Vocal tract biomechanics and regularities in speech production.

Pascal Perrier
DPC/Gipsa-lab
CNRS & Grenoble University
Grenoble France.

Articulatory and acoustic speech signals are the results of the movements of the vocal tract articulators. These articulators made either of bones or of soft tissues, have complex and variable biomechanical properties. In our research group, we believe that the influence of these biomechanical properties on the spatio-temporal patterning of speech signals and, consequently, on important phonetic characteristics of language is important and in some cases determining.

This is why we have been working in the last 15 years on the development of biomechanical models of the speech production apparatus. 2D and 3D models of the tongue, the face and the mandible have been designed, with increasing requirements in terms of realism and complexity. These models have been extensively used to assess the constraints that biomechanics impose to speech production outputs.

In this talk, the models will be presented and their implications for the understanding of general properties or regularities of articulatory signals, shared across languages, will be analyzed. We will focus more specifically on the well-known degrees of freedom of the tongue, front raising and back raising, on saturation effects for the tongue and for the lips, as well as on articulatory loops in the production of VCV sequences, when C is a velar consonant. We will also address the issue of centralization and vowel reduction, in the context of a target undershoot hypothesis.