

Unification of Activation

John E. Laird (University of Michigan)

with help from

Bob Marinier (Soar Technology) and

Nate Derbinsky (Disney Research)



BOB AND BETTY BEYSTER BUILDING



The 33rd Soar Workshop
June 4 – 6, 2013
Computer Science and Engineering
University of Michigan



BOB AND BETTY BEYSTER BUILDING



The 33rd Soar Workshop
June 4 – 6, 2013
Computer Science and Engineering
University of Michigan

Problem/Opportunity

- Soar has multiple, independent activation schemes:
 - Semantic Memory: used for biasing retrieval
 - Working Memory: used for forgetting
 - Procedural Memory: used for forgetting
- Opportunity:
 - Unify activation schemes so activation flows between memories
 - Expand activation to Episodic Memory
 - Explore more ways to use activation

Activation: Background

Meta data that indicates importance/relevance of memory item.

- Recently used data is probably relevant
- Frequently used data is probably relevant

Base-level activation combines both
(Anderson et al., 2004)

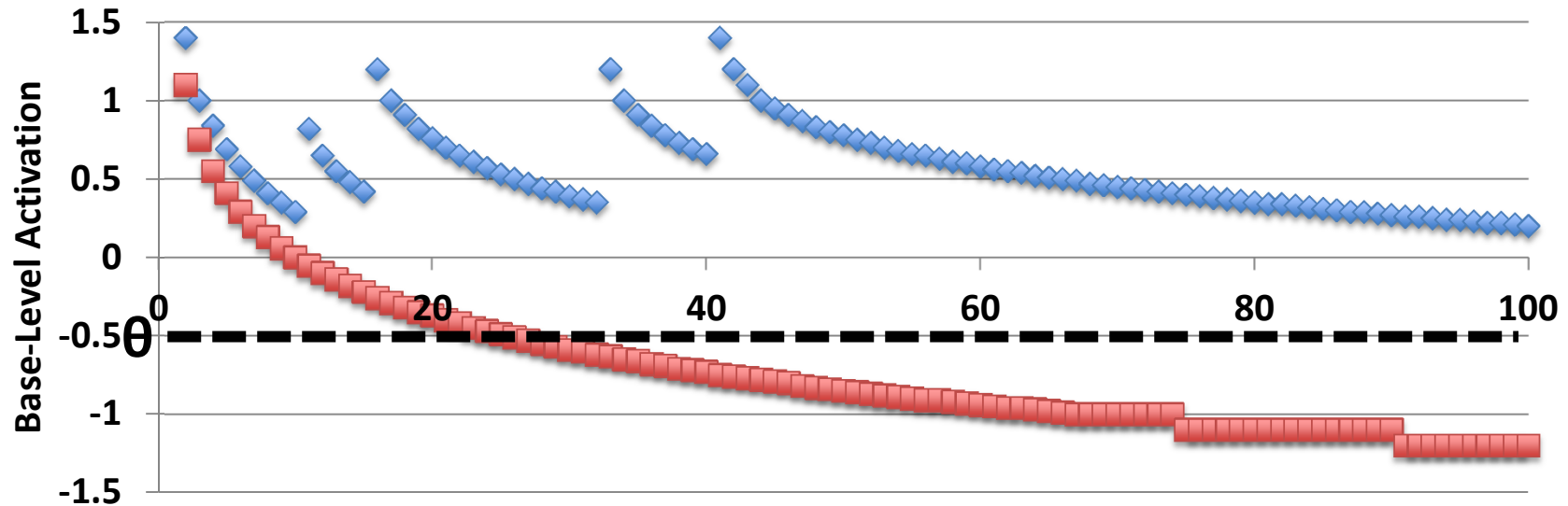
Base-Level Decay

(Anderson et al., 2004)

