Command and Control of Mixed Human and Robotic Forces

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Model both Humans and Robots as Cognitive Agents

Using a simple cognitive goal-driven architecture allows modeling of humans, cybernetic and robots in a unified manner. Modeling in this way decouples the cognitive capability from the platform and allows aggregations of entities to be treated as a single cognitive agent.

Cognitive Agent Architecture

Autonomy

We create a 7 level framework based on three cognitive abilities:

1) Matching sensor data to a goal (Sensor)
2) Preparing responses to accomplish a goal (Staff)
3) Deciding which response to take (Commander)

Autonomy Levels: RD + 2*RP + 4*RS								
Level	0	1	2	3	4	5	6	7
Response Demand (RD)		■		■		■		■
Response Production (RP)			■	■			■	■
Response Selection (RS)					■	■	■	■

Research Goal

Develop an Autonomy Framework for Command and Control of Hybrid Forces based upon Cognitive Capabilities. Evaluation will be through experiments in synthetic environments with discrete mission simulations.

VR-Forces Simulation

Hybrid Forces

Task organization and granting of decision rights will determine the autonomy level for each agent's goal process. An agent may have many different goal processes running at the same time.
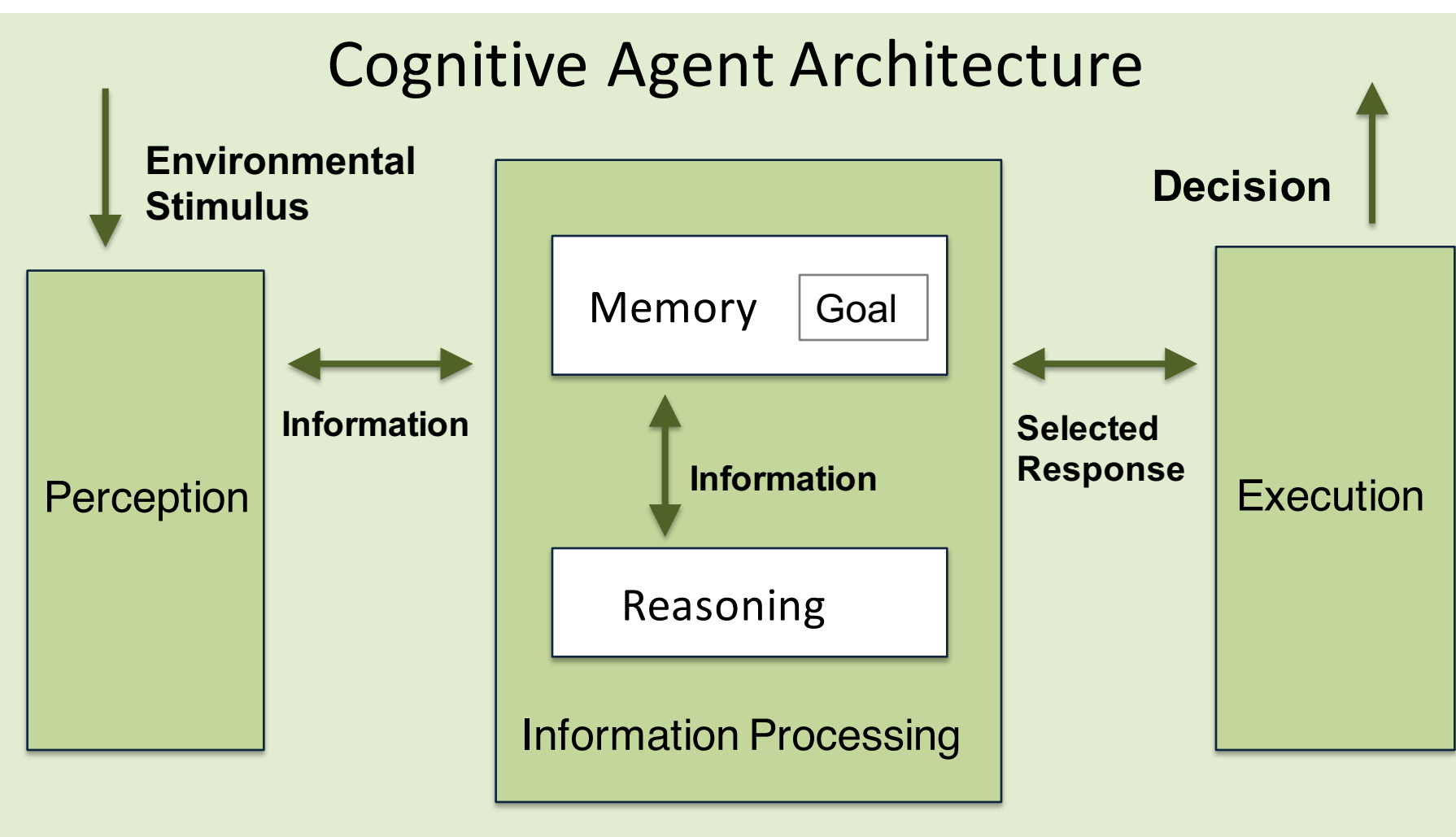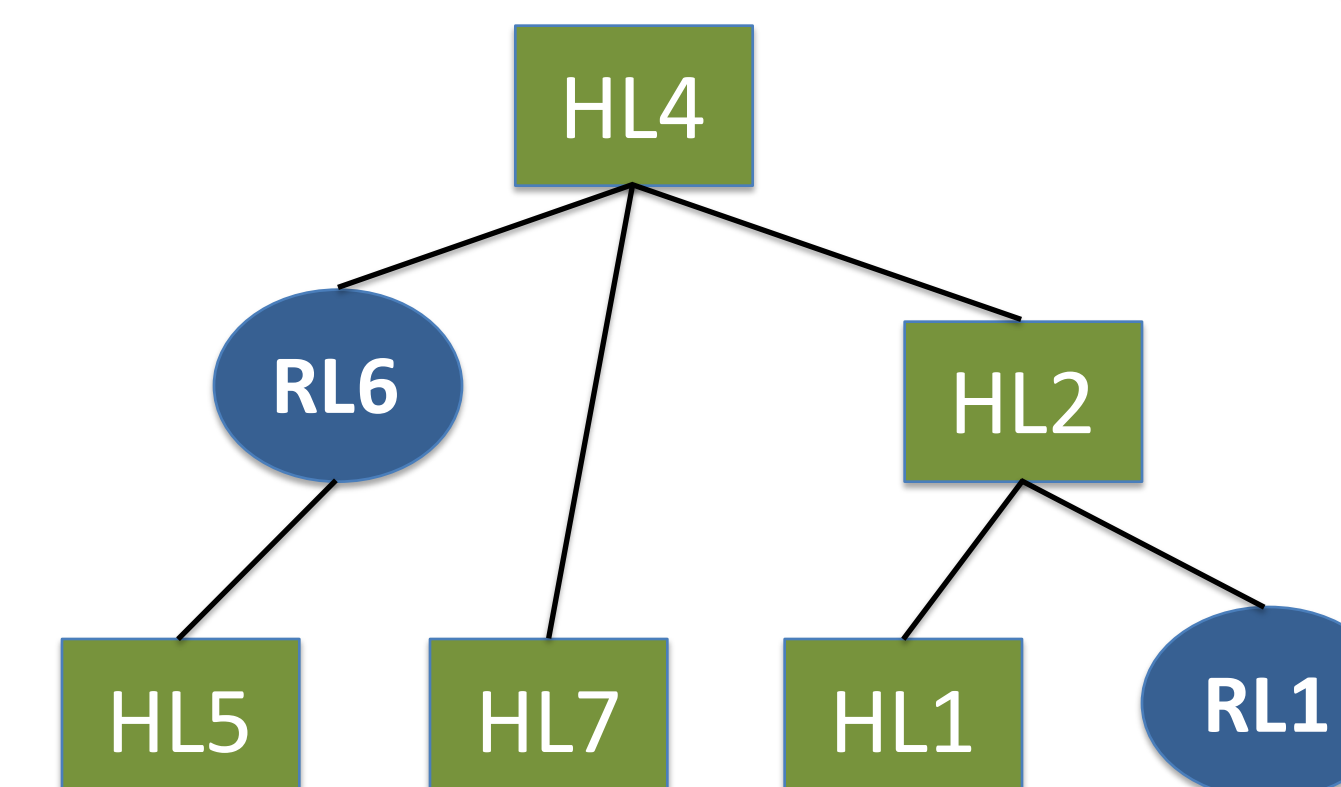
Scenario

A hybrid task force of engineers, UAVs and ground robots is responding to an earthquake in a small town. Upon arriving, the UAVs use their sensors to identify spots where the humans are sent for relief and hostile forces. The ground robots are controlled by both the engineers and UAVs.

Collaboration

The key contribution of this research is to regard humans and machines in the same fashion. Thus a machine may control a human, as well as the more usual construct of a human controlling machines. We see that many agents will have complimentary abilities.

	Human	Machine
Sensing	• Medium glucose level • Multi Dimensions	• Intermittent Electric Power • Low Latency
Abstraction	• High glucose level • Self Organizing	• Continuous Electric Power • Algorithmic
Calculation	• High glucose level • Estimation	• Continuous Electric Power • High Speed
Pattern Discovery	• Medium glucose level • Self Organizing	• Continuous Electric Power • Algorithmic

Focus on Mission

Understanding the mission is key. Units must be organized, trained, and equipped differently for each mission. The autonomy levels can be used to build software and robot interfaces for unified Command and Control.