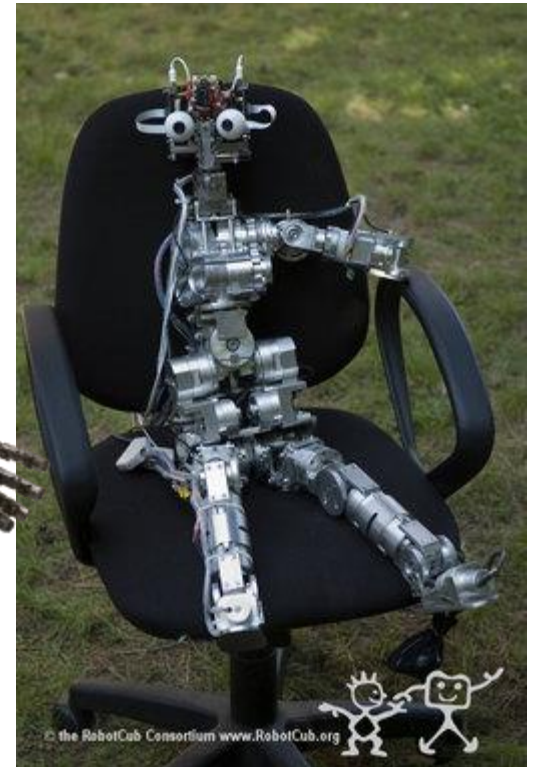
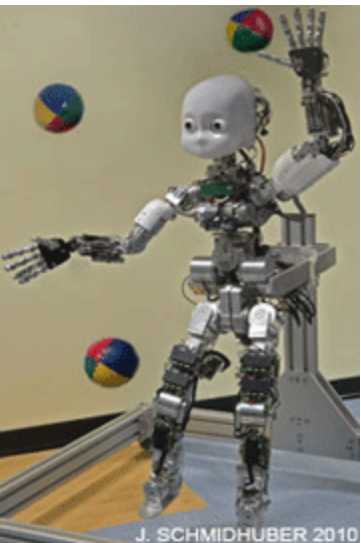
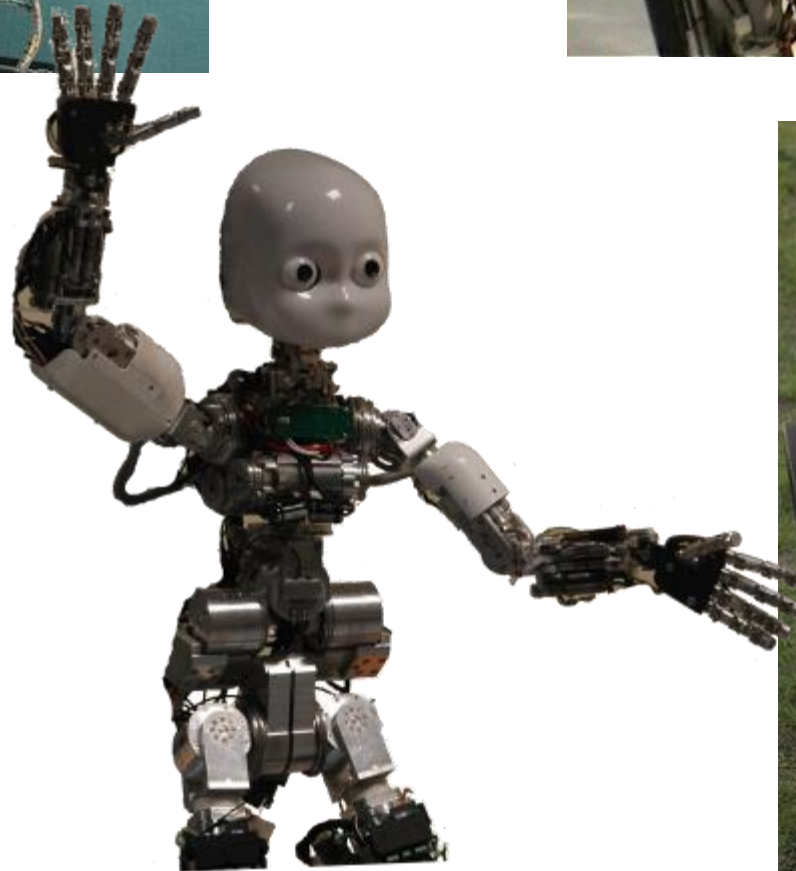
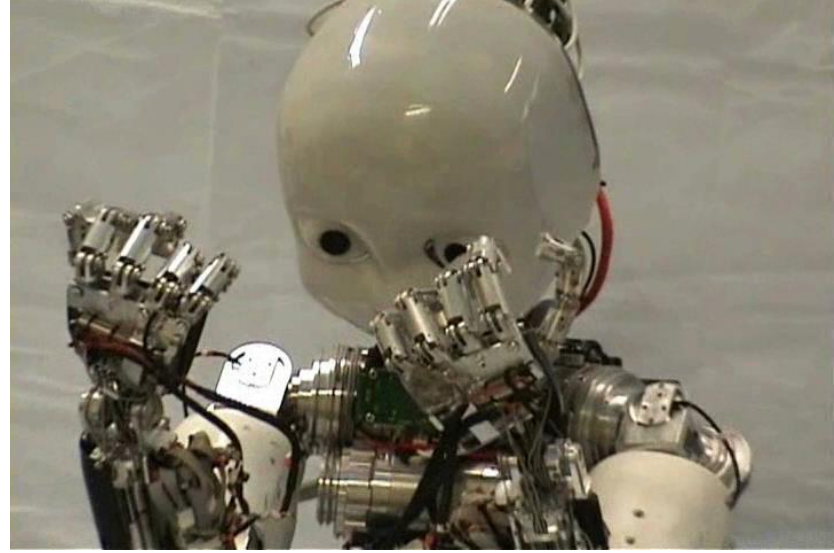
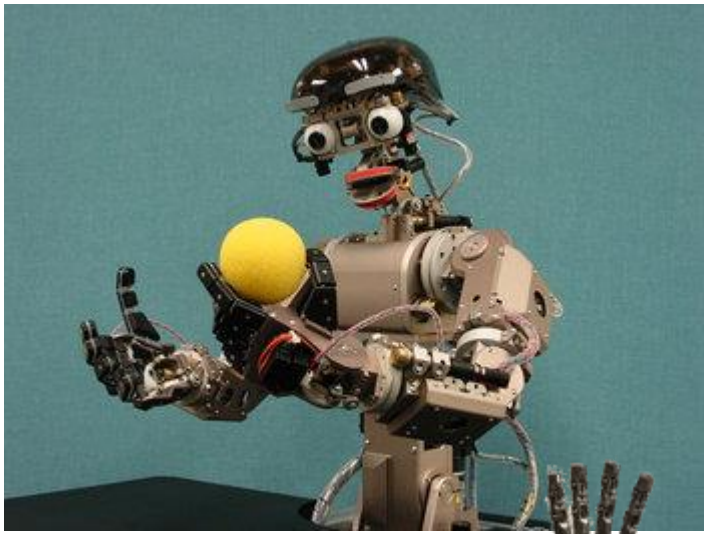
**Anthony G. Cohn** (University of Leeds, GB)

