Can Activity Trace Database Become Cognitive Models?

Soar Workshop Talk
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Outline

- Introduction
  - Human operator cognitive model
- Trace of activity
  - What is it?
  - Example of the Vacuum cleaner
  - Example of the Car Driver
- Discussion
  - Can activity trace database become cognitive models?

Human Operator Modeling

- Operator
  - A human subject embedded in a context of activity

- Operator cognitive model
  - A theory about how the operator performs the activity

- Model captures analyst's knowledge
  - Helps the analyst answer questions about how the operator performs the activity

What is an activity trace?

- Inscription of what happened

- Allows the analyst to understand what happened, at least to some extent
  - Help the analyst answer questions about how the operator performs the activity
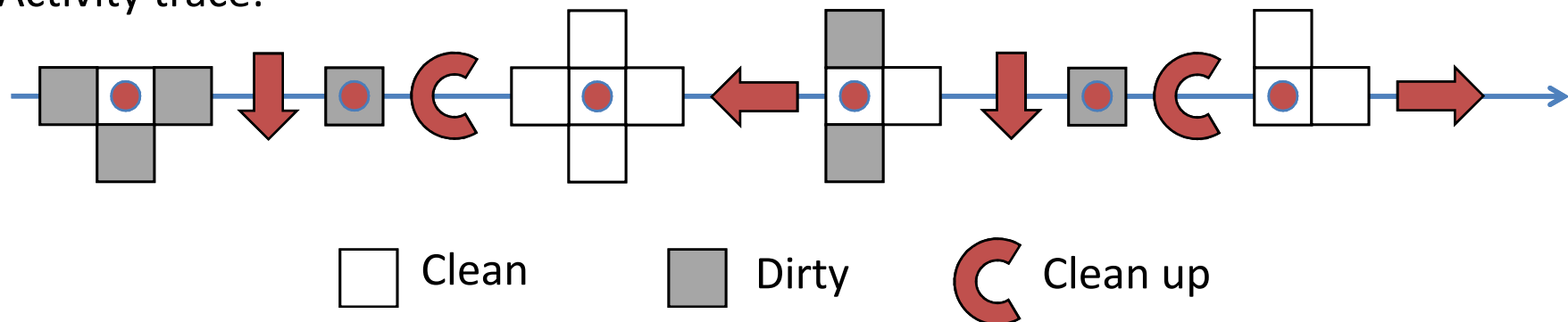
Example of the Vacuum Cleaner
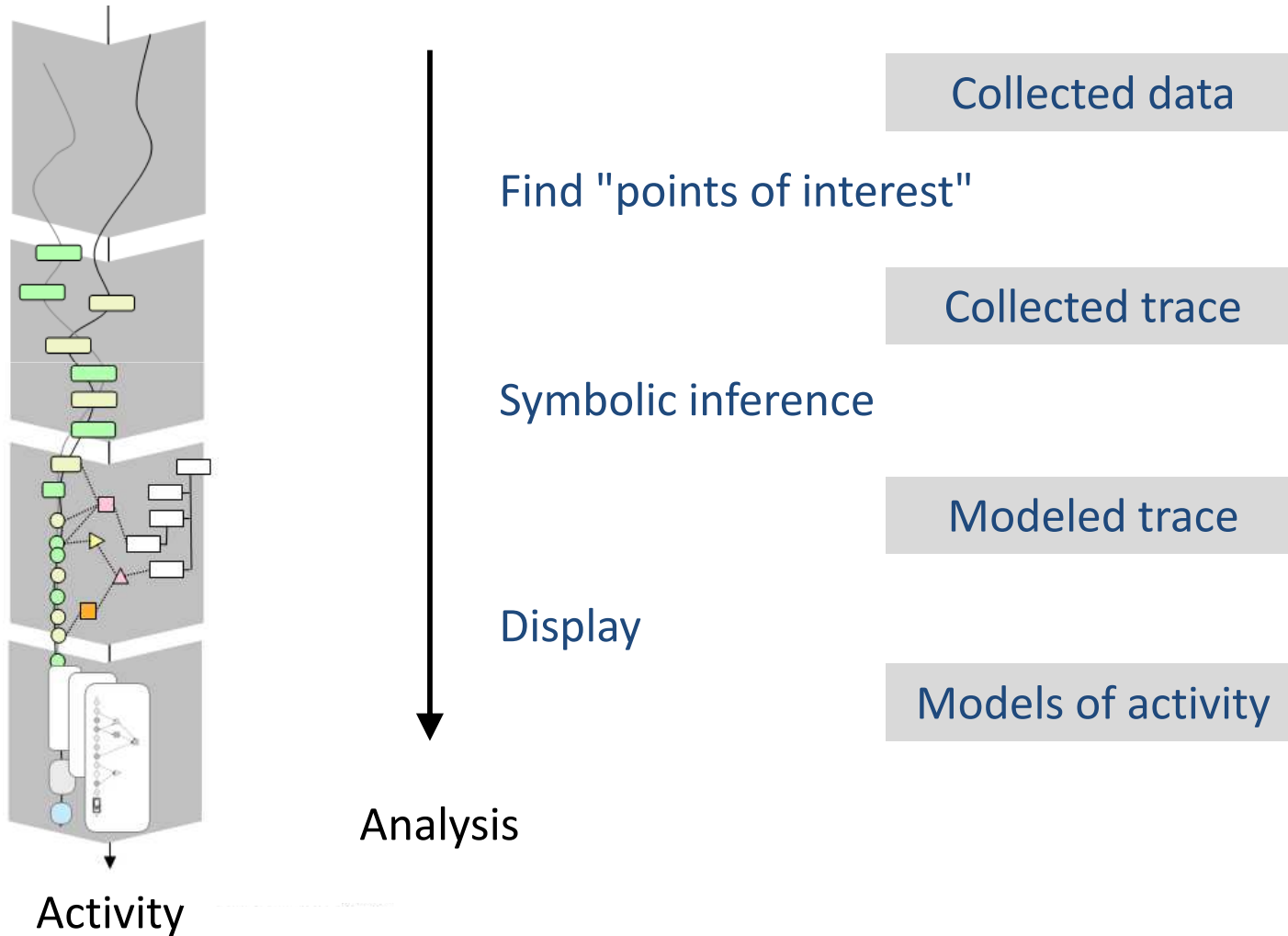
Cognitive model (Herbal -> Soar) :

