

# An update on motor control through SVS

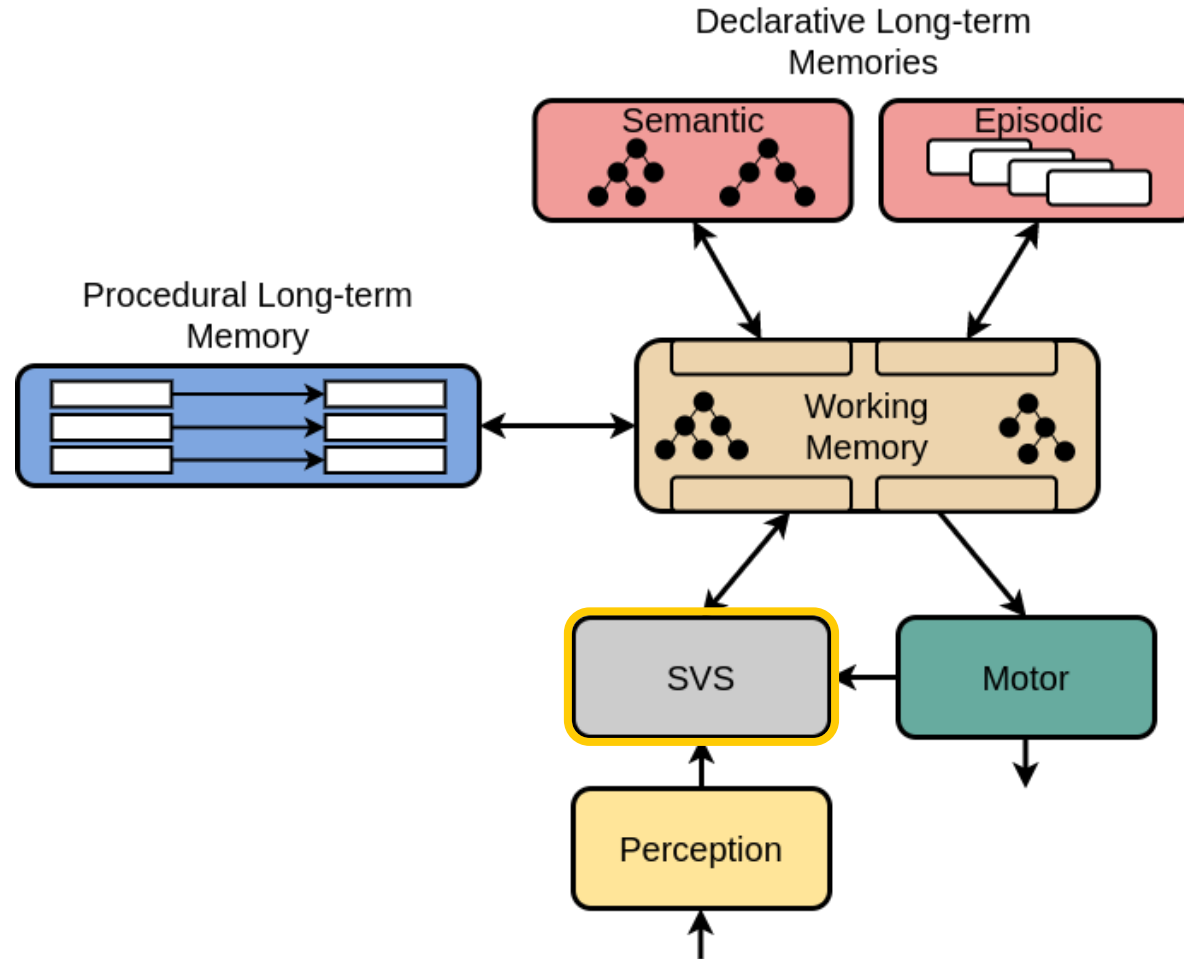
Lizzie Goeddel