**Bernd Neumann** (Universität Hamburg, DE)

**Alessandro Saffiotti** (University of Örebro, SE)

**Markus Vincze** (TU Wien, AT)

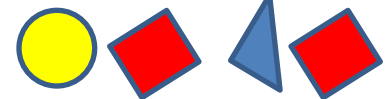
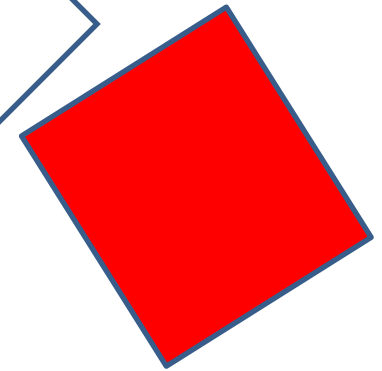
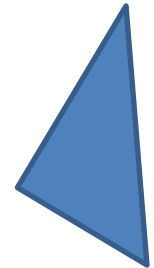
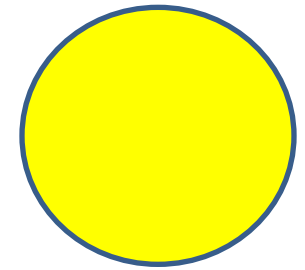




# Robotics approach

Sensory-motor interactions leading to stable clusters of experiences

Abstraction leading to crispy symbols suitable for manipulation





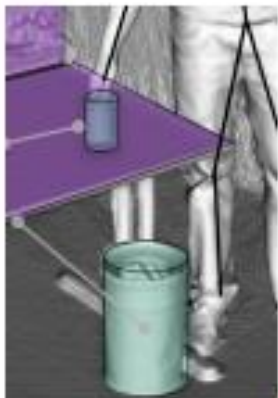
**Chair category**  
pre-trained from web or  
user data



Is this also a  
chair?



User requirements from  
**application partners**



What is this category?  
Is it relevant?

**Proposed proto-category**  
encountered at run time

# Learning and tracking objects

## Learning, Recognising and Tracking Instances

- Obtain stable tracks of tens of seconds of objects taking part in activities
- Segment, aided by **attention** from person-centric work space
- *Challenges:*
  - Long term occlusions by people
  - What objects should be learned?



