

# Scaling Up, Out, and Understanding

Perspectives from jACT-R

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## Scaling Up

*Perception, Declarative Memory,  
Conflict Resolution*

## Scaling Out

*Perceptual Interfaces, Declarative  
Memory, Runtime*

## Scaling Understanding

*Structure, Information Overload,  
Audit Trail*

# Scaling Up

*Perception, Declarative Memory,  
Conflict Resolution*

## Parallel Perception

Central model thread

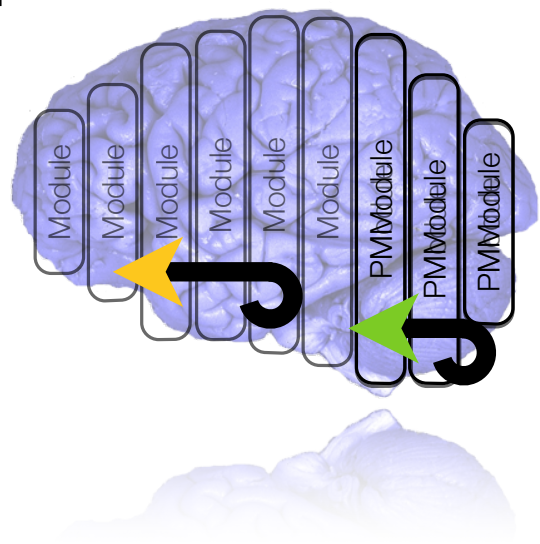
Perceptual modules share second  
thread

Updating perceptual memories  
(e.g. *visicon*)

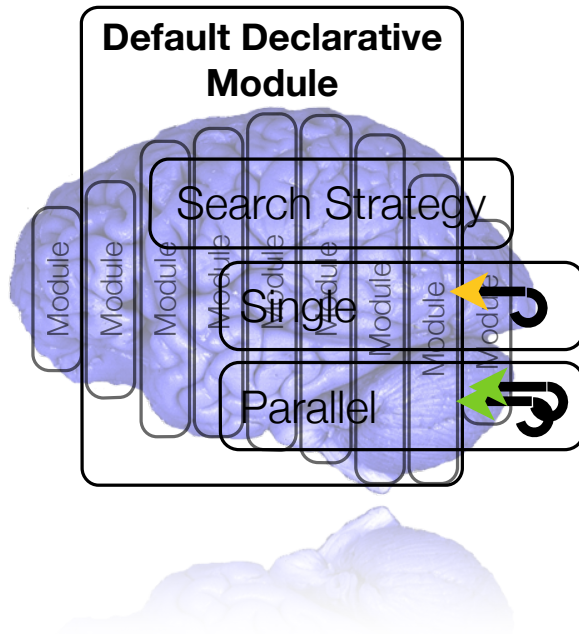
Precoding percept chunks

Tracking

Permits realtime\* perception



# Pluggable Declarative Memory



DM searches are frequent & expensive

Pluggable search strategies

Serial (model thread)

Parallel (shared pool)\*

Have a better algorithm?

# Pluggable Procedural Memory

Conflict resolution performance varies greatly

Candidate selection?

Large candidate set?

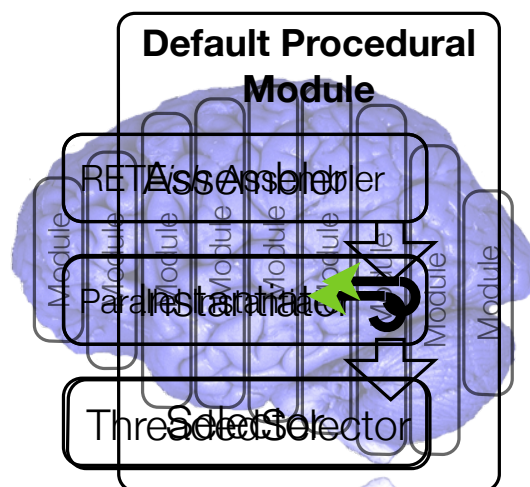
Large conflict set?