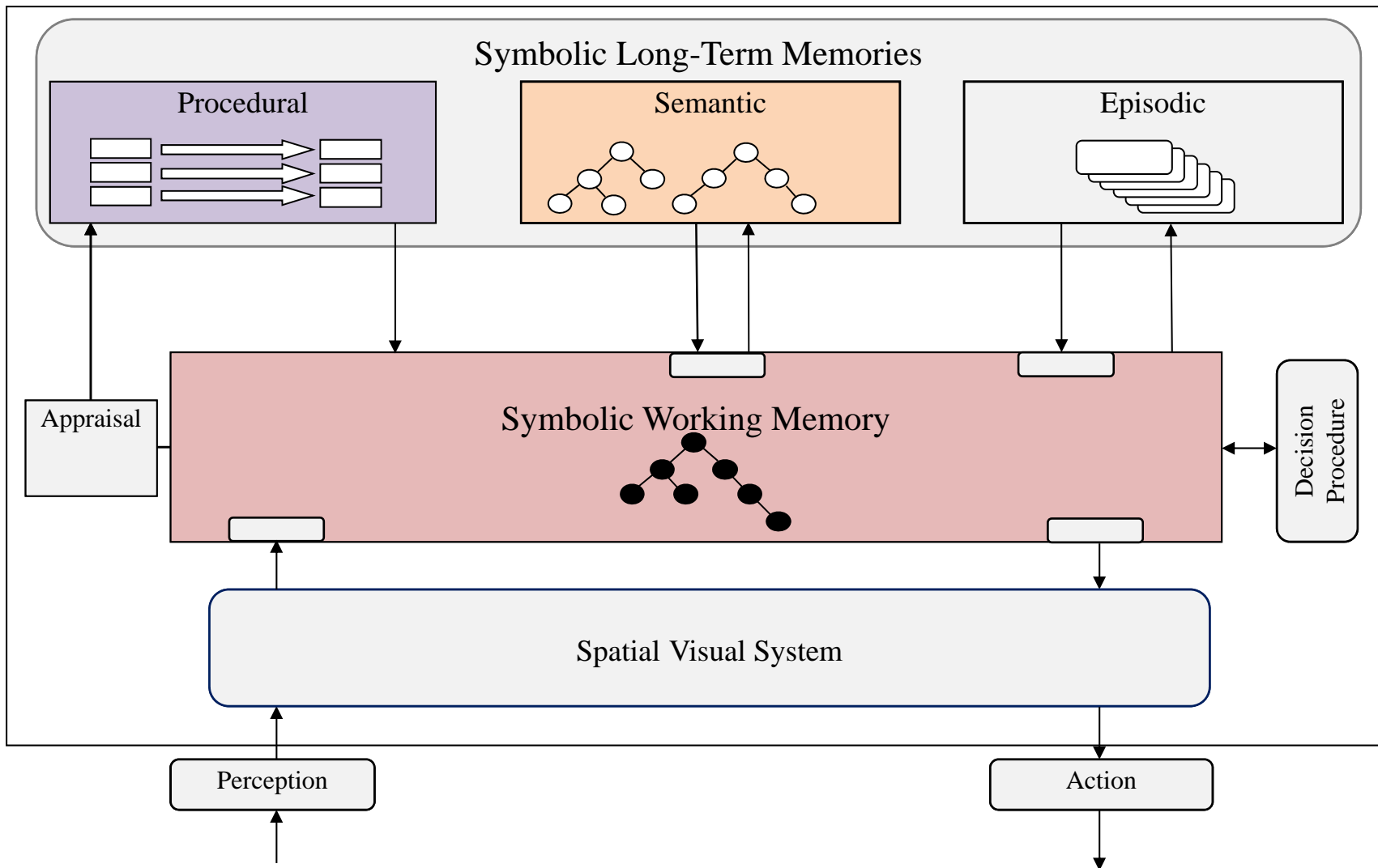
Predict future usage via history

Used to model human retrieval bias, errors, and forgetting via failure

$$\ln\left(\sum_{j=1}^n t_j^{-d}\right)$$



Soar 9 Structure



Proposals:

Working Memory and Semantic Memory

- Semantic Memory -> Working Memory
 - Important long-term memories get higher activation in working memory
 - Initialize activation of WMEs retrieved from SMEM using their SMEM activation
- Working Memory -> Semantic Memory
 - Activation of semantic memory elements should reflect activation achieved in working memory

Proposals: Episodic Memory

- Activation of Episodes
 - Reflect recency and frequency of access
 - Retrieve based on activation not just recency
 - Possibly initialized by overall activation of WM or arousal (appraisal)
- Original activation of WMEs stored in episodes.
 - Bias retrieval by combined activation of matching WMEs and episode structure
 - Retrieve episodes whose highest activated elements match highest WMEs.

Proposal:

Appraisal/Arousal

- Soar's appraisal mechanism computes an intensity that could be related to arousal
- Arousal could be used as baseline for
 - Working memory
 - Accessed semantic memory
 - Episodic memories
- WME activation could influence appraisal intensity (and vice versa).



Nuggets and Coal



- Nuggets
 - Could potentially improve Soar's ability to access the right memories at the right time.
 - Could potentially improve decision making
- Coal
 - Doesn't have a good theoretical basis
 - Complex compared to ACT-R scheme
 - Computational overhead for computing and using activation could be significant
 - Will require significant implementation effort