

## Implementing cognitive semantics in a cognitive modeling system

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Cognitive modeling (CM) systems process information with methods not commonly used in traditional computer software systems. Typically CM systems are: goal-directed; capable of planning; able to integrate and use various levels of task-specific and general knowledge sources; able to encapsulate and exercise rich hierarchical control; able to support various types of learning including semantic, episodic, and reinforcement; and capable of transitioning between deliberation and recognition. Many are agent-based, thus enabling an even wider array of capabilities: rich exploration of the perception/cognition interface, embodiment, agency, emotion, motivation, teamwork, and attention. The scope and variety of CM implementations is steadily increasing.

Language use is a key area of cognition. However, CM implementations that involve language processing are still relatively uncommon. This can be partly explained by the relative paucity of treatment of the above-mentioned cognitive properties by most linguistic theories. Cognitive Grammar (Langacker, 1987) is an outlier in this respect. Still, it has triggered only a modest amount of research in the CM community. Holmqvist's (1993) proposal for implementing cognitive semantics is a good example of a theoretical treatment from an artificial intelligence perspective. His proposal has in turn led to theorizing about how cognitive semantics could be applied as a knowledge source to such areas as robotic control where time, perception, agency, and motion are crucial.

This talk presents ongoing research in implementing Holmqvist's suggestions in a full-scale CM system. As text is input to the system, it performs a full syntactic parse based on current generative-based analysis principles. The system's execution is similar to human performance in several respects: resolution of local structural ambiguity, word sense disambiguation, failure on garden paths and other problematic constructions, incrementality, etc.

Beyond just parsing, though, the system is also capable of generating a semantic representation. Incremental operations on the parse tree induce pieces of semantic structure involving concepts and their relations, based on primitives like word senses, valence, subcategorization, and thematic roles. This interpretive approach to semantics creates a lexical conceptual structure (Jackendoff, 1990). Real-time rendering of the syntactic and semantic data structures is assured via state-of-the-art visualization techniques.

The discussion centers on how semantic processing has been repurposed to implement cognitive semantics as discussed by Holmqvist. The system thus generates an incremental, completely compositional, and syntactically licensed semantic representation. Salient features include the handling of image schemata, superimposition, metaphor, metonymy, and anomaly detection. The talk ends with a discussion of future research and possible applications.

**Keywords:** cognitive semantics, cognitive modeling, parsing, semantic representation

### References

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