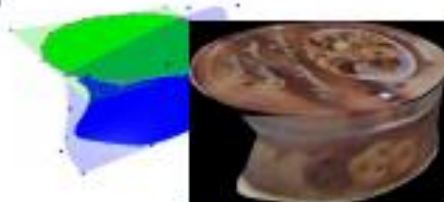
Track



Recognise



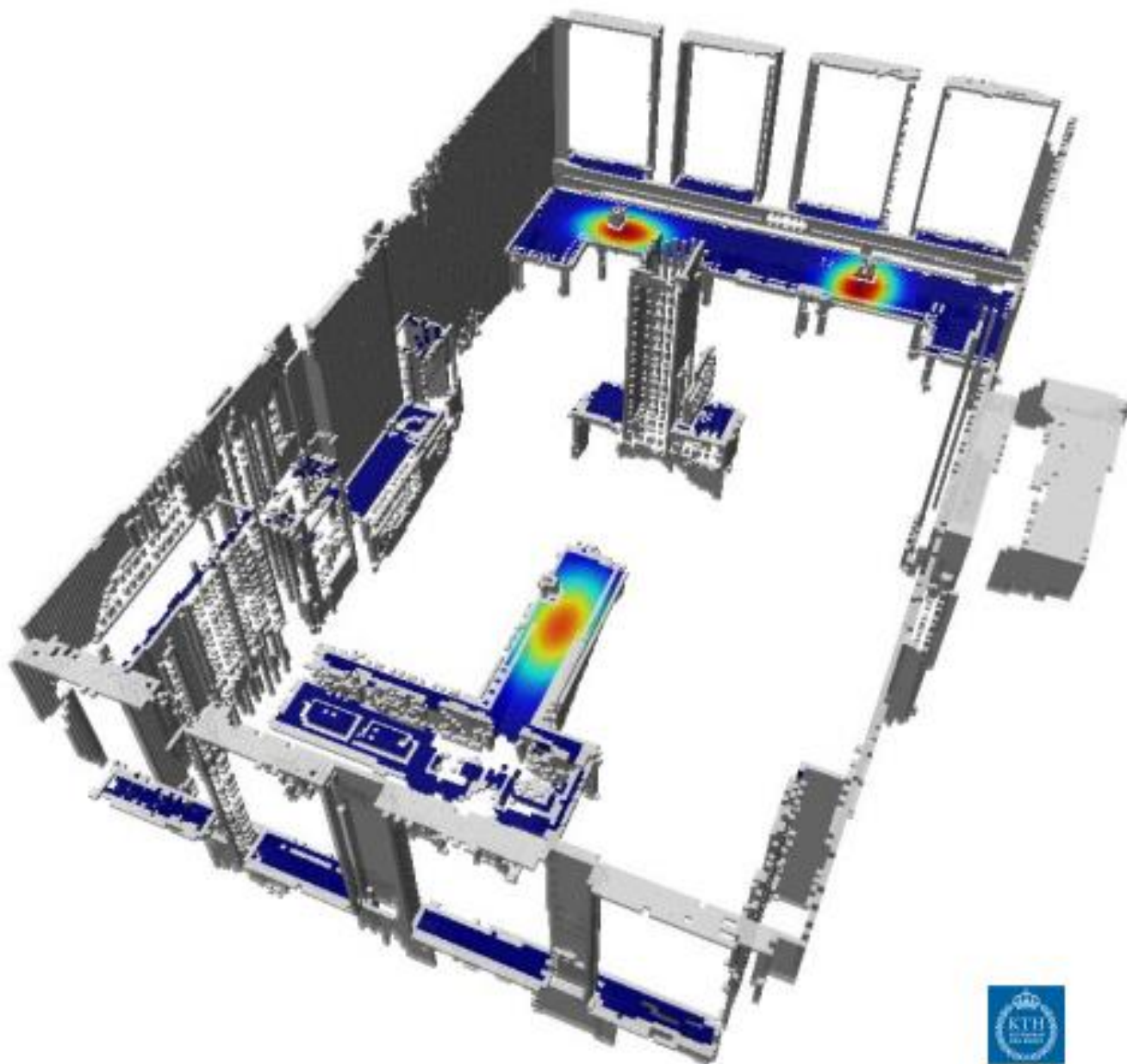
Segment



Model



# Typical object locations

