A Cognitive Architecture for Situation Awareness

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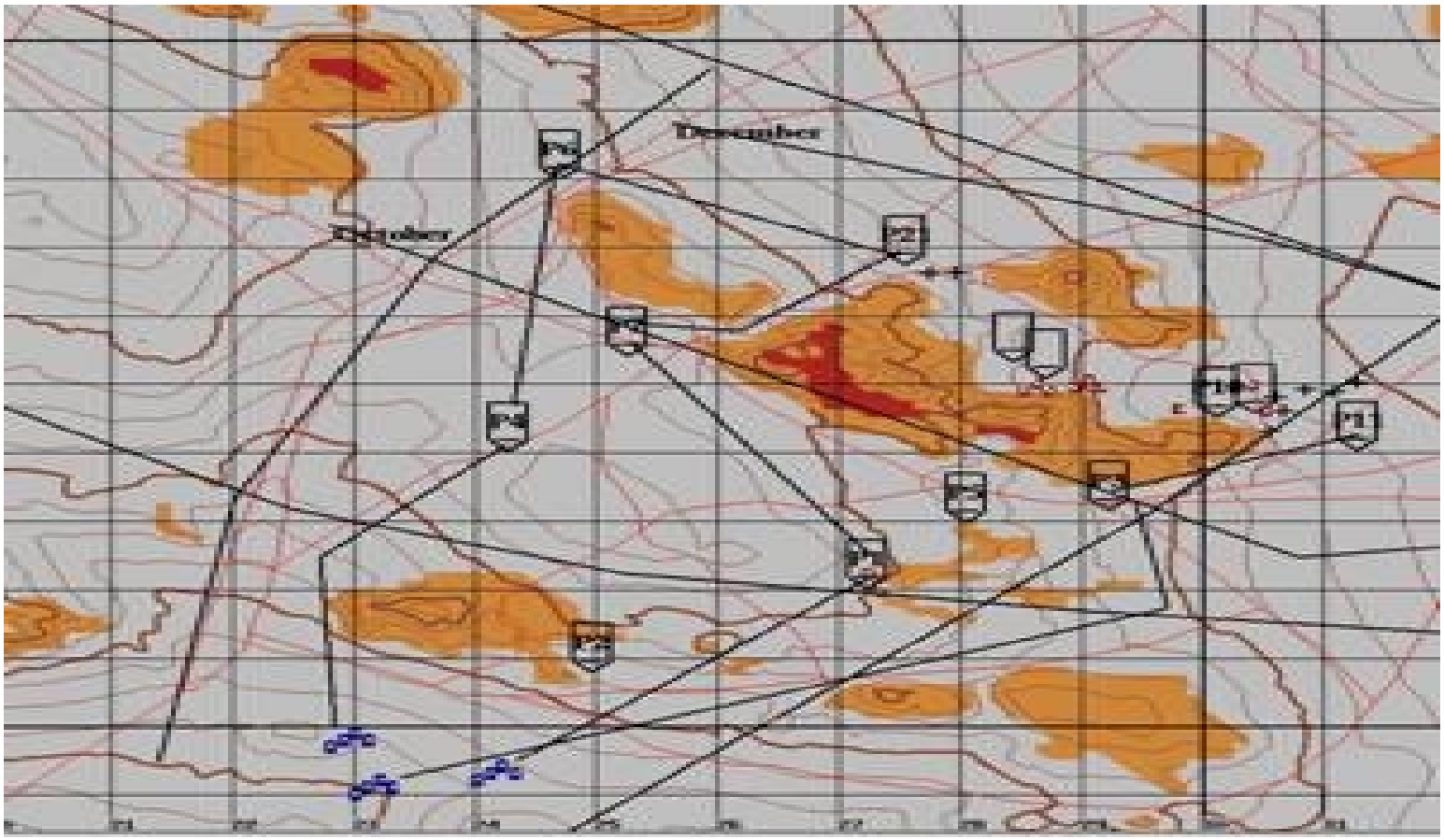
Research Sponsored by the US Army Research Lab

SCENARIO



Situation Awareness (SA)

