

Episodic Memory for Soar

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What is Episodic Memory?

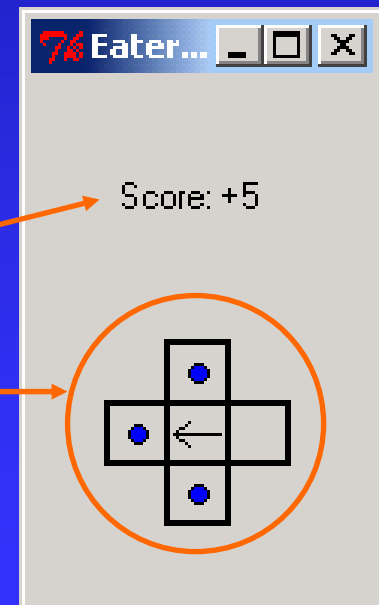
- Memories of specific events in our past.
 - ◆ Example: Your last vacation.
- Expected benefits of episodic memory
 - ◆ Use past experiences to anticipate future events.
 - ◆ Learn from past experience when new time/resources become available
 - ◆ Generalize its knowledge by comparing multiple events simultaneously.

Overview

- Previous work by Erik Altmann
- Key Differences:
 - ◆ Architectural implementation
 - ◆ Aimed at being domain independent

Encoding

- Episodic memories are encoded as Soar operators that perform recall
- Select salient features of the current state
 - ◆ Actions of apply rule
 - ◆ Condition of the proposal



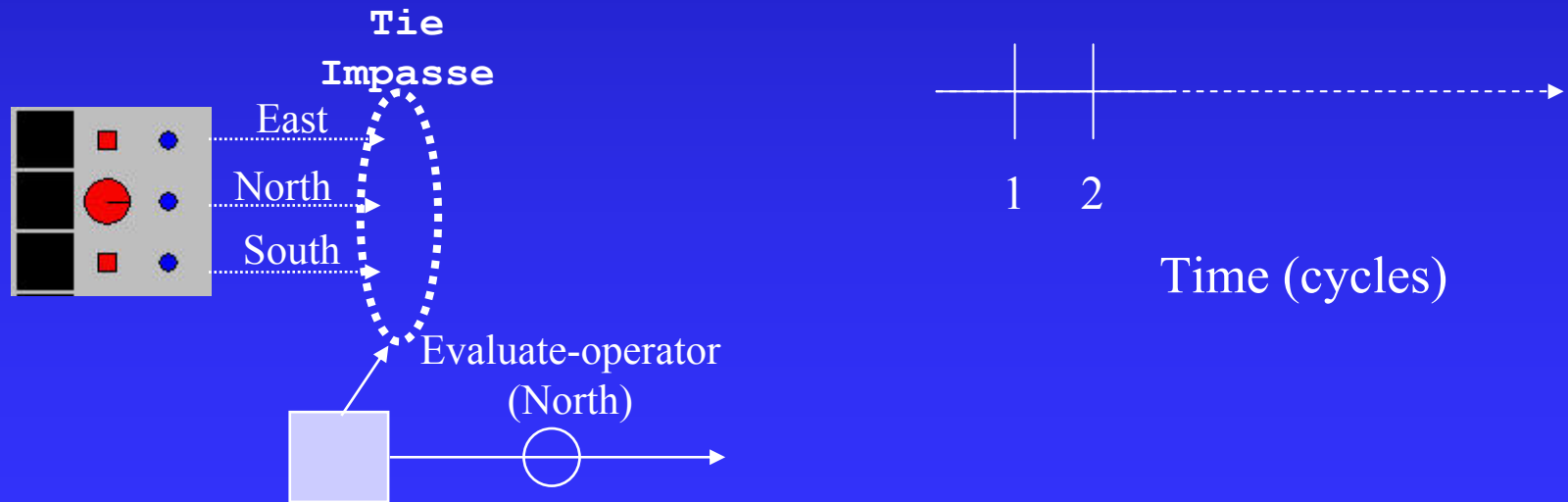
Storage

- Example episodic proposal rule
- “If I am moving south and there is normalfood to the south and an empty square to the east then propose recall operator 117.”

```
sp {recall-proposal-70
  (state <rs2> ^io <I1>)
  (<I1> ^output <I3>
    ^input <I2>)
  (<I3> ^move <M1>)
  (<M1> ^direction east)
  (<I2> ^my-location <I4>)
  (<I4> ^south <I7>
    ^east <I8>)
  (<I7> ^content normalfood)
  (<I8> ^content empty)
-->
  (<rs1> ^operator <o1> + =)
  (<o1> ^name epmem-recall +
    ^number 117 +)
}
```

