

Ph.D./M.Sc.. Project: Design of an electronic earpiece with increased auditory naturalness



General Information

Research fields: Design of an electronic earpiece with increased auditory naturalness
Advisors: Prof. Jérémie Voix <Jeremie.Voix@etsmtl.ca>
Location: École de technologie supérieure, Montréal, Quebec, Canada
Starting date: Winter 2022 Semester



1 Description

The goal of this project is to achieve auditory naturalness by mitigating occlusion and isolation effects for all day wearing of an electronic in-ear device (aka "hearable"). Currently, CRITIAS is working on a musician's earplug, a digital hearing protection device specifically designed to mitigate the occlusion (cancelling the musician's own "wind" instrument or voice) and isolation effects (uniform attenuation across frequencies and accounting for the change in hearing sensitivity caused by the attenuation) [1-2] and is now interested in exploring hybrid electromechanoacoustical approaches involving electrodynamic speaker membranes for the active control of the residual sound pressure in the occluded ear canal both for incoming (isolation effect) or outgoing (occlusion effect) sound waves.

[1] Bernier, A., Bouserhal, R.E., Herzog, R., and Voix, J., "Design and assessment of an active musician's hearing protection with occlusion effect reduction," *J. Audio Eng. Soc.*, vol. (In Press), p. 23, 2021.

[2] Bernier, A., and Voix, J., "Active musician's hearing protection device for enhanced perceptual comfort," in *Euronoise 2015*, Maastricht, Netherlands, Jun. 2015, pp. 1773- 1778.

2 Supervision and Funding

Supervision will be provided by Prof. Jérémie Voix. Prof. Voix is an acoustics specialist and chairholder of CRITIAS. Financement via la Chaire de recherche industrielle ÉTS-EERS en technologies intra-auriculaires (www.critias.ca) ainsi que via des stages MITACS au sein de la compagnie EERS Global Technologies Inc. (www.eers.ca)

3 Location

École de technologie supérieure is located in Montréal, Québec, Canada. Often described as an appealing blend of North American and European culture, Montréal is a safe, multicultural city, nice to live in, with an affordable cost of living. Since its inception in 2016, Montréal has constantly ranked as Quacquerilli Symonds' Best Student City in North America. Montréal is also recognized for its quality of life. Close to both peaceful rural beauty and exciting ski slopes, this dynamic city offers lively districts and many green spaces. Located in the heart of the city, the ÉTS campus is easily reached by bicycle or public transit.

Since its creation, ÉTS has pursued a mission that is deeply rooted in all its activities: To meet the needs of the industrial sector, which is in need of engineers who have not only a good theoretical background, but also practical knowledge. To fulfil this mission, ÉTS has a unique partnership with the business and industrial spheres that includes both small and large companies. It stands out from other universities in Quebec because of the applied training it offers students, as well as its research activities conducted by and for companies. Furthermore, this position is affiliated with the ETS-EERS Industrial Research Chair in In-Ear Technologies (CRITIAS) located at the Carrefour d'innovation INGO, which offers a unique and intimate relationship with the industrial partner EERS, located just across the hall.

4 Requirements

- Good oral and written communication skills in french and/or english
Une préférence sera accordée pour les candidat.e.s maîtrisant le français, langue officielle du Québec
- Bachelor's degree in Mechanical or Electrical Engineering with courses in signal processing, system modeling, as well as sensors and actuators
- Proficiency in signal processing
- Experience with machine learning is an asset
- Interest in speech science

5 How to Apply

Interested candidates should send to Prof. Jérémie Voix <Jeremie.Voix@etsmtl.ca>, their CV, university transcripts, contact information of suitable references, and a short statement (max. 1 page) describing how their experience is relevant to successfully carrying out this project.