Default & specialized delegates

Simple & RETEish assembler

Single & Parallel\* instantiators

Threaded Cognition (Salvucci & Taatgen, 2011)



# Scaling Up

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# Scaling Out

*Perceptual Interfaces, Declarative Memory, Runtime*

# Perceptual Interfaces

CommonReality framework for perceptual interfaces

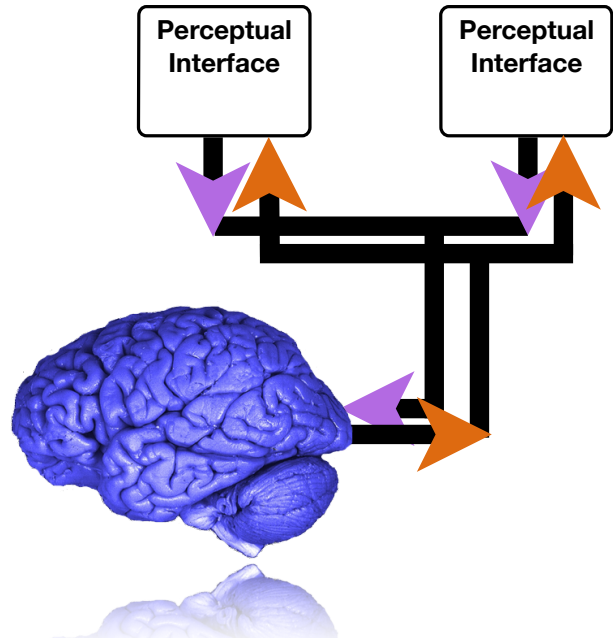
Architecture agnostic

Distributed simulation broker

Transparent & pluggable communications

Compositable interfaces

afferent percepts & efferent commands



## Existing Perceptual Interfaces

Keyboard : provides both simulated and actual keyboard and mouse access.

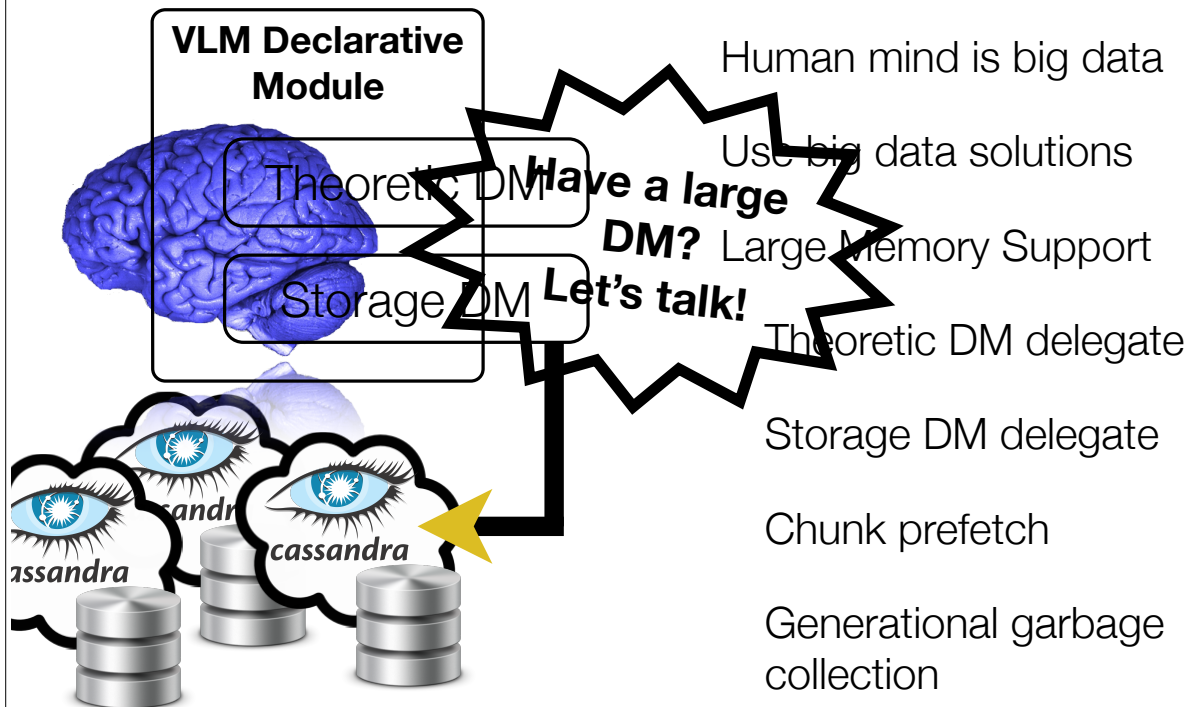
Speech : provides action and vocalization support. (*pluggable TTS support*)

