PhD position in Artificial Intelligence, Bioacoustics, Cognition, and Speech Sciences

Interactive rhythms and vocal learning

The overall rationale of the project
How do two or more individuals coordinate their vocal communication in time? Interactive vocal rhythms are key in many aspects of our life: language, music, sport, religion, etc. To understand them, several unrelated fields have studied what is shared among languages, in non-human species, or computer-simulated interactive behavior. Mysteriously, these rhythms are partly absent in other apes, our closest relatives, but present in a few selected mammals. Studying interactive rhythms, and their hypothesized link with vocal learning, in these mammals is key to understanding how we as humans have speech and music. This multidisciplinary project will address three questions about human interactive vocal rhythms: What is their fine-grained structure and how do they differ from non-vocal or non-interactive rhythms? How unique are they to our species, both behaviorally and neurally? Can we 'teach' computers how to separate individual contributions from multiple speakers, and, conversely, what are the minimal computational requirements to produce interactive rhythms? This project will tackle these questions by studying interactive rhythms 1) not only in human speech, but also in 2) human music, 3) animal vocalizations, and 4) computer simulations. Approaches from zoology, linguistics, informatics, music cognition, acoustics, and cognitive neuroscience will pin down the unique features of interactive vocal rhythms in humans, and test hypotheses on their evolutionary origins: The reasons why we are chatty, rhythmic animals will become less of a mystery.

The envisaged research of the PhD student
The PhD candidate will tackle the computational and quantitative side of this project, collaborating with another PhD student already performing empirical work in humans and seals.

In practice, the PhD research will focus on developing a cognitively plausible model of the interplay of rhythmic and vocal learning capacities in humans and other animals. This model would test, using a cognitively plausible approach – for instance based on a neurologically and cognitively constrained deep neural network – the hypothesis that the ability to entrain to a beat and the ability to do open-ended vocal imitation are evolutionarily linked. If a model that can solve the one task can also solve the other, this provides powerful support for the hypothesis, and it can help to understand why and how these two abilities are linked. If such a model cannot be constructed, it provides evidence that the hypothesis may not be correct, and may help to provide alternative explanations. In both cases the model would provide insight into how the mechanism(s) for rhythmic entrainment and vocal imitation work.

In addition, the PhD candidate may also work on 1) quantifying interactive vocal rhythms in multi-party human conversations using tools originally developed in music cognition, dynamical systems, econometrics, and topology, and 2) modeling, via computer simulations, interacting agents communicating rhythmically according to different strategies.

Logistics
The PhD candidate will be based at the AI Lab at the VUB in Brussels, Belgium. They will be supervised by Prof. Bart de Boer, the promotor. The student will be co-supervised by Prof. Sonja Kotz (Maastricht) and Dr. Andrea Ravignani (Max Planck Institute, Nijmegen). If interested, there is the possibility for the candidate to enroll in a double PhD to obtain one doctorate in artificial intelligence and second doctorate in psychology.

The PhD position

The PhD is full-time and fully funded for 4 years, under the condition that the student receives a positive evaluation on their yearly PhD progress report. The precise amount of the scholarship is calculated based on governmental guidelines that take your experience into account.

In addition to the scholarship you have the following benefits: Reimbursement for travel to and from work; Medical insurance; Ecocheques; 35 holidays per year; And all the facilities that the VUB campus has to offer: sporting facilities, the student restaurant and professional training programmes.

Requirements

The successful applicant will have as much as possible of the following:

- Obtained or shortly expects to obtain a MSc or MA qualification in AI, Computer Science, Computational Biology, Cognitive Science, Engineering, Speech/Language Sciences, or a related discipline involving the study of sound and/or cognition and/or behavior; Masters degrees should involve several months of experience and training on a scientific project;
- Notice, however, that *motivation, curiosity, and interest in the research topic and programming skills are much more important than the specific training the candidate* obtained *during their BSc and MSc;*
- Some knowledge of speech and/or bioacoustics, and familiarity with their methodologies;
- Good written and verbal English;
- Good social and organizational skills;
- A solid background in algorithms, computation, and/or machine learning;
- Experience with computer programming, especially Python, but preferably also a compiled language.

Application procedure

Please send the following documents in a single pdf file by e-mail to Interactive.rhythms@ai.vub.ac.be with subject 'Application: PhD position rhythm':

  i. A current CV, listing relevant experience and containing a list of your publications;
 ii. One letter of recommendation plus names, email addresses and contact numbers of two more referees who would be willing to provide letters of recommendation;
iii. A one-page statement of why you are interested in this post and why you consider yourself a good match for the post;
 iv. A one-page general statement of which research projects you would like to pursue during the whole PhD, with your name and suggested earliest, latest and preferred starting date as header.

For informal scientific enquiries, please send an email to Interactive.rhythms@ai.vub.ac.be with subject 'Scientific enquiry: PhD position rhythm'. Short-listed candidates will be invited to participate in a skype interview. The job interview will be held in English.

Please send all your application documents by **January 31st 2021**. Applications will be reviewed **from February 1st 2021** onwards. The starting date is negotiable and should be between April and September 2021.