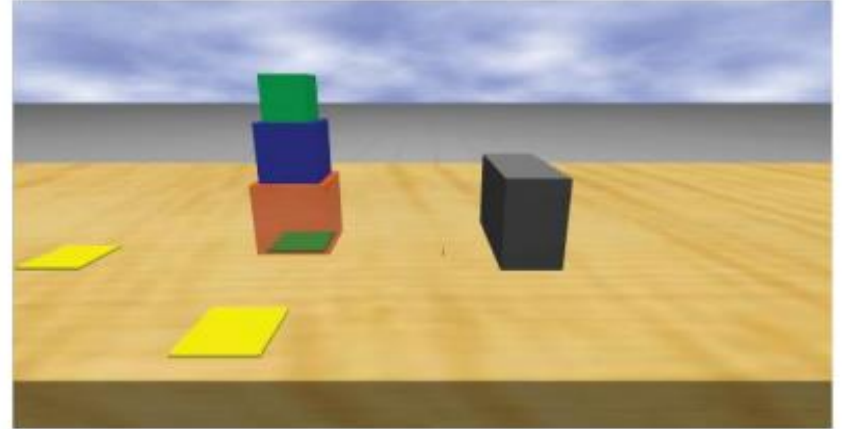
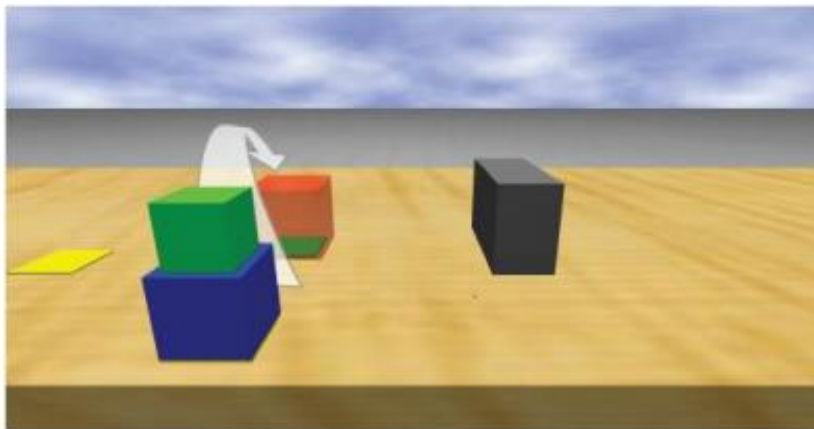
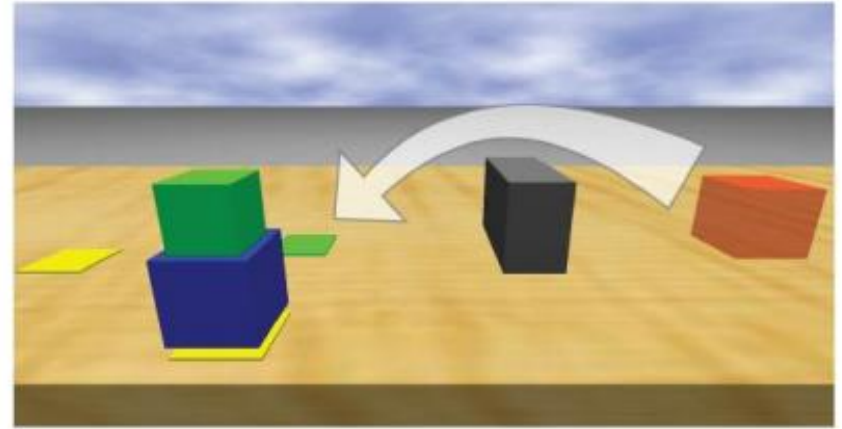
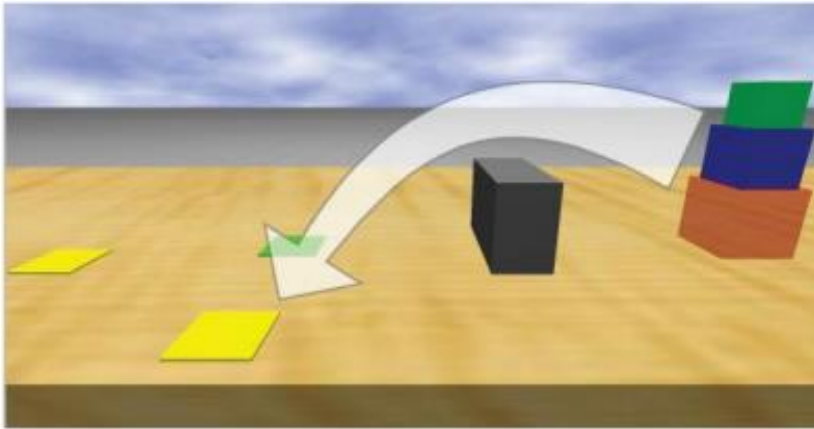