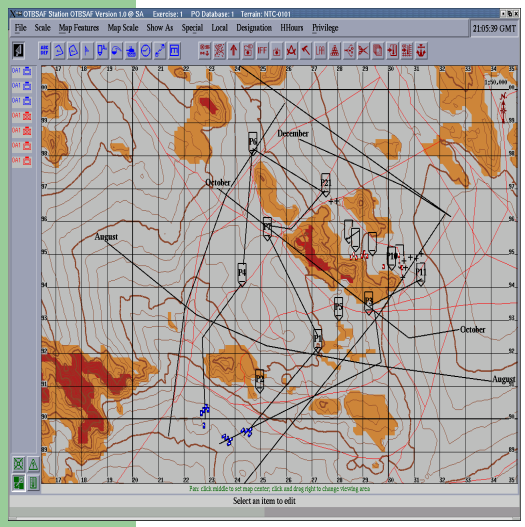
- SA (Mica Endsley)
  - Level1: Perceiving of elements in the environment
  - Level2: Understanding the current situation
  - Level3: Projection of the future status
- SAGAT
  - Situation Awareness Measurement Tool
  - SA Global Assessment Technology
  - Freezes the action to administrate a set of queries to question about the three levels of SA

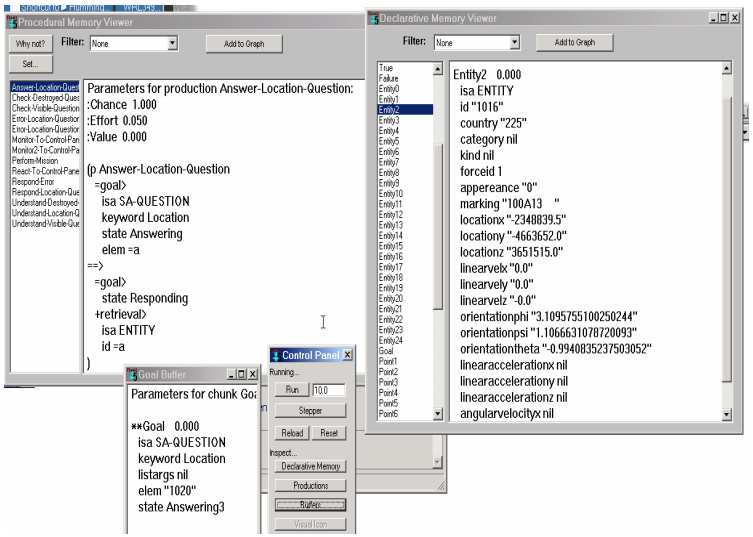
Tools to interact with the ACT-R SA model

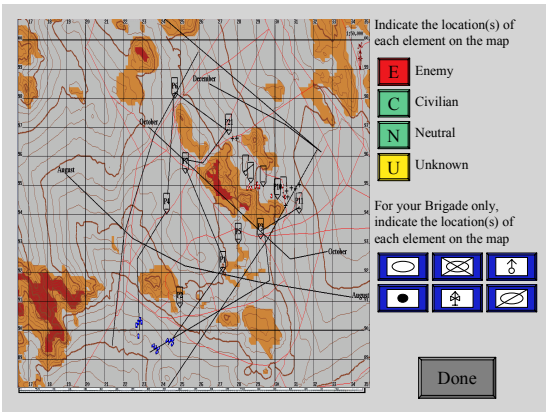
- OTB
  - OneSaf Test Bed
    - Military Product
    - Used to train commanders at Ft. Leavenworth
  - SAGAT data collection
    - A set of queries question the cognitive model
    - Data on the accuracy of the responses is stored

Research Framework

OTB → ACT-R SA Model ⇄ SAGAT







Goals

- Understand the cognitive basis of SA using a Cognitive Model
- Measure SA in humans and in the model using the same instruments
- Implement a model of SA for a military commander

