UNIVERSITY OF WATERLOO

L. I. M. B. S.

Locally Integrated Multi-Brain Systems

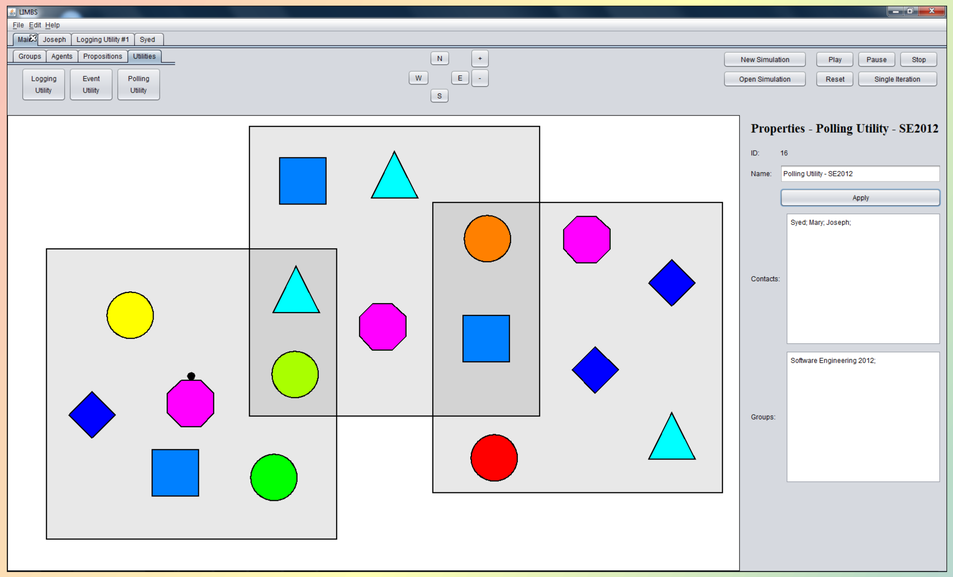
LIMBS models people – the way they interact, make decisions, and react to information within their environment

What is it?

LIMBS is a framework for modeling psychologically plausible people in social situations.

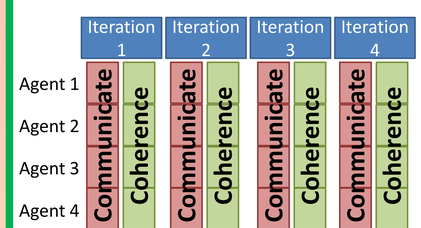
Why?

Artificial Intelligence is hard. LIMBS makes it easier to produce complex models, providing a friendly interface where users can produce socio-cognitive models, without needing to know any programming languages.



Simulation

Each component is contained within its own thread, leading to higher performance across heterogeneous components. Simulations contain iterations of communication and coherence phases. To communicate, components send messages to each other containing aspects of their internal state. In the coherence phase, the internal state is updated according to the messages received, all done in parallel.



Model Structure

Models consist of different types of components:

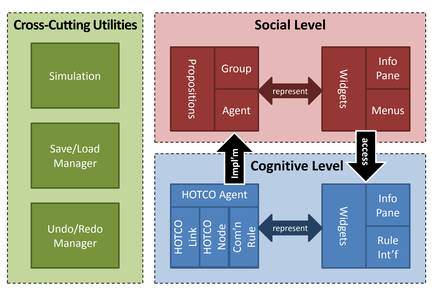
- **Agents**: represent people in the simulation world
- **Groups**: specify the way other components are organized
- **Utilities**: non-affect components which monitor or represent institutions and processes

Propositions: any type of information that agents can communicate to each other; 3 types:

- Actions
- Evidence
- Goals

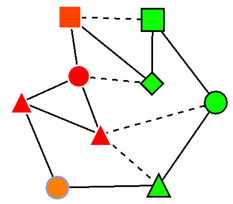
Architecture

The architecture of the LIMBS framework had two major goals: easy-to-use core facilities, and an easy-to-extend cognitive level. This is achieved through creating an easily extendable cognitive layer, with cross-cutting utilities that are agnostic to the structure of that layer.



HOTCO

HOTCO (*hot coherence*) is a numeric framework for modeling a person based on a recurrent neural network where nodes represent concepts and edges represent the coherence or lack thereof between concepts.



The agent's state is updated each iteration by the following equations until the system is stable.

$$a_i^{(t+1)} = \begin{cases} a_i^{(t)}(1-d) + net_i(1-a_i^{(t)}) & net_i > 0 \\ net_i(1+a_i^{(t)}) & else \end{cases}$$

where $net_i = \sum_i w_{ij} a_j^{(t)}$

$$v_i^{(t+1)} = \begin{cases} v_i^{(t)}(1-d) + net_i(1-v_i^{(t)}) & net_i > 0 \\ net_i(1+v_i^{(t)}) & else \end{cases}$$

where $net_i = \sum_i w_{ij} a_j^{(t)} v_j^{(t)}$

After the agent has reached a stable, coherent state, it can send messages to other agents, and absorb other agents' beliefs into its own state.

Who are we?

Danielle Grenier
Kevin Veloso
John Stevenson
John S. H. Baxter

Causal Interaction

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