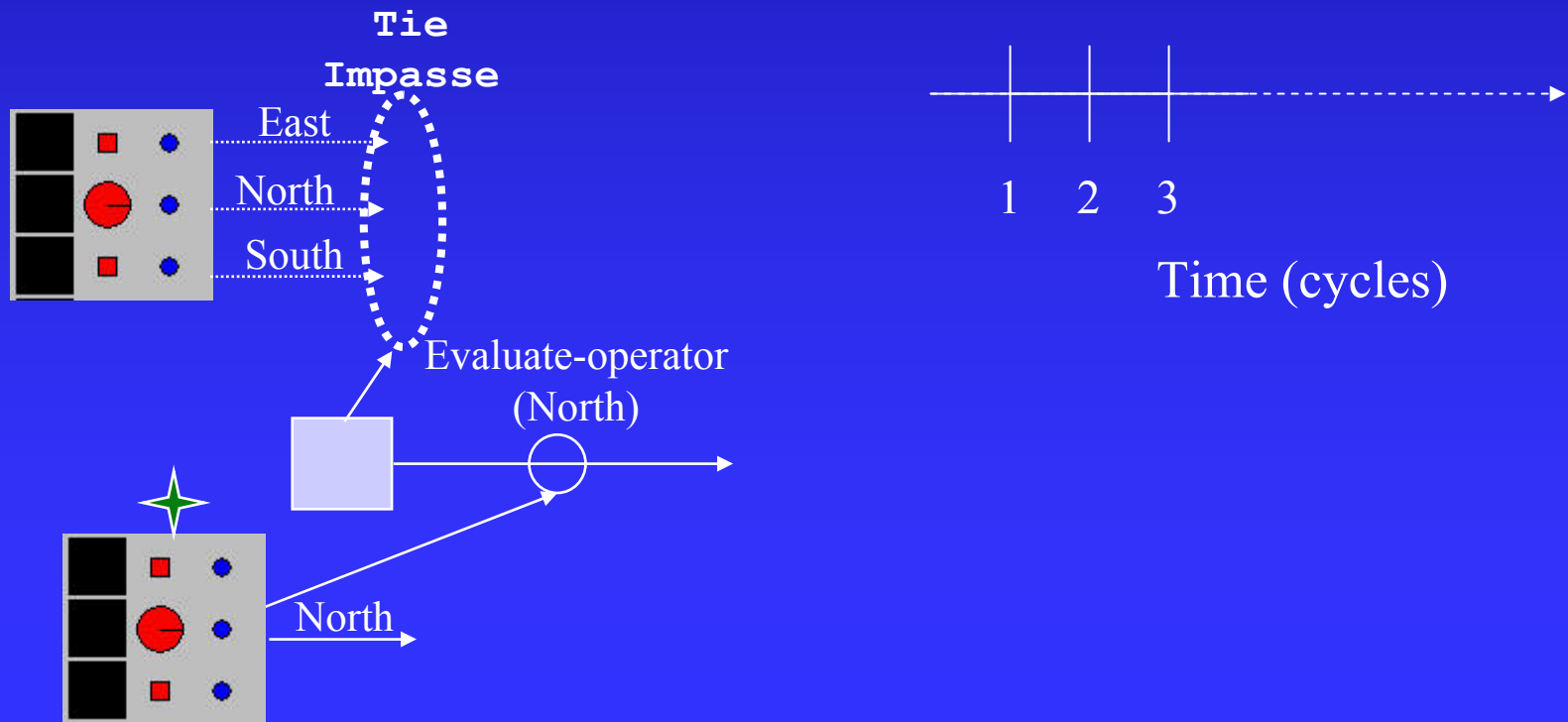
Retrieval: Triggering Retrieval

- Deliberate retrieval by the agent
- Eaters: triggered by a tie impasse



