A Proposal For Changing Soar's Decision Procedure

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26th Soar Workshop

Soar Basics

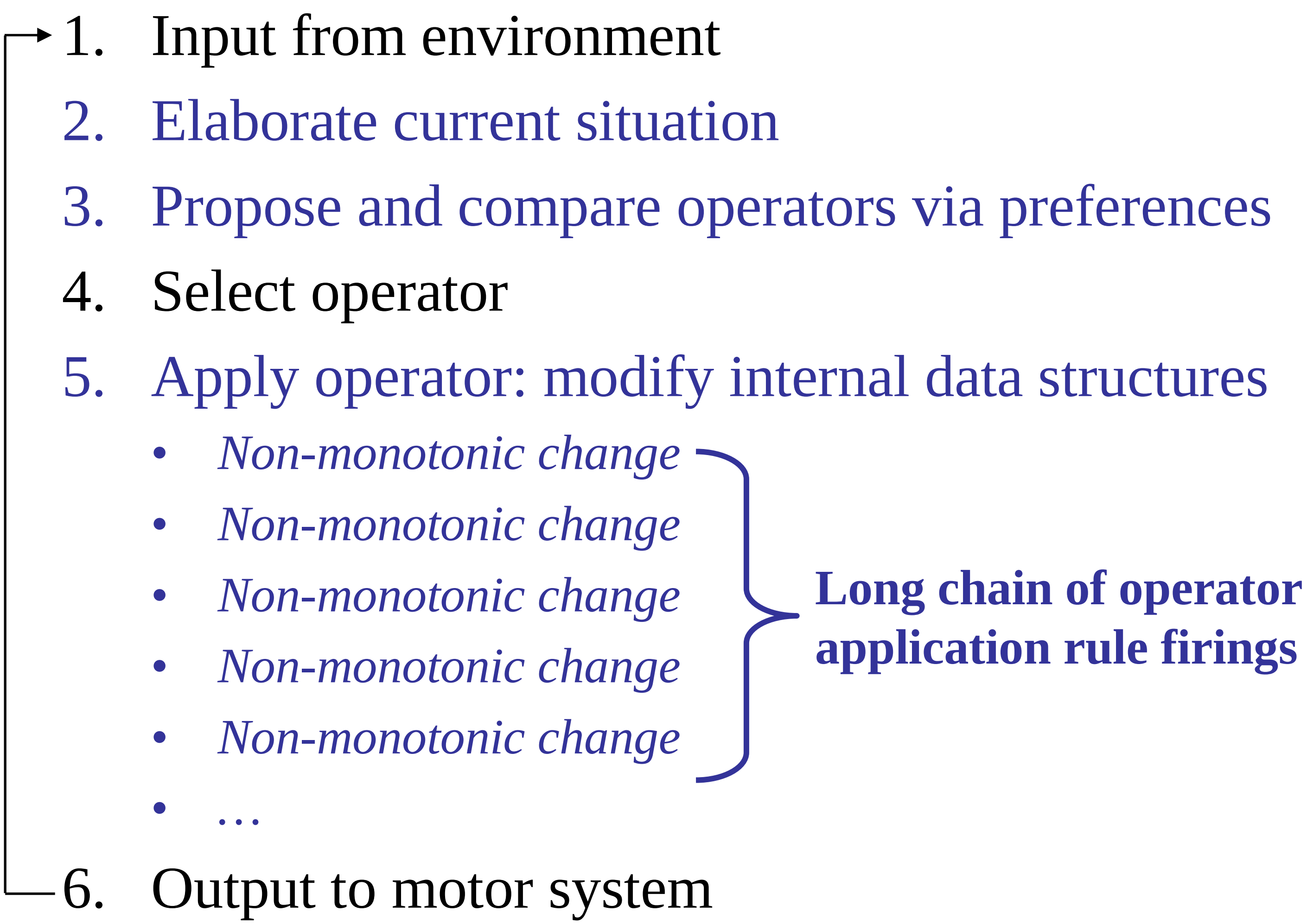
- Activity is a series of operators controlled by knowledge:

1. Input from environment
2. Elaborate current situation
3. Propose and compare operators via preferences
4. Select operator
5. Apply operator: modify internal data structures
6. Output to motor system

Monotonic inferences

Non-monotonic inferences

Soar Basics



1. Input from environment
2. Elaborate current situation
3. Propose and compare operators via preferences
4. Select operator
5. Apply operator: modify internal data structures
   - *Non-monotonic change*
   - *Non-monotonic change*
   - *Non-monotonic change*
   - *Non-monotonic change*
   - *Non-monotonic change*
   - …
6. Output to motor system