Soar Workshop • June 14, 2021

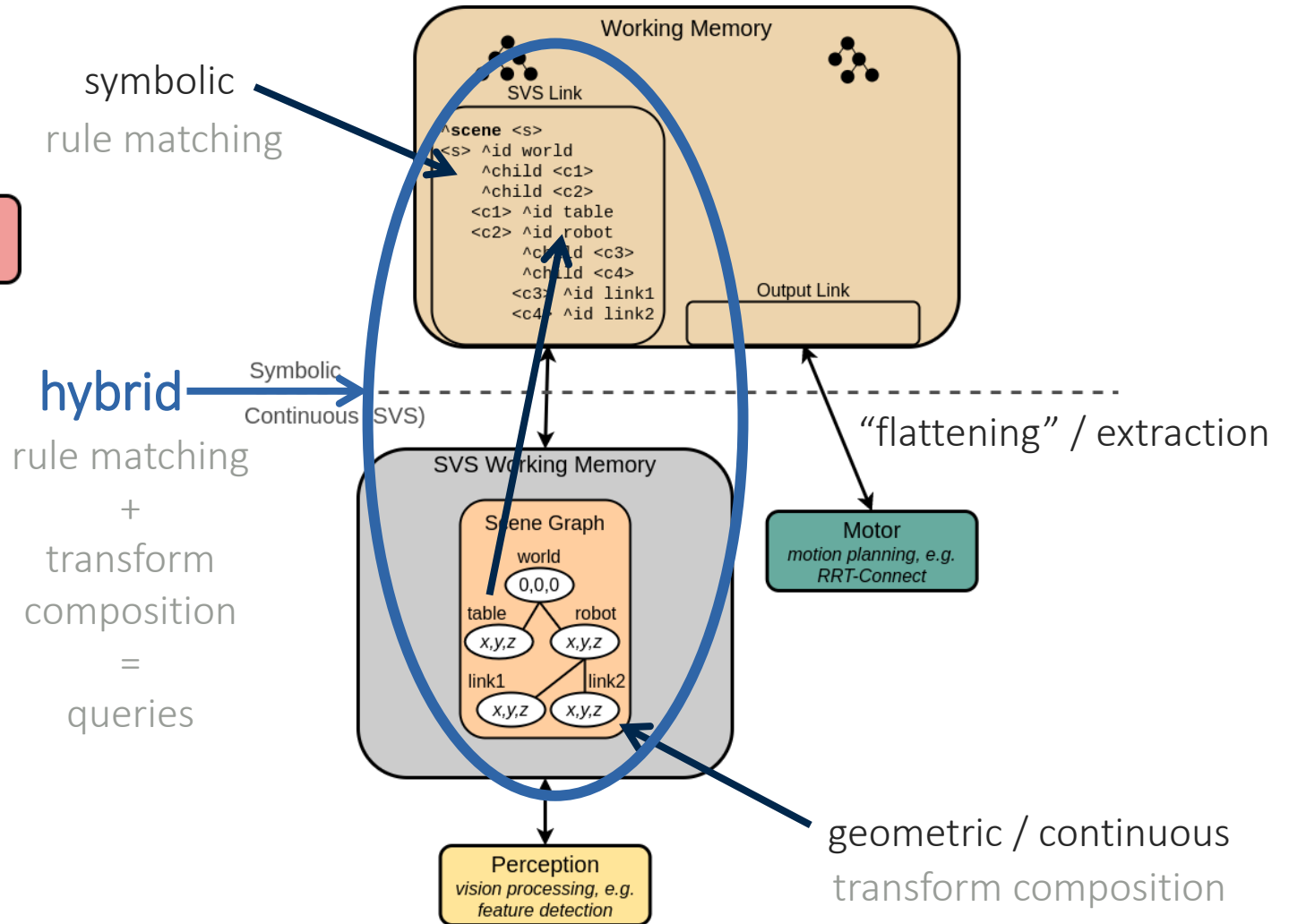
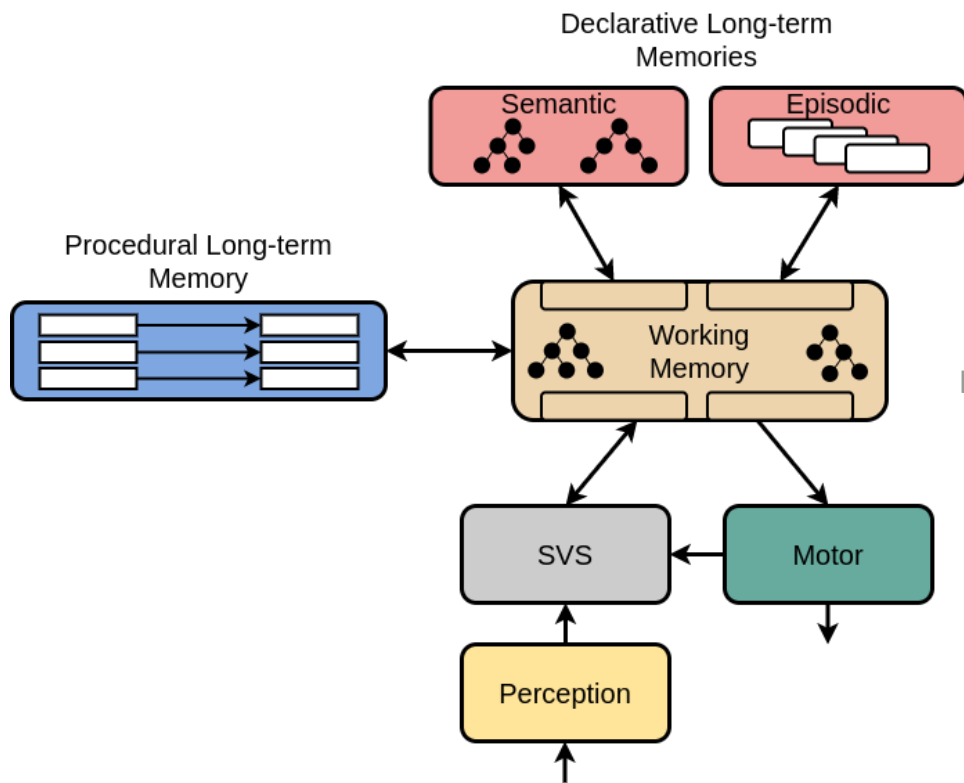
# Talk roadmap