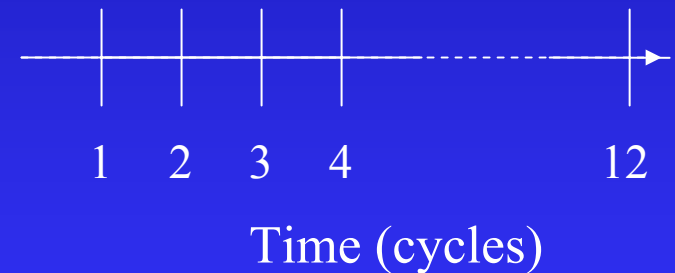
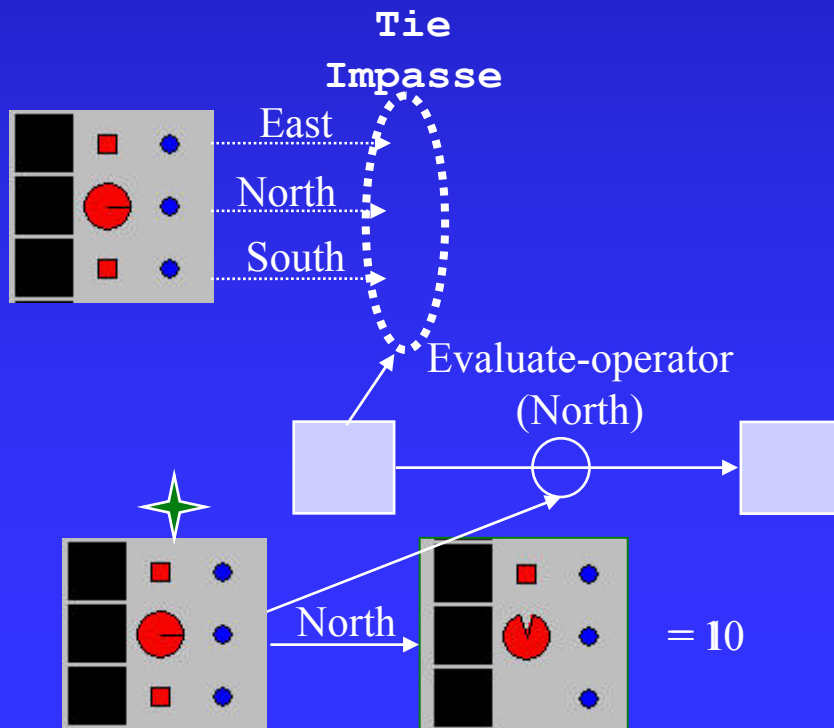
Retrieval: Cue Construction