Aural : generic aural system that detects simulated sounds and generates percepts for connected agents. (*easily integrated with speech recognizers*)

XMLSensor : provides simple perceptual information from xml configuration files. (*programmatically controllable*)

ROS : provides pluggable access to ROS networks. Robotic interfaces and Gazebo. (*pending release*)

# Scaling Declarative Memory



## Runtime Scaling

How the model *executes* is independent of how it *behaves*

Runtime is configured based on *modeler*, not *model*, needs

Flexible execution environment

Different pros/cons

Runtime Implementations

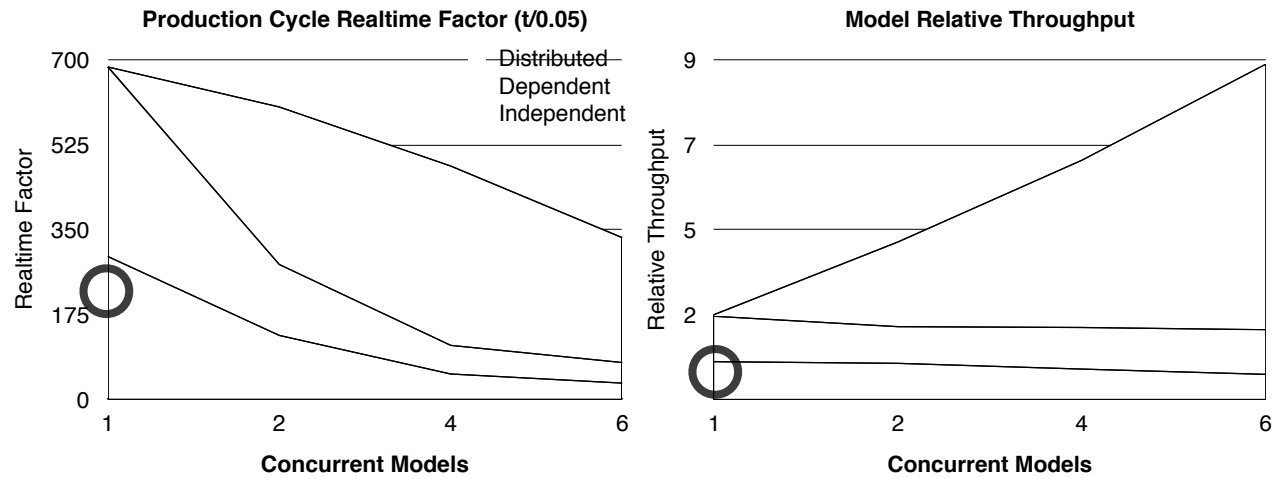
Distributed  
Perceptual  
Simulation

Embedded,  
Dependent  
Clocks

Embedded,  
Independent  
Clocks

*Mobile?*

# Concurrent Performance



## Scaling Out

*Perceptual Interfaces, Declarative Memory, Runtime*

# Scaling Understanding

Structure, Information Overload, Audit Trail



**Experiment  
& Analysis**

**Model &  
Architecture**



**Perception  
& Interface**

Have you ever broken ACT-R while getting your  
model to work?

How easy is it to share complex models and have  
them run?



