

Categories of Persistence in Soar 8

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Soar8 Review

Soar8 will retract a goal when a local o-supported WME is no longer supported by the hierarchical context (goal dependency set) that was used in the WME's creation

- Local persistence: goals/states with o-supported WMEs (other than top state) look “i-supported” wrt the hierarchical context
 - “local:” persistent only within the goal (and further decomposition)
- Global persistence: o-supported structures in the top state persist until knowledge is asserted that removes the structure
 - “global:” persistent throughout the hierarchy

```
<ts> ^io.input-link.color red  
<s> ^operator.name  
→  
<s> ^red-in-gds *yes* +
```

```
WME<= (I2 ^color red)  
WME=> (I2 ^color blue)
```

Goal that was bound to <s> gets retracted (assuming <s> is not top-state)

Soar8 Questions

☀ Recurrent questions

- ☀ Why shouldn't I just put all o-supported WMEs in the top state?
 - Shouldn't everything have global persistence?
- ☀ When should I return something to the top state?
 - When should something have global persistence?

☀ Answer (until now):

- ☀ Depends....

☀ Answer (now):

- ☀ Reason for creating o-supported structures will tell you where they should be asserted

Categories of Persistence

Different reasons for using an operator to assert a WME:

1. Non-monotonic reasoning
2. Hypothetical reasoning
3. Remembering
4. Avoiding expensive computations

Non-monotonic Reasoning

- ☀ Need to destructively change a state
 - ☀ Example: change the current-route

```
<s> ^routes <r>
      ^operator.name update-route
<r> ^current-route <cr>
      ^next-route <nr>
<cr> ^achieved *yes*
→
<r> ^current-route <cr> - <nr> +
```

- ☀ Probably the most often encountered reason for using o-support?

Hypothetical Reasoning

- ✦ Need to assert WMEs not grounded in the currently known (asserted) situation
 - ✦ Useful for look ahead planning
 - ✦ Example: Blocks World
 - Assume a space is empty if the robot can't sense it

Remembering

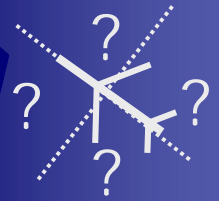
- ☀ Need to remember something after its instantiating conditions no longer hold
 - ☀ Example: Remember a radar contact

```
<ts> ^io.input-link.radar <blip>
<ts> ^radar <rdr>
<blip> ^disappearing *yes*
<s> ^operator.name  save-blip-before-disappear
→
<rdr> ^save-blip <blip> +
```

Avoiding Expensive Computation

- ★ Save some information because it's expensive to elaborate it repeatedly
 - Example: In what quadrant is the bogey?

```
<s> ^operator.name compute-side
<ts> ^io.input-link <il> ^bogey <bogey>
<il> ^my-heading <h> ^bogey-bearing <b>
→
<bogey> ^quadrant (f(<h>, <b>))
```



- Use knowledge to determine when computation needs to be repeated, rather than continuous recalculation

Why these distinctions?

Non-monotonic R.
Hypothetical R.

Want changes in the environment & hierarchical context to affect local reasoning → local persistence

- ☀ If the agent sees that the space is not empty, the hypothetical reasoning that depended on the space being empty should be abandoned/revisited.

Remembering
Avoiding Recalculation

Want an assertion to persist regardless of changes in the environment & hierarchical context → global persistence

- ☀ The agent wants to remember the radar blip even after it's disappeared from the input-link.

Guidelines

If your o-supported WME is being created for:	It should be located in:
Non-monotonic R. Hypothetical R.	Local state
Remembering Avoiding Recalculation	Top state
Some combination of first group with second group	Top state * Replacing an old value to be remembered (e.g., current-desired-speed) with a new one still requires global persistence

Conclusions

- ★ Simple guidelines for determining where to assert o-supported structure in Soar8
 - Not precise definitions of categories
 - Guidelines only as good as the developer's ability to make the category distinction
 - Guidelines do apply for learning
 - "local" state can be a result state
 - Question to ask: why is this result being created?
- ★ Anything persistent returned to the top state requires knowledge to manage it (i.e. "clean up")
 - Haven't developed general methods for managing persistent knowledge in top state