- Agent constructs the cue
- Eaters: the cue is a copy of the current state



Retrieval: Recall

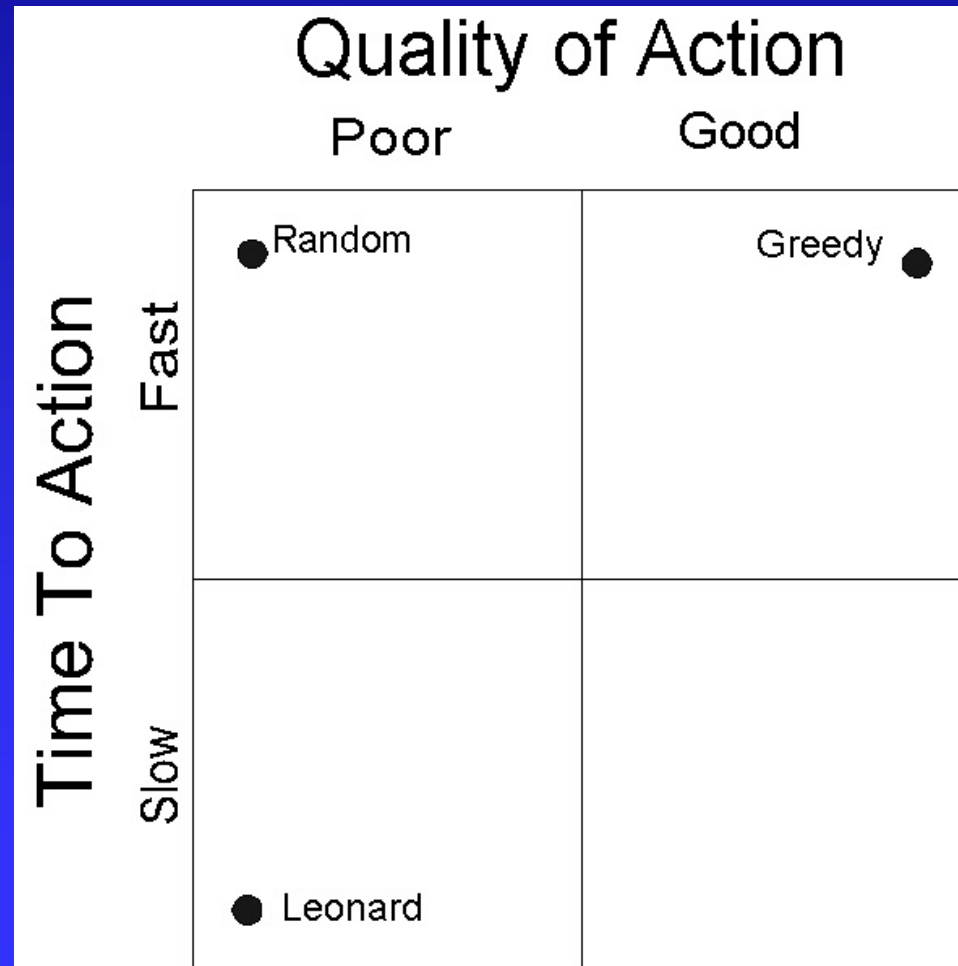
- The recalled state is reconstructed by modifying the cue



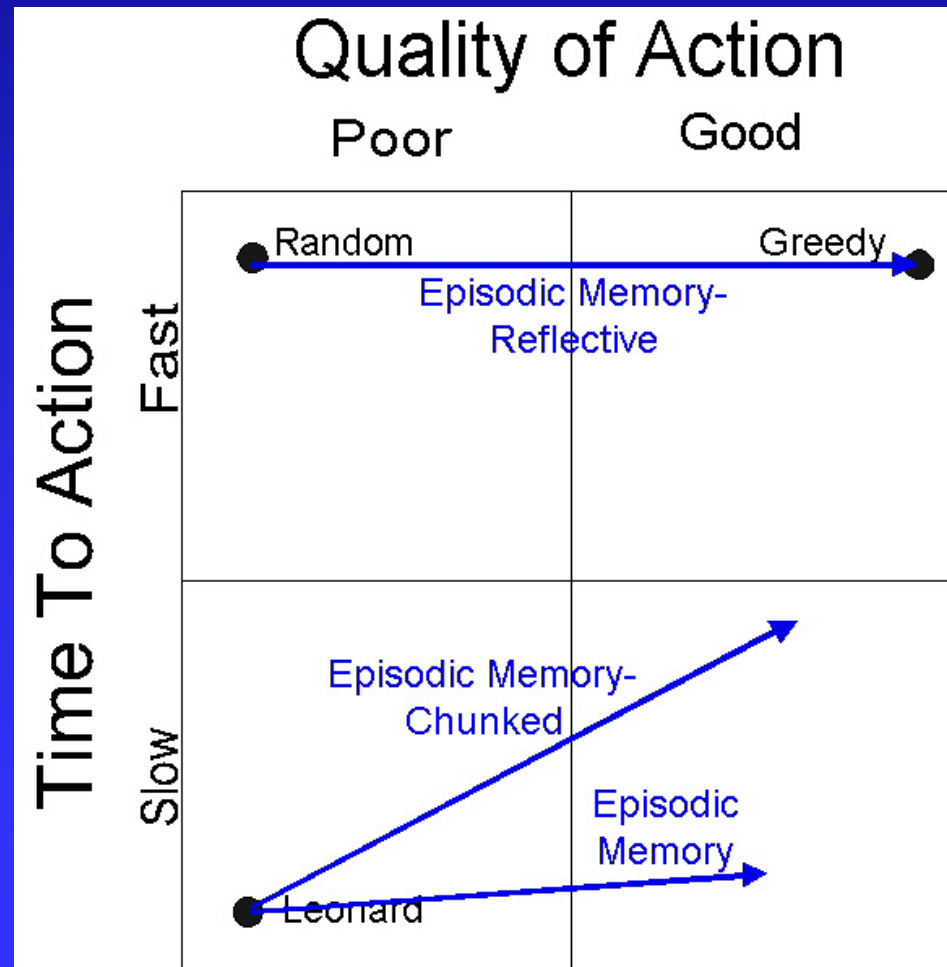
If a memory matches, it computes correct next state

If no memory matches, returns default evaluation [1].

