LETTER OF MOTIVATION

I’m currently working in the project “Acoustic and Aerodynamic Analysis of Speech Production by Patients with Unilateral Vocal Fold Paralysis” that involves the development of analysis strategies and processing of acoustic, aerodynamic and electroglottographic (EGG) biomedical signals.

This research project attempts to bridge the knowledge gap between the information that we can derive from acoustic and aerodynamic measures, and the application of extracted features to language specific phonetic description and speech technology (synthesis and recognition).

We also are working to address the following vocal tract (VT) modelling questions: How well does the all-pole VT model work for unilateral vocal fold paralysis (UVFP) patients? Can we estimate their glottal source function? Can we use an estimate of the glottal source function to help with speech therapy? We will need to do some theoretical modelling here and to test new algorithms. The turbulence production during a duty cycle may be qualitatively predicted using the scaling law for sound power and the scaling law for the source function may be used for modelling UVFP patients’ speech.

This work experience has given me the motivation and shown me the need to learn more about physical models of speech production, speech perception and the production-perception interaction. This knowledge base can be expanded by attending the *Summer School CPMSP2 – 2010*, as well as having a better perception of the work that is being developed in this area by other research institutions. New key international collaborations can also be established at the Summer School to develop new research work. I also hope to develop new ideas to apply during my PhD work.

These are just some of the reasons why I think it is very important to attend to the *Summer School CPMSP2 – 2010*.

With the best regards and looking forward to attend the Summer School CPMSP2,

Cátia Pinho.

IEETA, Aveiro University.

ABSTRACT

When speech is impaired due to organic lesions of the vocal folds, phonation clearly changes, because the dynamic patterns of closed and open phases of the vibratory cycle are quite irregular. These difficulties to maintain modal vibration present a rich experimental scenario and can be the basis of models of voicing over the normal speaking range. To study the conditions for initiating and maintaining unilateral vocal fold paralysis (UVFP) patient’s weak voicing we analysed the strategies they use from aerodynamic, acoustic and electroglottographic (EGG) data, and by measuring weak voicing in normal people (e.g., during voiced fricative production). Looking at when/why normal speakers devoice will help us to develop new strategies/treatments to aid UVFP patients.

We will try to address the following vocal tract (VT) modelling questions:

- How well does the all-pole VT model work for UVFP patients?
- Can we estimate their glottal source function?
- Can we use an estimate of the glottal source function to help with speech therapy?

We are therefore currently developing an adequate theoretical modelling framework and testing new algorithms.

Partial closure always generates a mean flow through the glottis during speech production. This will increase the average power of the radiated speech signal at the beginning of the opening phase and at the end of the closure phase [1]. It is likely that this is due to a permanent turbulent flow generated downstream of the VT. We will therefore build on findings by authors such as Zhang and Mongeau (2006) and propose a model for the UVFP patients. The turbulence production during a duty cycle may be qualitatively predicted using the scaling law for sound power and the scaling law for the source function may be used for modelling UVFP patients’ speech.

During voiced speech the source of sound production arises from the vibrations of the vocal folds within the larynx. In order to terminate these vibrations it is necessary to change the mechanical properties of the folds so that the transglottal pressure drop is no longer sufficient to sustain voicing, or to reduce the pressure drop across them to below a threshold level. A reduction in pressure drop might be achieved by reducing the sub-

glottal pressure, by increasing the supra-glottal pressure or by abduction of the folds [2]. The investigation of the aerodynamic mechanisms of voicing offset:

1. reducing sub-glottal pressure,
2. increasing supra-glottal pressure,
3. abducting the vocal folds,

and the mechanical mechanisms of voicing offset:

4. adducting the vocal folds,
5. stiffening the vocal folds,
6. relaxing the vocal folds,

may help us to characterise the mechanism by which we stop the voicing, and guide the development of new strategies/treatments to aid people with UVFP.

We are performing a detailed analysis of videostroboscopy images during the production of voiced fricatives (e.g., see Figure 1). We hope this analysis allow us to extract some key features and parameters related with the vocal fold behaviour during the production of the voiced fricatives, in the way to address some of the VT modelling questions.

Simulations of temporal patterns of oral airflow in men and women using a two-mass model (2MM) of the vocal folds under dynamic control [3]

and modelling the different cases using an adapted version of 2MM of [4] allows dynamic change of pressure and/or mechanical properties of the folds.

FIGURES

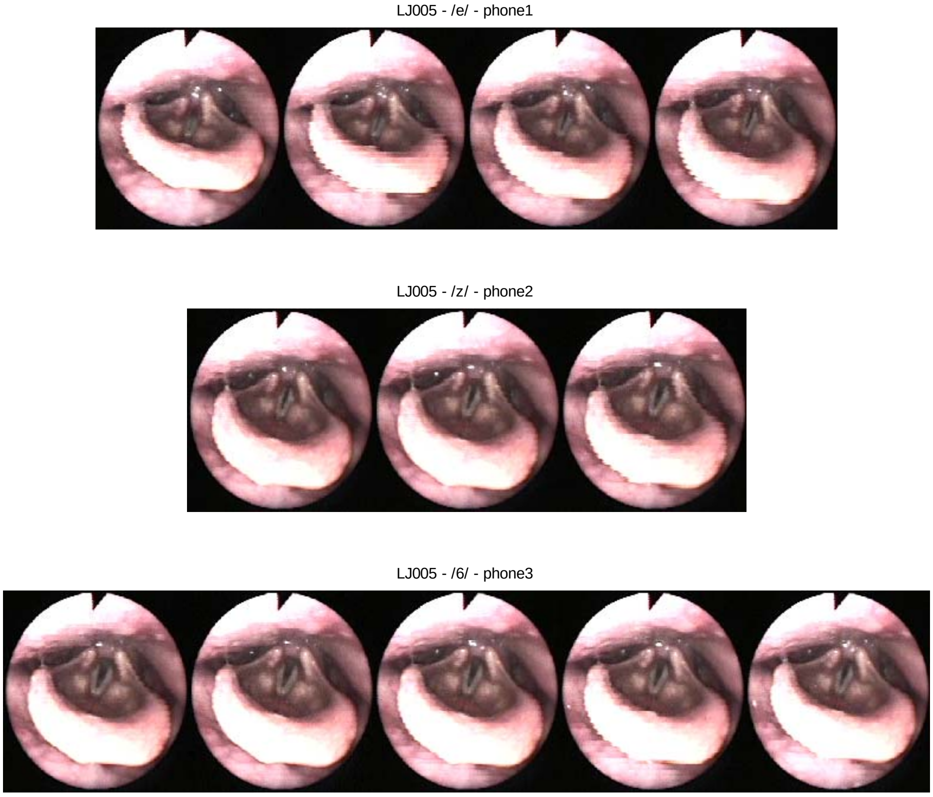

Figure 1. Images of videostroboscopy frames (fps =25) from LJ’s VFV production (fricative /z/). Top frames are from the phone that precedes the fricative; middle frames are from the fricative; and down frames are from the phone that follows the fricative.

REFERENCES

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