- Top
  - Clean
    - Clean up
  - Pursue
    - Move to dust (down, up, right, left)
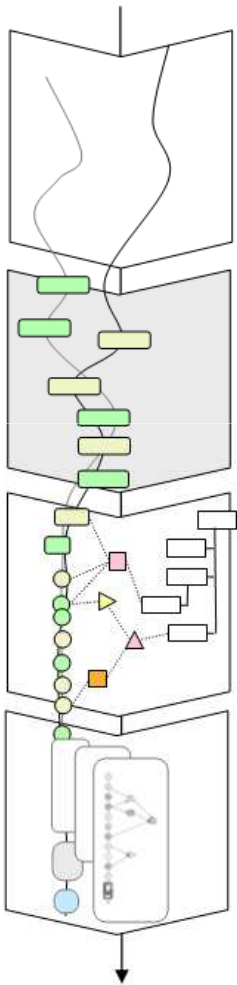 - Wander
    - Random move

Activity trace:

How to build traces of activity?

Collected data

Find "points of interest"

Collected trace

Symbolic inference

Modeled trace

Display

Models of activity

Activity
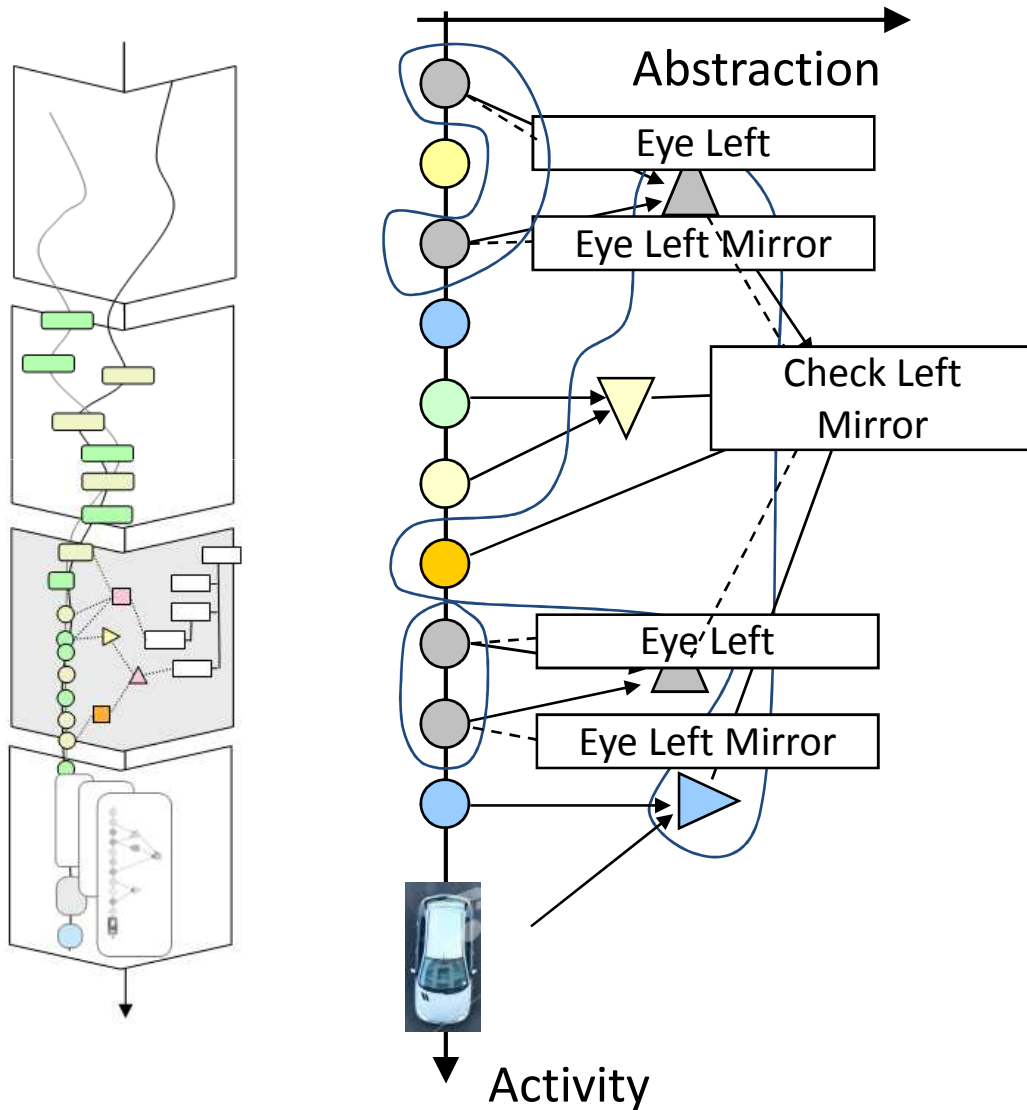
Analysis

Example of the car driver

Sensor data:

   Steering Angle, Pedal use, Speed, Blinker, Eye information (Oculometer), Distance ahead (Telemeter), Cartography (GPS), Actionable button, Video
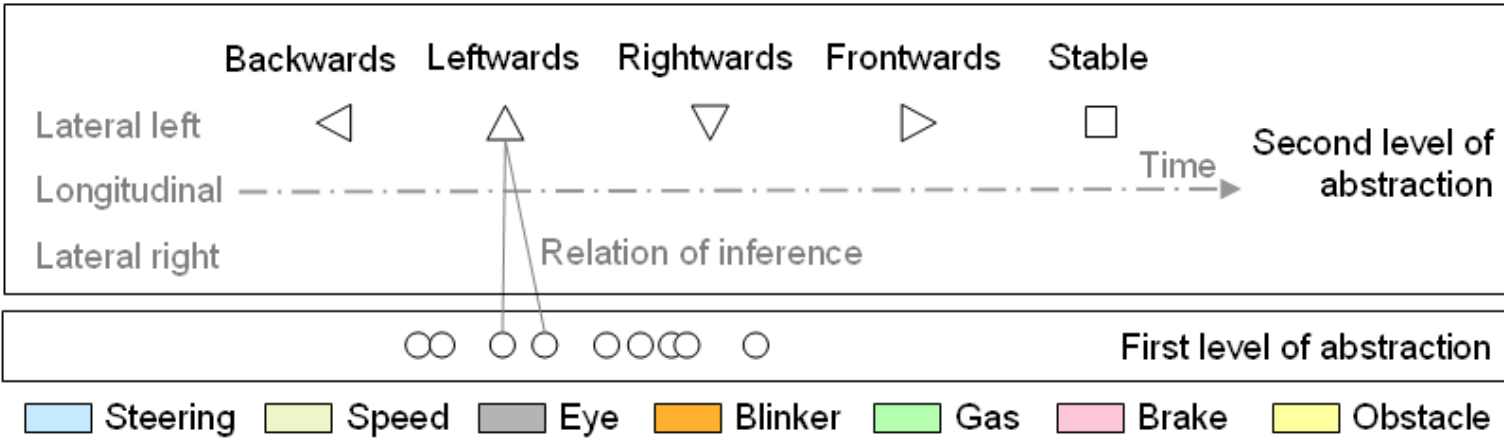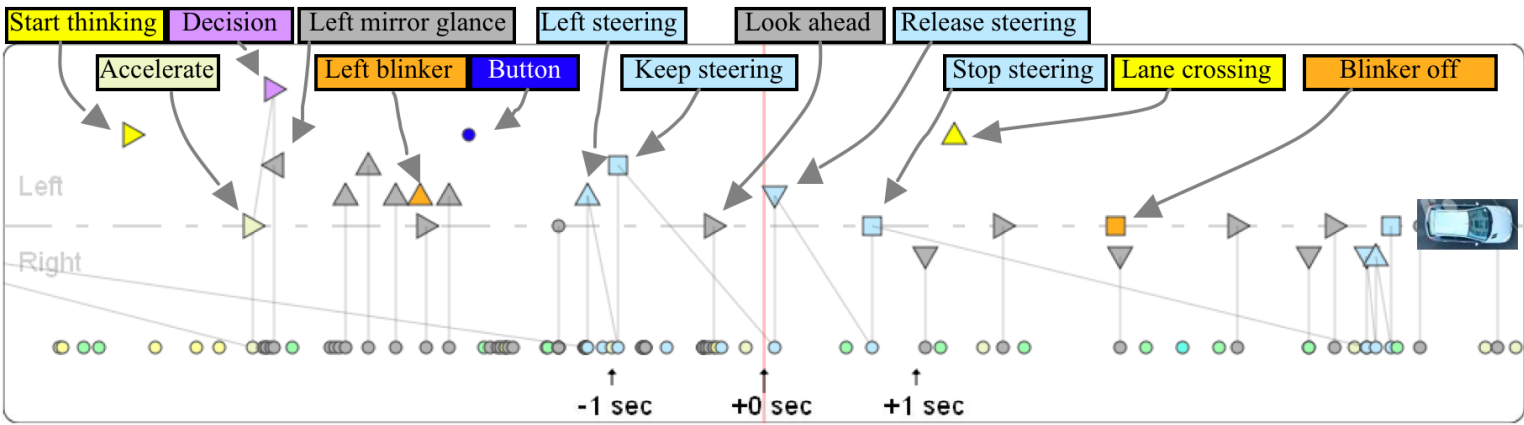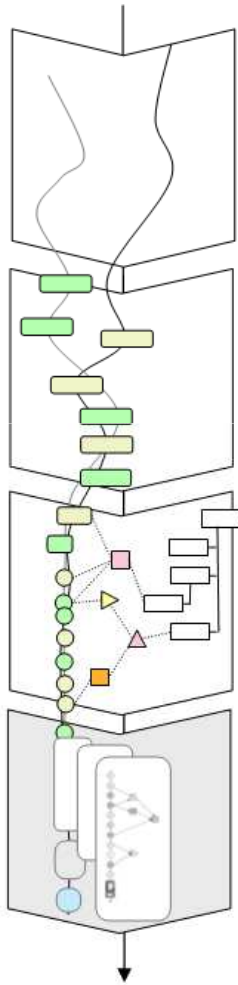
Subjective data:

   Evaluation from the driver in interview with video played. Assessment from the experimenter

Symbolic inference

- Trace is handled as a graph
- Ergonomist defines inferences rules as queries

Models of car driving activity

Model "in extension" vs "in intention"

- Definition "in extension" : give all the cases
  - Example: the set {2,3,4}
- Definition "in intention" : give the rules
  - Example: the set {x $\in$ N where x > 1 and x < 5}

- If traces are properly modeled, the trace database is a cognitive model "in extension".
- But with humans, we never have full cognitive models "in extension" nor "in intention".

Conclusion

- For a trace database to become a cognitive model "in extension", we need:
  - A sufficient set of traces
  - Facilities to understand traces
  - Facilities to model traces, according to our understanding, with our expertise
  - Facilities to query the database, according to this modeling
- This is complementary with cognitive models "in intention"
  - Include episodic memory in cognitive architecture under the form of activity traces