PhD in Bayesian modeling of reading

Location: Campus of St Martin d'Hères, Laboratoire de Psychologie et NeuroCognition CNRS UMR 5105/UGA, Grenoble, France

Type of contract: temporary contract

Duration: 36 months

Tentative starting date: 10/01/2017 (October 1st)

Tentative schedule for the selection process: we will receive applications and conduct interviews throughout the summer: the position is considered open until it is fulfilled (and up until August, 31st for applications, until September 8th for interviews, at the latest). Skype interview requests will be taken into account if justified; do not hesitate to ask if the position is still available before submitting a complete application.

Contract type: full time

Net Salary: around 1,450 €/mth

Required diploma: Master's Degree in Cognitive Science, Computer Science or related field

Previous experience: Previous experience with modeling research in cognitive science would be a bonus.

Supervision: The PhD candidate will be jointly supervised by Sylviane Valdois (DR CNRS) and Julien Diard (CR CNRS)

Contacts for more information and for sending applications:

Sylviane Valdois sylviane.valdois@univ-grenoble-alpes.fr (+33) 4 76 82 78 07
Julien Diard julien.diard@univ-grenoble-alpes.fr (+33) 4 76 82 78 07

Elements to provide in your application:

- Cover letter presenting your application (motivation, professional project)
- Complete CV, featuring your publication list and/or your scientific communications list
- Master's Degree transcript of records and/or certificate
- Title and summary of your Master's Degree research project (supervisor name, University, grade if applicable)

Applications can be written in French or English. The working language will be French or English. In case of doubt, or for preliminary questions, informal enquiries are encouraged before submitting complete applications.

Missions:

The PhD candidate will aim at developing, implementing and experimentally assessing a mathematical model of reading aloud, and studying its learning.

Project context:

This PhD is part of a large-scale project, called "FLUENCE", of the e-FRAN project call, operated by CNRS and funded by the "Caisse des Dépôts et Consignations". The goal of this project is to create and experimentally validate new computer-based systems that improve reading acquisition in school, so as to improve education quality.

The PhD candidate will work in the Laboratoire de Psychologie et NeuroCognition (LPNC – CNRS UMR 5105), a research lab of about 100 researchers, divided into 3

research teams (Language, Memory and Cognitive Development, and Perception and Sensori-Motor systems). More precisely, the PhD candidate will be part of the Language research team.

The PhD candidate will integrate the research group of S. Valdois and J. Diard, that also includes several PhD students and MD students, among which: Thierry Phénix (development and experimental validation of the BRAID model), Emilie Ginestet (modeling of orthographic learning in BRAID), Svetlana Meyer (design of an action video-game that targets attentional training in order to improve reading acquisition).

Scientific description:

In the domain of reading modeling, most of the models are either models of visual word recognition, that focus on visual properties (such as positional coding, parallel processing, etc.), or models of reading aloud, that focus on phonological properties (association between written symbols and sounds, serial processing, etc.). Our main objective is to unify these approaches by extending a model of visual word recognition, the BRAID model, into a model of reading aloud, the BRAID-Phon model. The BRAID model (for "Bayesian word Recognition model with Attention, Interference and Dynamics") is a probabilistic model that includes an attentional component, which is quite unique in the field. BRAID successfully reproduces a large number of known experimental effects, allows simulating word recognition deficits that are present in some pathologies, and the manner in which visual word representations are learned during reading acquisition.

We want to extend the BRAID model by implementing additional components to simulate reading aloud. Current reading aloud models are usually structured as dual-route models. They assume two processing pathways: the first is lexical and parallel, directly associating orthographic representations of words to their phonological representations, and the second pathway is sub-lexical and serial, associating graphemes (sequences of letters) and phonemes (elements of sounds). Such models usually assume, for instance, that the sub-lexical route is used for decoding new words and pseudo-words.

Our theoretical assumption is to try to do away with this structural assumption. We propose that a model of reading aloud, if it features an attentional component, will be able to successfully decode the stimulus, whether it is a word or a pseudo-word. Visual attention will make the dynamics continuously go from a slow, serial decoding (for pseudo-words) to a fast, parallel decoding (for words).

To extend the BRAID model into the BRAID-Phon model, we will draw inspiration from other modeling works, developed, in the context of speech perception and production, by J. Diard in collaboration J.-L. Schwartz and P. Perrier of the GIPSA-Lab, that deal with how phonological representations can be modeled. We will first compare the BRAID-Phon model with other models of the literature, on theoretical grounds, and second, compare the predictions of the BRAID-Phon model, obtained from computer simulations, with experimental data. Moreover, we will aim at defining new experimental predictions, specific to the BRAID-Phon model, in order to suggest new experimental protocols. Finally, we will study the model's capacity to simulate reading acquisition and various types of deficits (e.g., dyslexia).

Required skills:

Applicants will need to have a Master's Degree diploma, in Cognitive Science, Computer Science, or a related field. The doctorate school that the applicant will be affiliated with will be either the EDISCE (Engineering for health, cognition and the environment doctorate school) or the EDMSTII (mathematics, information science and technology, computer science doctorate school), depending on the selected applicant's specialty. Required skills include mathematical modeling, probabilities, algorithmics, and the mastery of both a computer programming language (e.g., C++) and a scientific computation software (e.g., Matlab). The BRAID model's current implementation is written in Mathematica. Oral and written communication skills are required. An interest for cognitive science and experimental psychology is expected.

For more information:

- Julien Diard's website: http://diard.wordpress.com
- Sylviane Valdois's website: http://lpnc.univ-grenoble-alpes.fr/Sylviane-Valdois
- LPNC website: http://lpnc.univ-grenoble-alpes.fr/
- FLUENCE project's website: http://lpnc.univ-grenoble-alpes.fr/Fluence or http://fluence.cnrs.fr/

Main activities:

- Scientific development of the project
  - Mathematical and probabilistic modeling
  - Software development and simulations
  - Literature review, theoretical comparison with other models
- Scientific writing
  - Prepare scientific communications (posters, talks, publications, etc.)
  - Present the project and its results in national and international conferences and workshops
- Supplementary activities
  - Teaching (in the "university teaching and research" program) is a possibility, to discuss early in the PhD (French proficiency required).

Theoretical, general, and domain-specific knowledge:

- Deep knowledge of cognitive science and computer science
- Good knowledge of data visualization and data processing softwares
- Good or excellent English level

Relational skills:

- Working in a group
- Project and personal time management
- Communication skills