

Learning from Others: Soar's memory extensions

Bill Kennedy
ACT-R PGSS
16-19 Aug 2011

Think. Learn. Succeed.



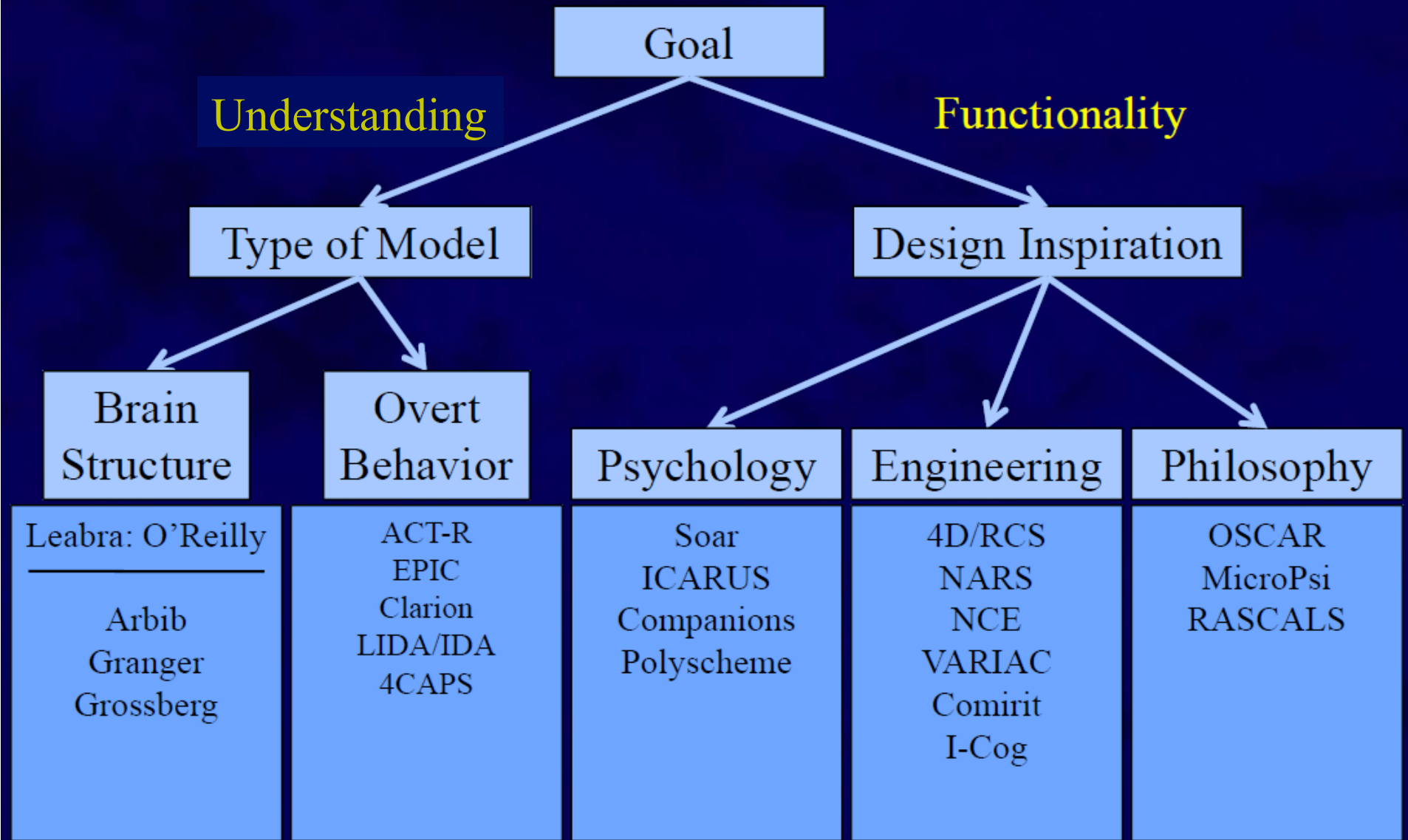
ACT-R Inspires Soar

“Inspired by ACT-R (Anderson 2007), we added activation to Soar’s working memory (Chong, 2003; Nuxoll et al., 2004).”

Newell's Strong Memory Claims

- One representation of tasks: problem spaces
- One form of long-term memory (rules)
- One form of short-term memory (WMEs)
- One learning method (chunking)