1. **SVS background**
  - Theoretical purpose
  - Current place in the architecture
2. **Goals for motor in SVS**
  - Parity with perception
  - Hybrid representations
3. **Plans and progress**
4. **Nuggets and coal**

# Soar's Spatial and Visual System (SVS)



# SVS today

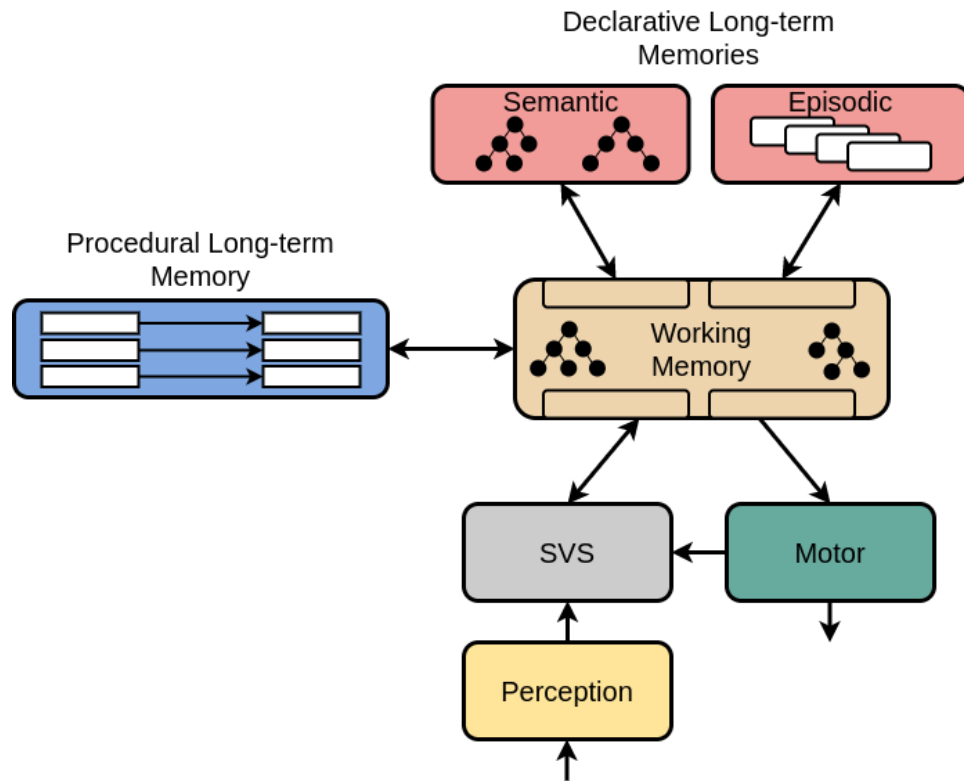


# Some history

“SVS sits between symbolic processing in Soar and the world.”

– Wintermute 2009

# SVS today

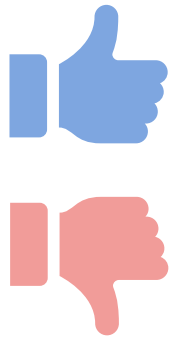


Not symmetrical!