# Robotics approach

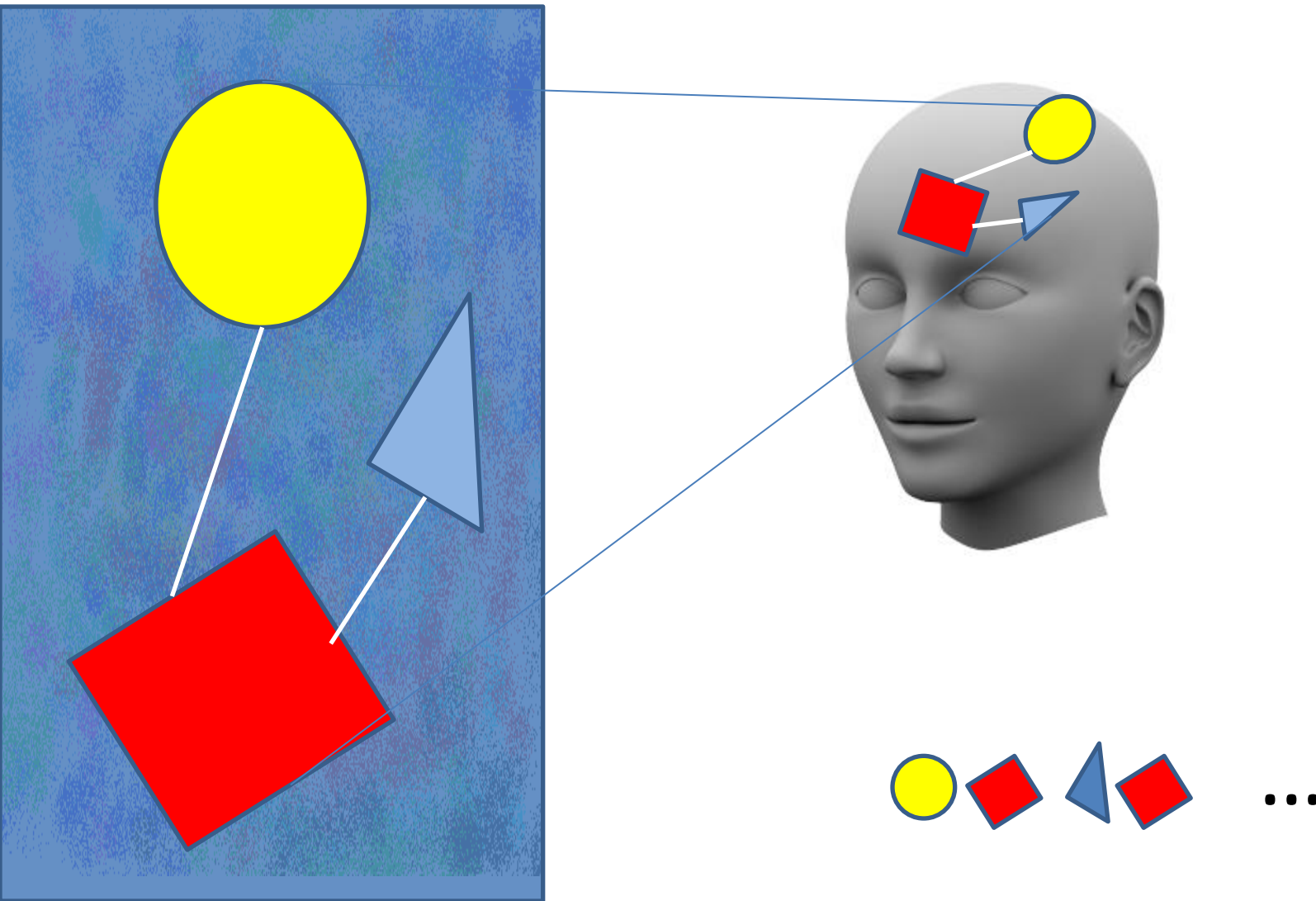
- Heavily biased towards looking for structure in the sensory-motor flux
- Very expensive computationally, because of the high dimensionality of sensory-motor space
- Poor collection of innate structures and/or biases
- Modest results so far