Control Eaters



Summary of Eaters Results

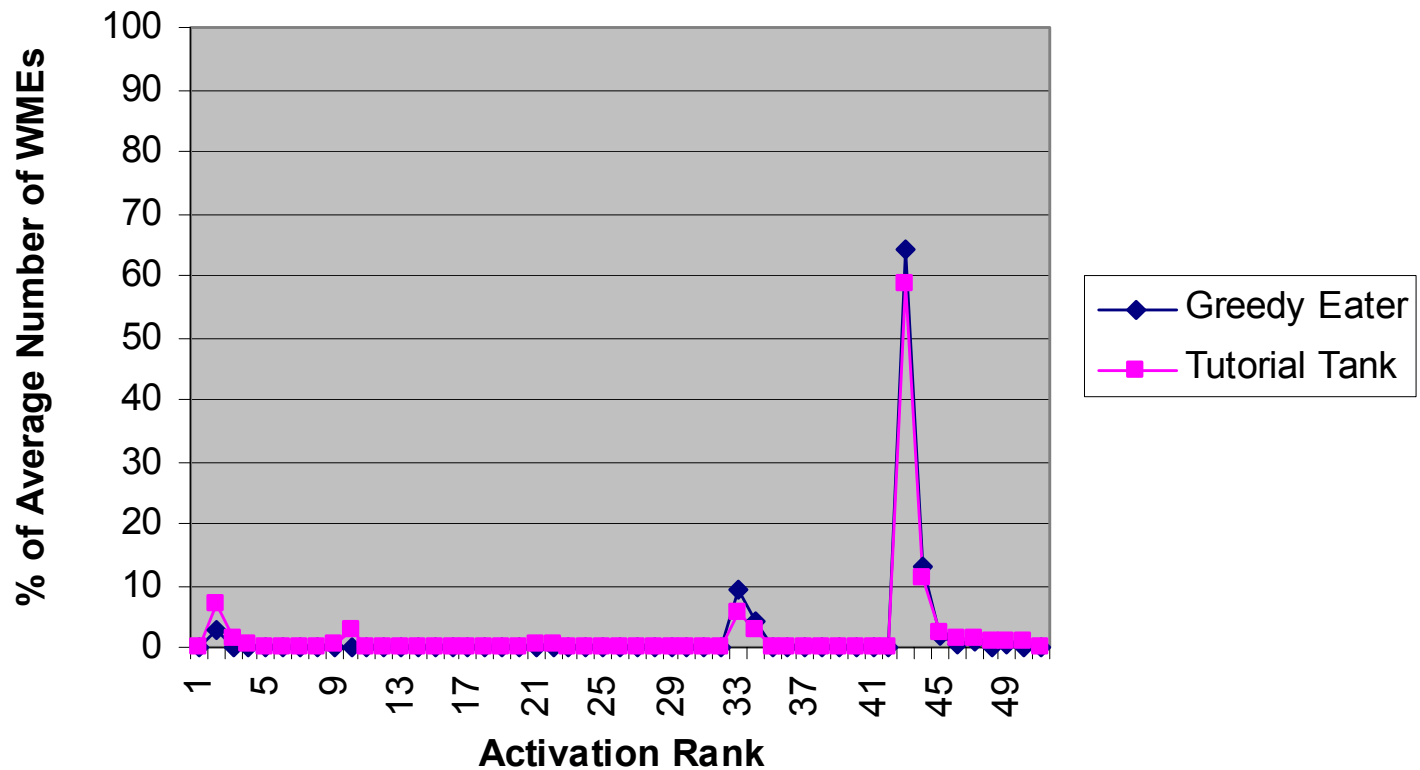


Towards Task-Independence

- Activation – a measure the frequency and recency of use
 - ◆ Based on research by R. Chong and M. James
- Current use: deciding *when* to record an episode
- Intended use: deciding *what* to record