Long chain of operator application rule firings

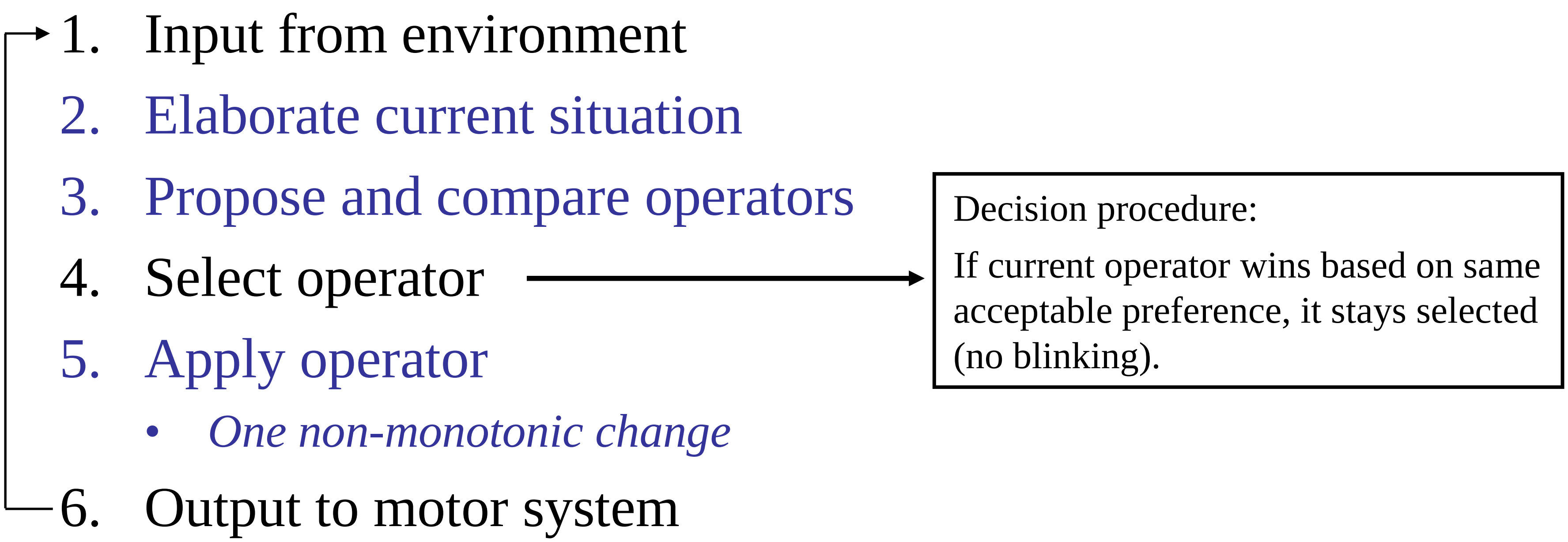
What’s Wrong with Soar 8.6.2?

1. No bound on the number of rule firings during operator application
2. Prevents Soar from entering output/input
3. Soar can do many internal actions with “eyes closed”
4. Post-chunking can be less reactive than pre-chunking
5. Timing predictions can become very unreasonable

Proposal

- 1 PE phase/decision cycle: Limit operator application to one wave of parallel o-supported rule firing
- Forces architecture to go back through input-output
  - Making it more reactive
- Has no impact on operator selection
  - except from input
  - [Limiting elaborations to 1/decision would impact selection]
- Number of decisions doesn’t collapse after chunking
  - Chunking will eliminate only unnecessary reasoning

Proposed Change



1. Input from environment
2. Elaborate current situation
3. Propose and compare operators
4. Select operator
5. Apply operator
   - *One non-monotonic change*
6. Output to motor system

Decision procedure:

If current operator wins based on same acceptable preference, it stays selected (no blinking).

Example

Task: Count to 10 in subgoal: intermediate results in the super state.

Before Chunking

```
24: O: O24 (count-test4)
25: ==>S: S2 (operator no-change)
26:    O: O25 (substate-count)
27:    O: O26 (substate-count)
28:    O: O27 (substate-count)
29:    O: O28 (substate-count)
30:    O: O29 (substate-count)
31:    O: O30 (substate-count)
32:    O: O31 (substate-count)
33:    O: O32 (substate-count)
34:    O: O33 (substate-count)
35:    O: O34 (substate-count)
36: O: O35 (test-complete)
```

After Chunking

Soar 8

```
24: O: O24 (count-test4)
25: O: O25 (test-complete)
```

Ten rule firings in sequence

1 PE/Operator

```
42: O: O24 (count-test4)
43:    O24 (count-test4)
44:    O24 (count-test4)
45:    O24 (count-test4)
46:    O24 (count-test4)
47:    O24 (count-test4)
48:    O24 (count-test4)
49:    O24 (count-test4)
50:    O24 (count-test4)
51:    O24 (count-test4)
52: O: O25 (test-complete)
```

Nuggets and Coal

- Nuggets:
  - Make Soar more reactive
  - Makes post-chunking behavior more *reasonable*
- Coal:
  - Behavior might be less intuitive