SVS only “sits between” perception and WM

Perceptual object representation is hybrid

Action representation is purely symbolic



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# Motor application

Geometric information means **trajectories**

- Fully-specified robot path

- Executable given motors and controllers

Fetch mobile manipulator

- Navigation domain is 3 DOF

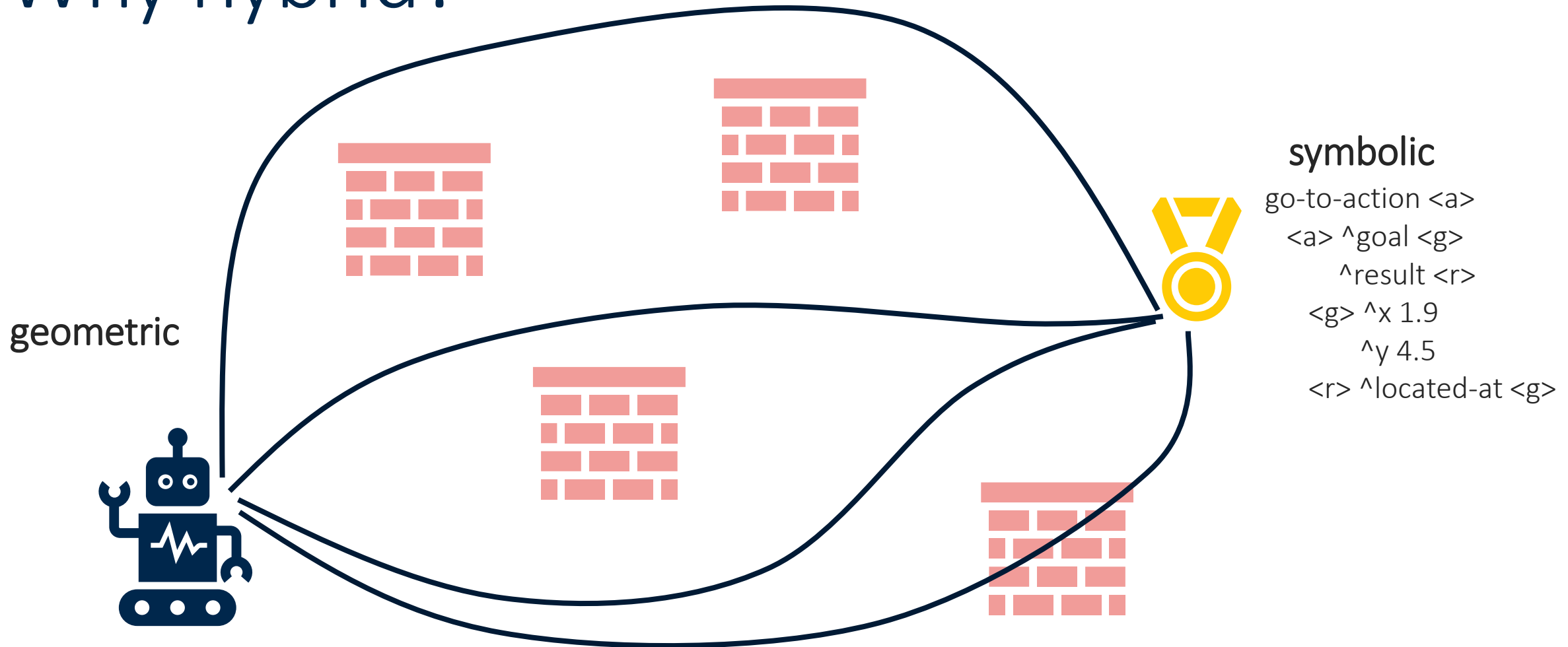
- Manipulation domain is 7 DOF

How to reason about 7DOF arm trajectories in Soar? **Hybrid representation!**

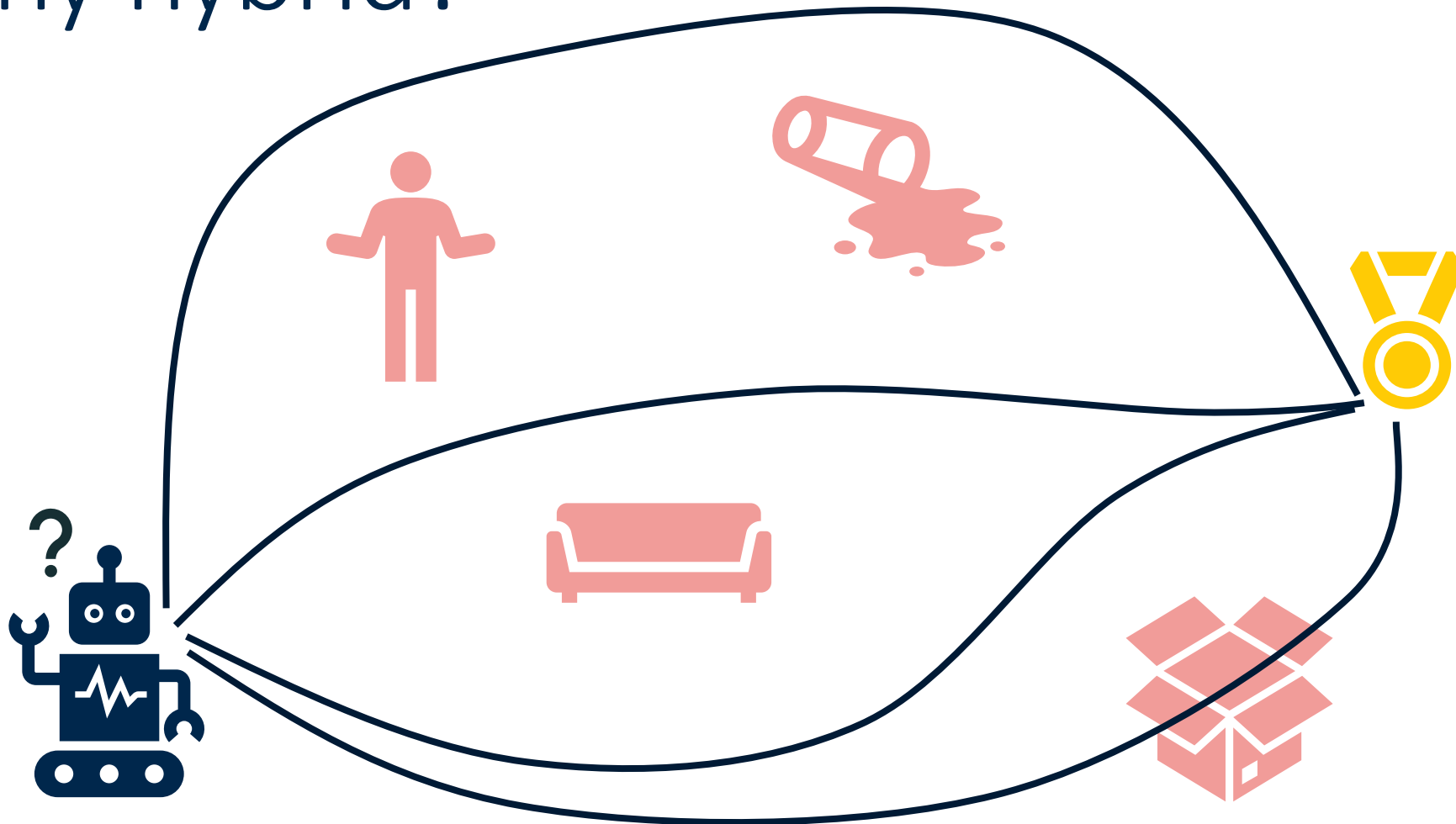




# Why hybrid?



# Why hybrid?

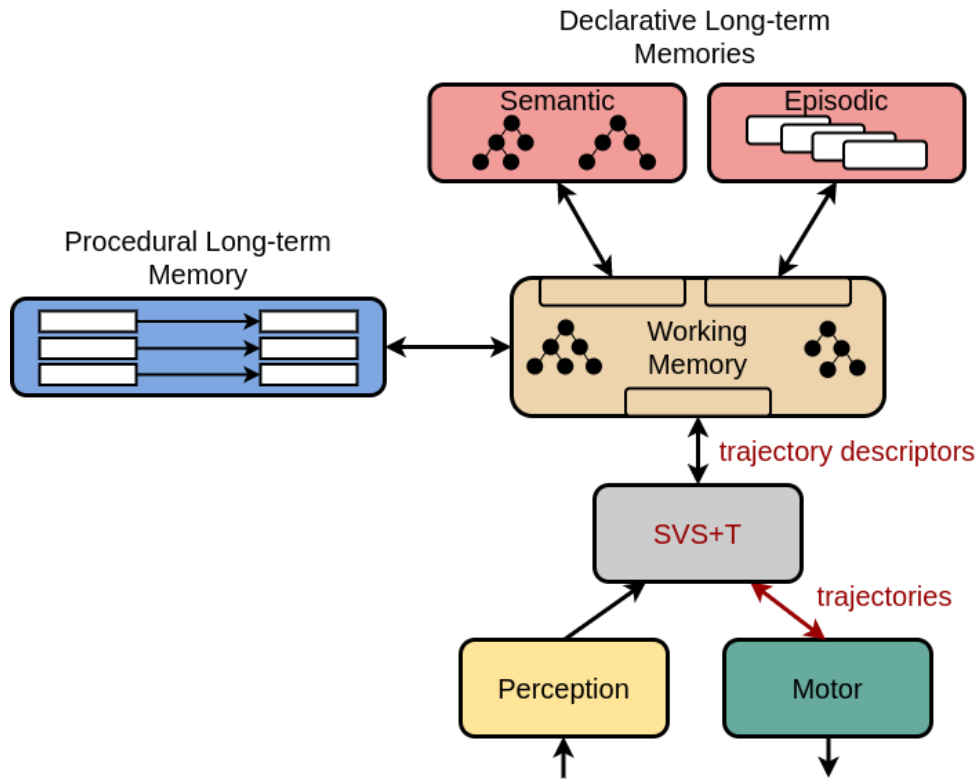


## hybrid

```
go-to-action <a>  
<a> ^goal <g>  
    ^result <r>  
    ^trajectory-set <t>  
<g> ^x 1.9  
    ^y 4.5  
<t> ^trajectory <t1>  
    ^trajectory <t2>  
    ^trajectory <t3>  
    ^trajectory <t4>  
<t1> ^close-to person  
    ^close-to spill  
    ...  
<t4> ^intersects box
```

+ queries

# Goal of my thesis

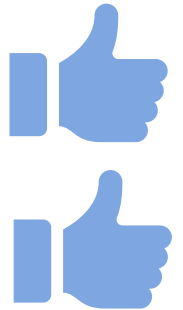


Symmetry!