# Structure

jACT-R projects *encourage* self-contained structure

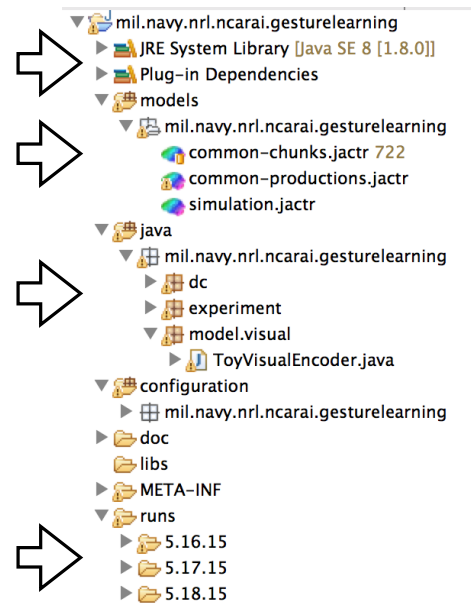
Unit of distribution

Separation of model from code

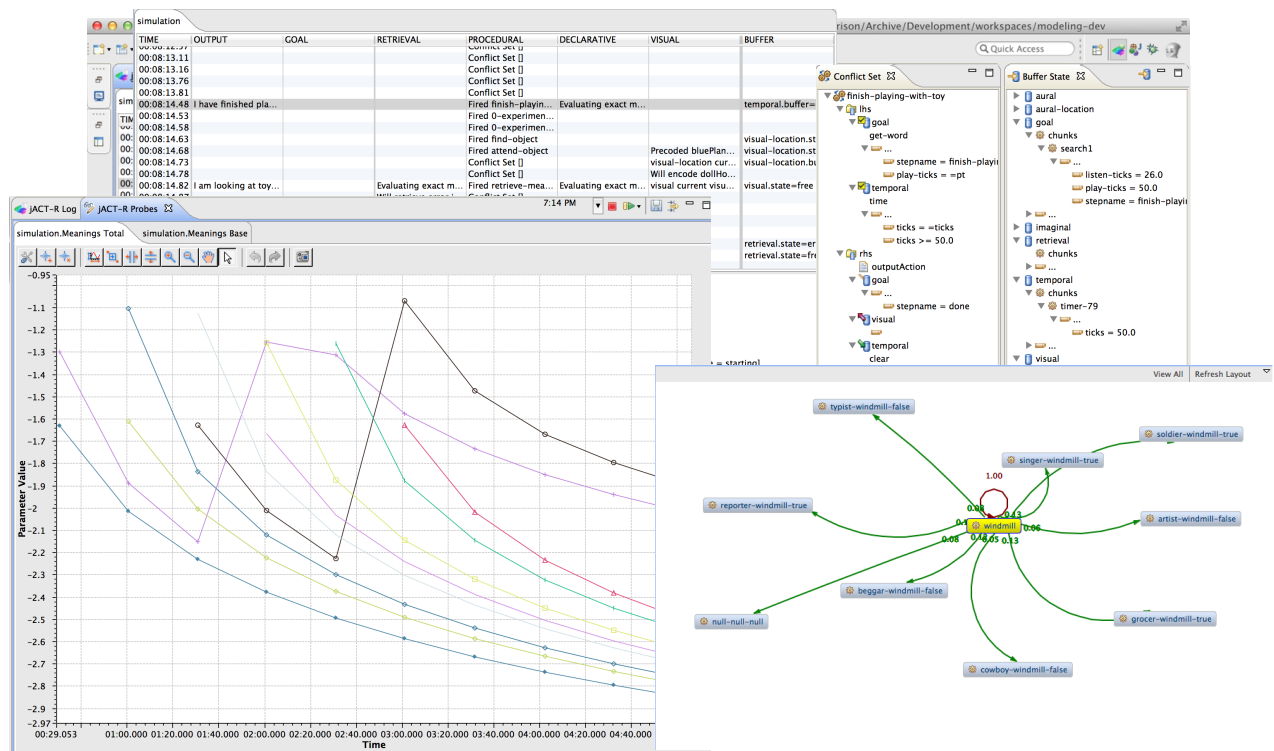
Dependency management

Persisted run configurations

Archive of runs



# Information Overload



# Audit Trail

*“Hmmm, that was strange. Let me rerun that”*

Don't rerun the model, replay it

Archive illustrative or anomalous runs

Self-contained & shareable

Perfect for reporting *bugs*

# Scaling Understanding

Structure, Information Overload, Audit Trail

# Funding



Thank you!

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