# Box Stacking Scenario

- Task: Move stack to green location
- At most two boxes can be lifted together



The long term goal is human-like perception of the environment in terms of these conventional/stereotypical symbols/concepts

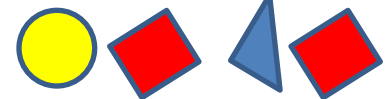
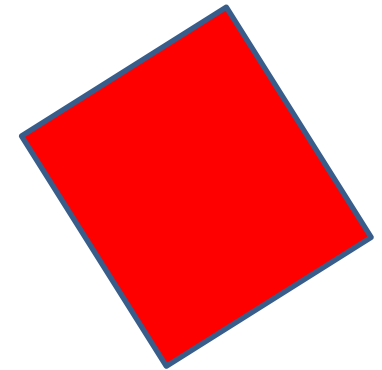
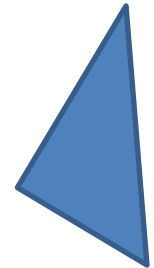
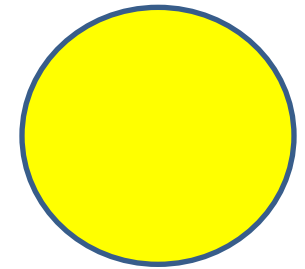


How?

# Projection mechanism

Starting with a rich vocabulary of innate structures and imposing this on the sensory input

Associating those structures with low-level sensory-motor flux





# How?

- [Demo 1](#) (Copyright (c) 1999 Takeo Igarashi)
- [Demo 2](#) (Tao Chen · Zhe Zhu · Ariel Shamir · Shi-Min Hu · Daniel Cohen-Or, SIGGRAPH Asia, 2013)

# The big assumptions

- **creative thinking and creative behavior** are integral part of **typical human cognitive development**
- by **exploring creative behavior** we might be able to **learn something about early cognitive development**
- conversely: by looking into the **early stages of this development**, we can learn more about creativity
- furthermore, we see **projection/(analogy?)** as a **core mechanism** in human cognitive development **rather than a special skill among many**

# Focus on P-creativity

- Many of the components considered relevant for creativity can be observed or develop during ontogenetic development:
    - Curiosity
    - Pretense play
    - Cognitive fluidity (functional fluidity vs functional fixedness)
    - Imitation
- These are universal across any human culture

