

**PhD POSITION (FULL SCHOLARSHIP)
EMERGENCE OF LINGUISTIC STRUCTURES IN MULTI-AGENT SYSTEMS**

Nature of the position: PhD scholarship in cognitive science (3 years)

Location: Laboratoire Dynamique du Langage (French National Center for Scientific Research (CNRS) - University of Lyon), Lyon

Desired profile of the candidate: Master degree or equivalent in cognitive science or computer science

Doctoral Program : Doctoral program in Neurosciences and Cognition, Université de Lyon

Keywords: modeling, cognition, lambda-calculus, multi-agents systems, evolutionary linguistics, origins of language, emergence of syntax,

Background:

The origins of language and more broadly of communication have caught the attention of scientists in fields as diverse as linguistics, biology, archaeology, psychology, computer science, etc. Among these various approaches, computer modeling sheds light on the emergence of a communication system both structured and distributed in a community of speakers.

Models are intrinsically reductionist and often fall short of encompassing the reality. However, they rely on plausible cognitive and social mechanisms. Their design, voluntarily kept simple and controlled, aims at unearthing the sufficient and/or necessary conditions of the emergence of a communication system.

Since the nineties, simulations have developed both in their range and complexity. From the emergence of a shared lexicon, they have shifted to the development of shared sound systems and syntactic structures. The “speakers” often consist of a purely virtual/software multi-agents system.

The emergence of regularities and structures in a communication system is a tough issue. Getting from basic rules – word order, declination systems, compositionality etc. – to more complex structures in particular raises a number of challenges.

Proposed approach:

The question of the emergence of complex structures in a shared communication system suggests relying on specific linguistic models and/or mathematic paradigms. They must on the one hand be rich and flexible enough to allow the emergence of original structures, yet on the other hand constrained enough for simulations to actually give birth to stable structured systems. The theory of construction fluid grammars, which underlies some of Luc Steels’ work, illustrates the search for an adequate modeling approach.

The PhD candidate will study the relevance of a mathematical formalism, lambda-calculus, for the modeling of the cognitive operations of software agents involved in the emergence of a communication system. This formalism has received attention in the quest for a general theory of functions, and has already been put to use in the study of other emergent phenomena. Fontana, Walter and Buss have for example applied it to the origins of life, and the emergence of organized and self-reproductive forms.

Lambda-calculus may be successfully applied to the emergence of linguistic regularities too:

- i) its main features echo those of human language: sequentiality and recursivity ;
- ii) its strong generativity and its internal constraints are good candidates for the emergence of diverse and original structures during simulation.

Linguistic theories such as categorial grammars, where syntactic constituents get assembled like functions applied to arguments, will provide a background to the models.

Results observed in various publications will first have to be reduplicated with the new paradigm: emergence of compositionality or word order etc. Other structures will then be studied, whether at the syntactic, phonological or morphological levels. Special attention will be granted to the ecology of the models, with the inclusion of cognitive constraints in terms of memory, capacity of processing etc. of the agents.

Work will take place at the Laboratoire Dynamique du Langage, where i) the candidate will benefit from the knowledge in modeling and simulation of several lab members, ii) the diversity of research themes – in descriptive linguistics, anthropology, psycholinguistics etc. –, will guide the development of models well-rooted in the cognitive and social reality of speakers. Collaborations with other research teams will be encouraged.

Required skills and experience:

- Strong programming skills mandatory (preferably C++)
- Experience in modeling and artificial intelligence
- Ability to deal with advanced mathematical formalisms (lambda-calculus)
- Knowledge in linguistics and/or psychology preferred, or strong motivation to acquire a range of notions in these domains

Income:

Monthly gross income: 1676,55 € (around 20% have to be deduced for taxes)

Application Deadline: October, 15 2010

Contacts:

François Pellegrino
Research Director, CNRS
Laboratoire Dynamique du Langage
francois.pellegrino@ish-lyon.cnrs.fr

or

Christophe Coupé
Research Associate, CNRS
Laboratoire Dynamique du Langage
christophe.ccoupe@ish-lyon.cnrs.fr