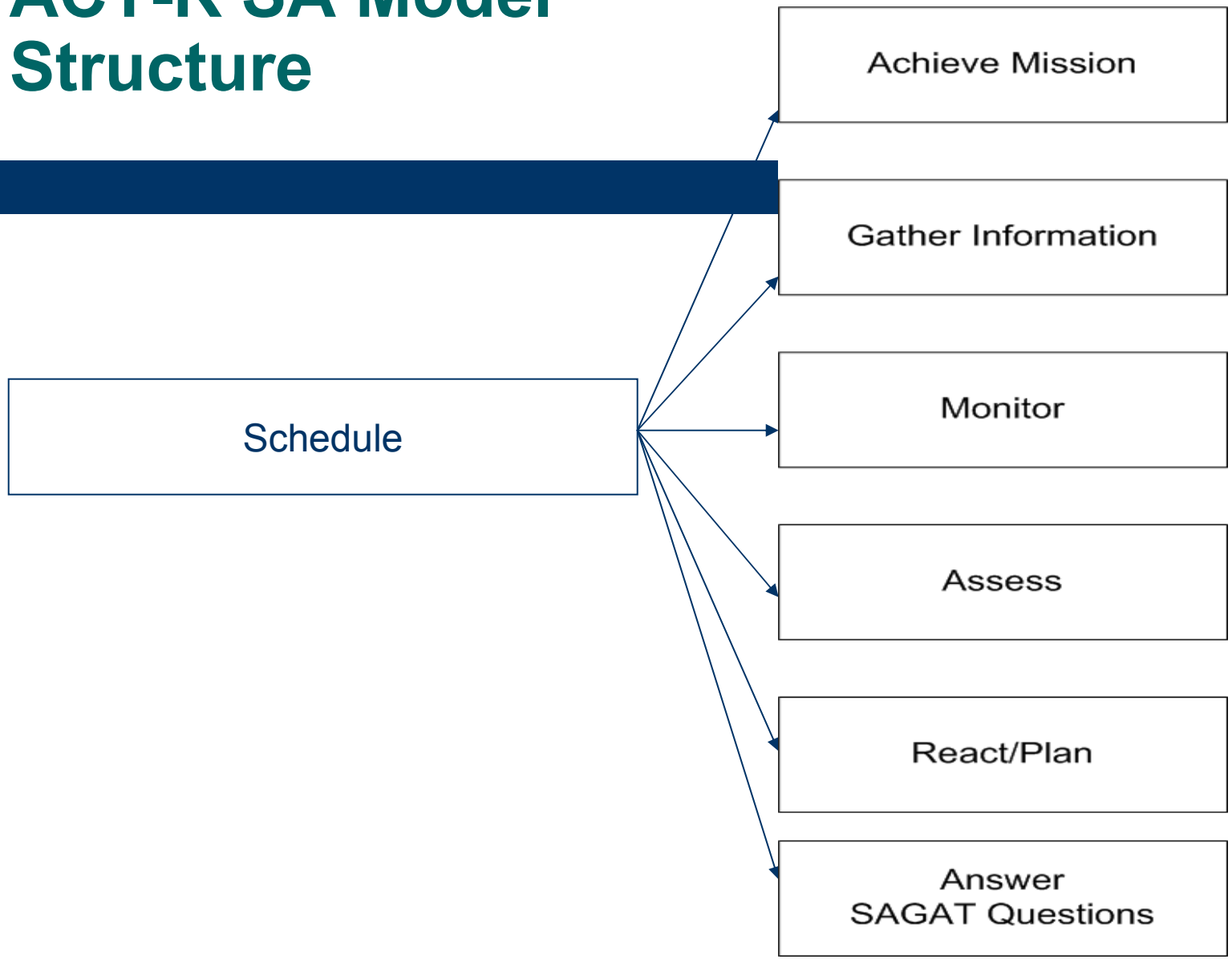
ACT-R SA Model Challenges

- Temporal and spatial reasoning
- Planning
- Information fusion
- Dynamic decision making
- Real-time requirements
- Encoding Experience

Encoding Experience

- Experience Encoded Partially
  - Temporal Reasoning
  - Spatial Reasoning
  - Military Doctrines

ACT-R SA Model Structure



Current ACT-R Model for SA: Level 1

- Accounts for the location of friendly and opposition forces units
- Answers SA questions related to location of units and visibility