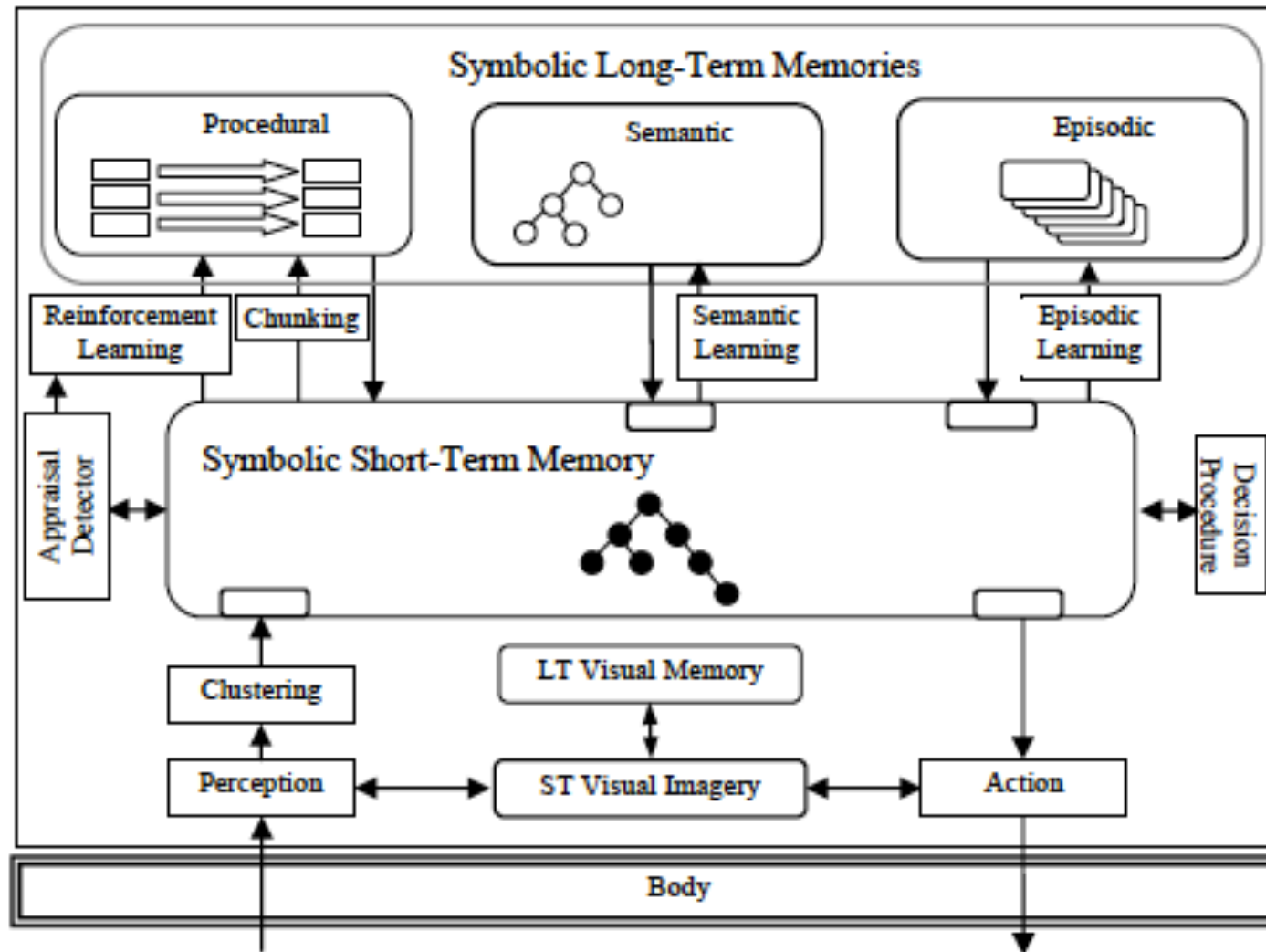
Classification of Active Architectures



Why Extend Soar?

- Increase **functionality** by:
 - Adding new learning and memory modules “that capture knowledge that is cumbersome to learn and encode in rules.”

Soar 9



Episodic Memory (Soar 9.1)

- Andrew Nuxoll's 2007 dissertation & 2004 ICCM paper
- Based on Tulving (1983) framework
 - When: when agent takes action
 - What: sensor data, internal data structures, and outputs
 - Where: separate memory (to avoid confusion)
 - Used: partial match of first of two sequential episodes

Semantic Memory (Soar 9.2)

- *“a person’s general knowledge about the world.”**
- Wang & Laird 2006 tech report
- Based on ACT-R’s declarative memory
- A 2nd type of declarative memory
- Facts without context (episodic memory)

* Daniel L. Schacter, A.D.E., Randy L. Buckner, *Memory Systems of 1999. The Oxford Handbook of Memory*, 2000: 627-643.

Visual Memory

- Scott Lathrop's 2009 dissertation & tech report
- Sam Wintermute's 2010 dissertation & AAI
- Based on mental image processing
- Visual and spatial imagery (Reno vs San Diego)
- Explicit encoding into depictive representation
- Integrated visual and spatial information for functionality
- (may be more AI than Cog Sci)

Summary of Soar Extensions

Memory/Learning System	Source of Knowledge	Representation of knowledge	Retrieval of knowledge
Chunking	Traces of rule firings in subgoals	Rules	Exact match of rule conditions, retrieve actions
Clustering	Perception	Classification networks	Winner take all
Semantic Memory	Working memory existence	Mirror of working memory object structures	Partial match, retrieve object
Episodic Memory	Working memory co-occurrence	Episodes: Snapshots of working memory	Partial match, retrieve episode
Reinforcement Learning	Reward and numeric preferences	Numeric preferences	Exact match of rule conditions, retrieve preference
Image Memory	Image short-term memory	Image	Deliberate recall based on symbolic referent

Laird (2008) Extending the Soar Cognitive Architecture. Proceedings of the Conference on Artificial General Intelligence. ISO Press: Memphis, TN.

Bottom Line:

I'm not advocating we develop a "***New Coke***", but is there something ***Classic*** to consider here?