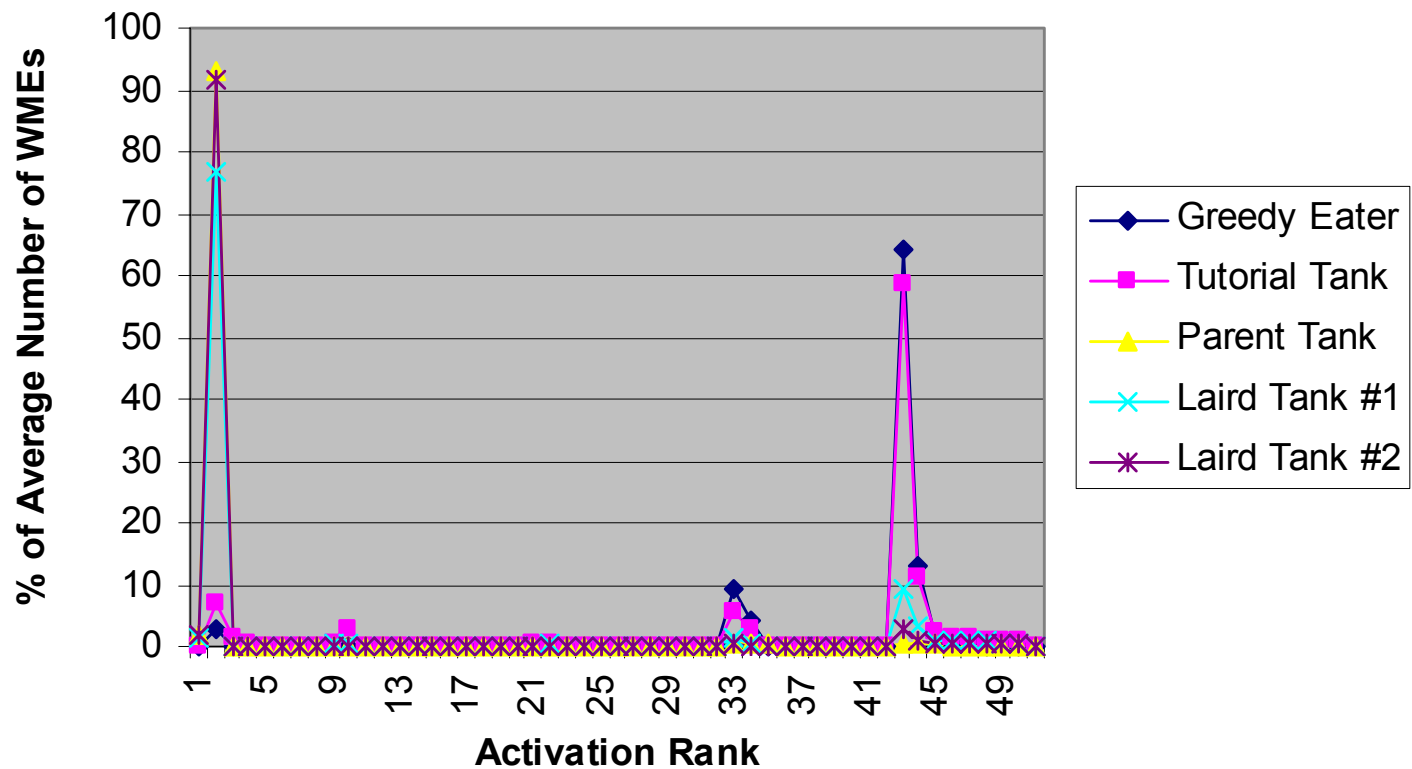
Data Hints

WME Activation Levels - Normalized



Data Hints

WME Activation Levels - Normalized



Nuggets

- Initial, functioning implementation
- Shown effective for one (simple) domain
- Lots of research potential

Coal

- Still restricted to domain specifics
 - ◆ Cue selection
 - ◆ Episode content
- Lots of research potential