SVS “sits between” WM and **both** perception and motor

Perceptual object representation is hybrid

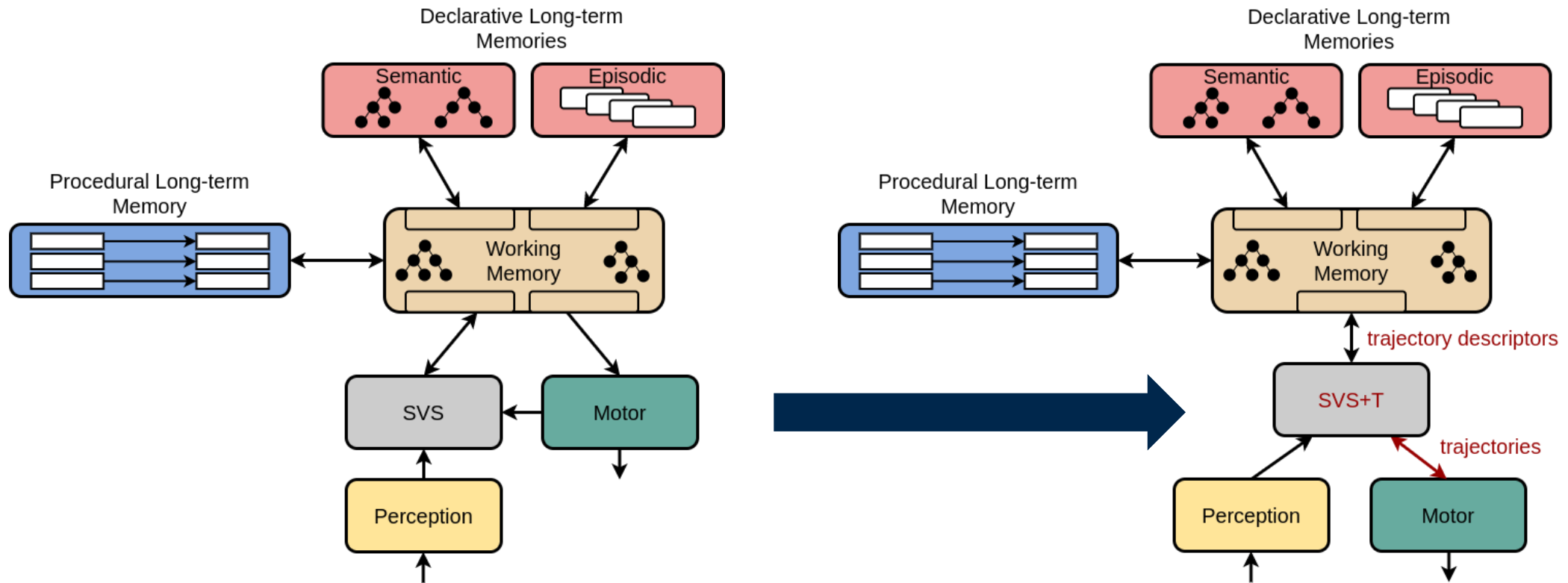
Action representation is hybrid

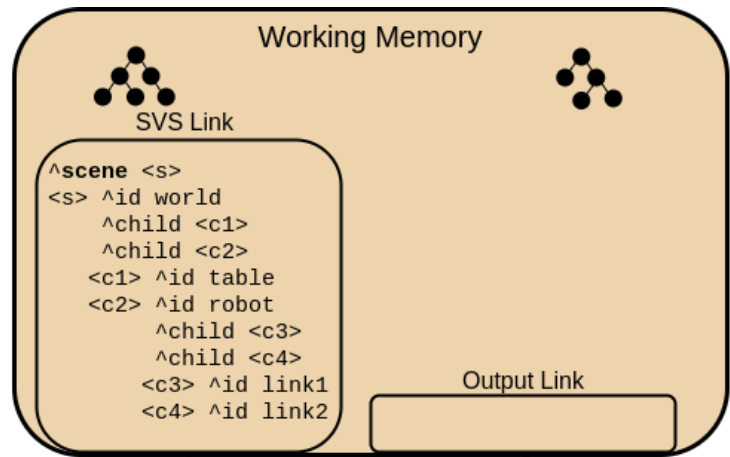


# Talk roadmap

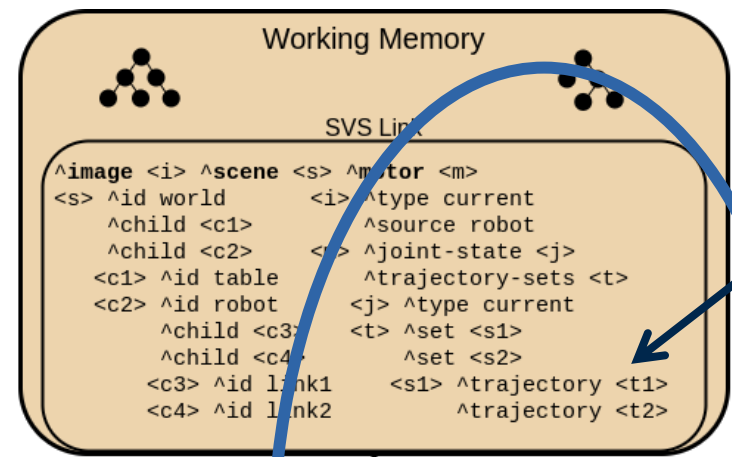
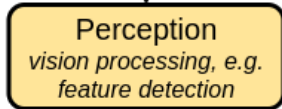
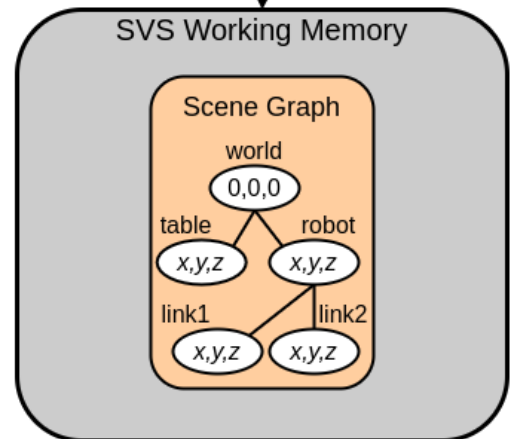
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# How do we get from here to there?

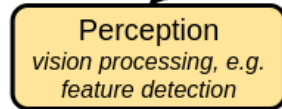
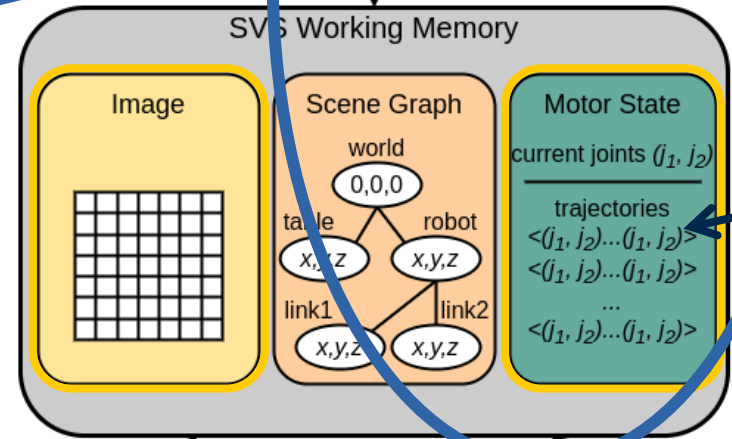




Symbolic  
Continuous (SVS)



Symbolic  
Continuous (SVS)



hybrid  
rule matching  
+  
trajectory  
planning and  
execution  
=  
queries

symbolic  
rule matching

geometric  
trajectory  
planning and  
execution

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# Nuggets + Coal

- + Theoretical and practical progress on SVS
- + Hybrid motor representation for Soar
- + Designed to be usable by others in arbitrary agents in the future

- Full motor pipeline is still in progress
- Agent usage, evaluation are TBD