Communicating Linguistic Agents

Siamak Rezaei
School of Computer Science
McGill University
siamak@cs.mcgill.ca

ABSTRACT
In this work, we specify a framework for modeling communicating and collaborating systems. This agent model has been designed based on our work for dynamic modeling of language and it has been used for grammatical representation in a dynamic approach.

1. LINGUISTIC PROCESS
There has been a growing interest in frameworks for modeling the communicating agents. Some frameworks have been proposed for this purpose in the field of agent-oriented software engineering. In this work we describe a framework for modeling the structure of communicating agents. This model has been designed for dynamic modeling of language. Specifying an agent model for the language could be the first step in speculating and discovering the cognitive processes for human intelligence. Such a model also bridges the gap between the researchers in language learning in computational linguistics and humanities and the researchers in learning in agent technology.

We specify linguistic agents as communicating process structures. These structured agents can communicate with each other through linguistic channels [2]. Table 1 highlights the main concepts in the two frameworks.

We are using this framework for modeling a range of different cognitive-biological systems from grammatical representation to modeling scrambled genes. Some of the basic mechanisms for learning and evolution in this framework are:

Each linguistic agent can evolve internally by transformation of its structure. Affixation is a simple internal mechanism which might not require complex structural transformations.

Each agent can also evolve externally by the change in its topology of communication. In our approach, it is possible to have examples of communication of processes and even *communication of channels* across channels. These kinds of mobile processes and channels were introduced in the Pi-calculus.

Table 1: Linguistic vs Agent notions

Linguistic Model	Agent Model
Word Order Relations	Agent Order
Argument Attachment	Communication
Local Scrambling	Resource Competition
Long Distance Scrambling	Mobile Channels
Phrase/Word Morphology	Agent Structure
Transformation, Probabilities	Evolution,Learning

There are further constraints on the order of linguistic agents. The agent order and their properties can be changed in the process of learning. The agent order constraints in our framework are examples of fuzzy order constraints [3] and they can be learned.

2. FORMAL MODEL
One advantage of the model is its establishment on top of two other formal frameworks in computational linguistics and process algebras. In another work we have elaborated on possible directions for a channel algebra for this framework based on mobile ambients [1]. The framework has been developed based on our research in application of software engineering techniques for modeling intelligent systems. One area of application of this framework is for modeling communicating and collaborating systems such as the human brain. The brain consists of highly interconnected brain cells and the human intelligence is a product of these communicating and collaborating systems.

3. REFERENCES
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[3] S. Rezaei and M. W. Crocker. A Dynamic Representation of Grammatical Relations. In *Proceedings of the LFG Conference*, University of California, San Diego, June 1997.