State Description

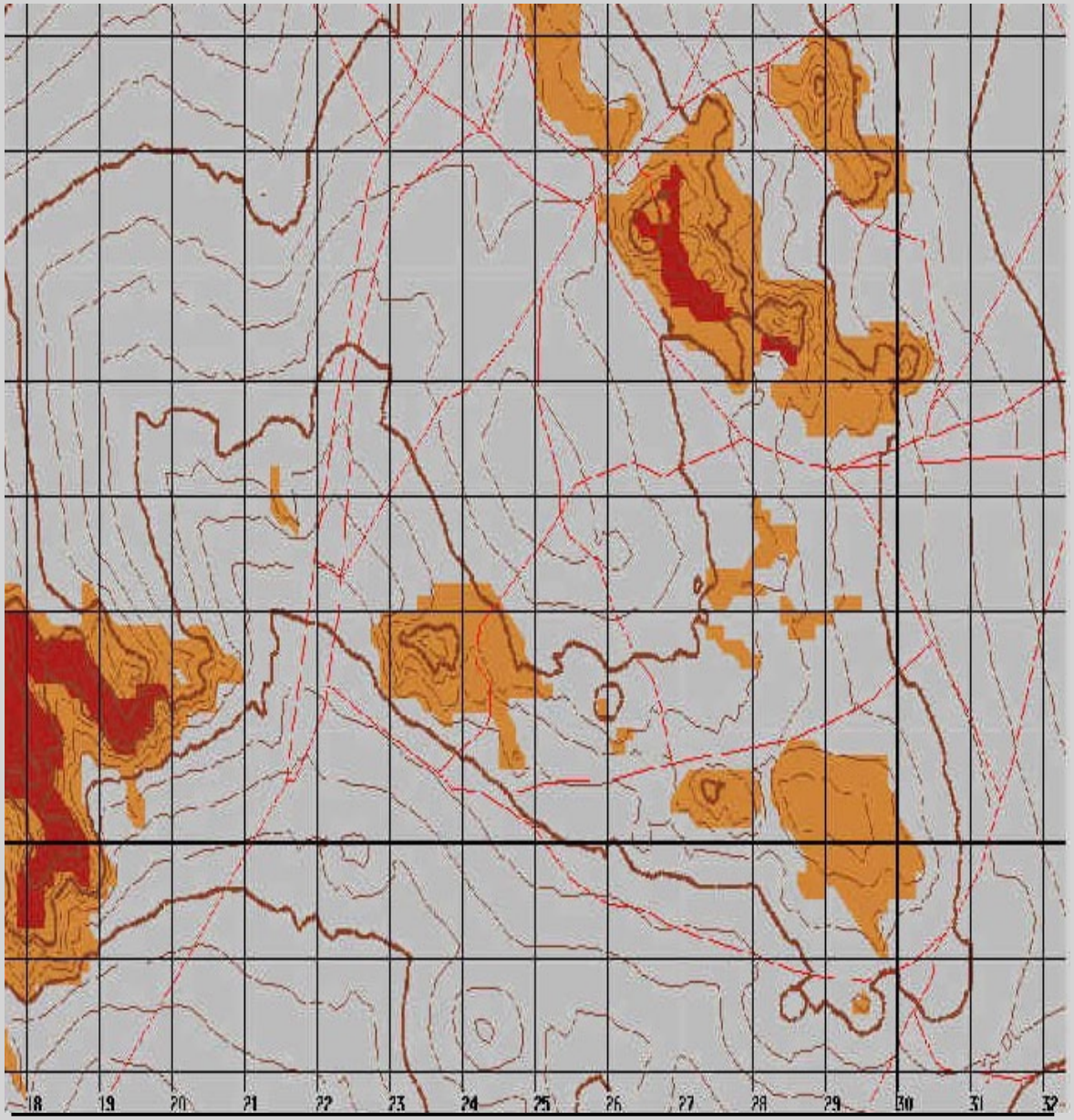
(chunk-type clean-area Opposition Friends nThreat state)

(chunk-type entity Id country category kind forceId
Appearance Marking LocationX LocationY
LocationZ)

A Production Rule

```
(p Answer-Location-Question
  =goal>
        isa SA-question
        keyword location
        state answering
        elem =a
  ==>
   =goal>
        state responding
   +retrieval>
         isa entity
        ld =a
  )
```

Example of SAGAT Question



Indicate the location(s) of each element on the map

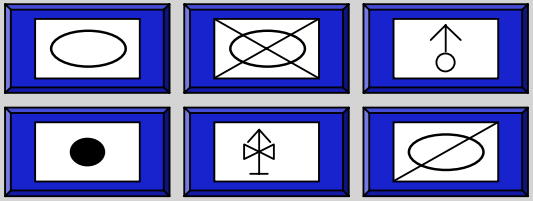
E Enemy

C Civilian

N Neutral

U Unknown

For your Brigade only, indicate the location(s) of each element on the map



Done

In summary the ACT-R Model:

- Has rules to locate friendly and opposition entities
- Estimates visibility between entities
- Evaluates the entities damage
- Answers SAGAT question with incomplete information

Future Work

- Improve/validate current model data
- Introduce intelligence agents in the model to change the existing information gathering process
- Model uncertainty using different formal models
- Complete the model to account for level 2 and level 3 of SA