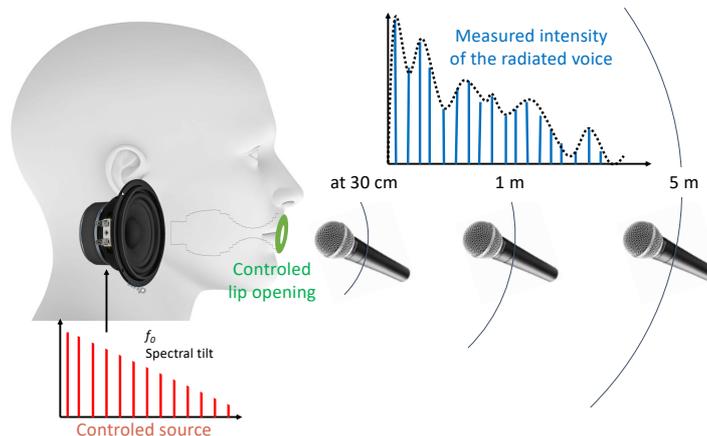


## Influence of mouth opening on voice radiation – measurements on human beings and artificial head

**Context:** Modifications of the vocal tract articulation are observed with increased vocal effort. In particular, speakers substantially increase their mouth opening when speaking loudly. The reasons or motivations for these vocal tract modifications are not yet fully understood.

**Research question:** The internship aims at better understanding the contribution of mouth opening and lip shape to variations in vocal intensity, and to what extent increasing the radiated power might be the primary objective of lip hyper-articulation observed in loud speech.

**Project:** The project will consist in running an experiment aiming at establishing the relationship between the overall intensity of the radiated voice – as measured on axis, in front of the speaker at several distances from the lips, and varying degrees of lip opening. To provide the ability to modify only the mouth opening (the glottal source and vocal tract shape remaining identical), the experiment will rely on the construction of an artificial head. The glottal source will be produced by a small loudspeaker located inside the head, connected to a realistic vocal tract configuration made by 3D printing. The area of its mouth opening will be able to adjust to different dimensions, corresponding to those naturally observed in speakers from murmured to shouted voice. The “glottal sound”, as played at loudspeaker, will be controlled in fundamental frequency  $f_0$  and spectral slope, in order to explore the possible interaction of these parameters with the radiation phenomenon in terms of the measured sound level at various distances from the head. The first step of the internship will therefore consist in developing and testing the artificial head, involving both mechanical and electrical skills. Then measurements will be conducted with the artificial head as well as human being participants in an anechoic chamber with several aligned microphones. Finally, the collected data will be analyzed and a report will be written, possibly under the form of a scientific article.



**Required skills:** Basic programming and signal processing skills. Knowledge in acoustics, voice production, and practical/experimental ease will be appreciated.

**Developed skills:** Theoretical knowledge on voice acoustics; Experimental design and acquisition of acoustic and articulatory data; Management of a whole experiment; Audio signal processing; Scripting in Python, Matlab and R.

**Supervision:** The project will take place over a period of 4 to 6 months, supervised by Maëva Garnier and Paul Luizard.

**Internship granting:** Monthly allowance of about 400 €.