Earbuds: A new method for measuring nasality in the field

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Nasality is defined by the coupling of the nasal and oral tract, as controlled by the velum and the posterior and lateral pharyngeal walls. Compared to other phonetic parameters (such as those relating to vowel quality and place/manner of articulation in consonants), quantitative measurements of the degree of velopharyngeal opening (and thus degree of nasality) are relatively difficult to obtain. So far, three types of methods have been employed to collect nasality data: articulatory, aerodynamic, and acoustic techniques. While all methods have particular strengths, most of them are problematic in the context of (potentially remote) fieldwork, especially with regards to cost and mobility.

This talk introduces a highly portable and low-cost tool for empirically measuring nasality in the field: low-impedance earbuds placed directly under the nostrils can be used to record the relative amplitude of speech sounds in the nasal cavity. This can then be compared to the amplitude of oral speech sounds, which are recorded simultaneously by a microphone placed near the mouth. The relative amplitudes can then be normalised in order to allow for comparison. Although this method cannot provide any information on airflow, and as such cannot be considered a replacement for typical aerodynamic approaches, it can provide detailed information about the timing and duration of nasal gestures e.g., pre- and post-nasalization, nasal harmony, nasal leakage, and co-articulation effects. As such, it can be used by fieldworkers to more reliably describe the behaviour of nasality in a given language in cases where aerodynamic tools are not available.

The languages involved in this preliminary study include English, known for its phonetic nasalisation of vowels (Chen, 2014), French, a language with phonemic nasality, and Spanish and Quichua which both contain phonemic oral-nasal plosive contrasts. Each participant was recorded on a TASCAM DR-1 using a mono channel format and a sample rate of 48,000 Hz for both nasal and oral recordings. Each recording was then time aligned in an empty stereo wave file with the nasal track inserted into the left channel and the oral track into the right (using a left & right audio convertor is planned for future studies).

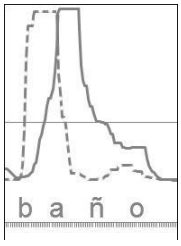

Figure 1: Pre- and Post-nasalization example of the Spanish word *baño* 'bathroom'— nasal (solid), oral (dashed).

The analysis of this method is based on a frame-by-frame reference of intensity fluctuations, which may help pinpoint exact moments of velum lowering and closing within a segment, and micro-perturbations caused by velum leakage. This analysis is beneficial for instances of phonetic nasalization which are not always apparent on larger scale analyses. In addition, if a researcher is interested in a comparative analysis between oral and nasal intensity, transforming the data into a logarithmic scale (*log10(x)*) provides a more precise quantitative baseline where individual frames from both the oral and nasal tracks can be compared in terms of greater or lesser moments of intensity at a given frame or section of frames. On the whole however, this method is best analysed on a macro scale where trends from both tracks provide suprasegmental details regarding nasal and oral intensity across an utterance.

Crucially, this method provides a low cost and effective tool for the collection of nasality data from the field. Until now, field descriptions of nasality have relied heavily on impressionistic evaluations because airflow devices have not been readily available for field studies because of prohibitive cost and/or portability.

References

Chen, N. (2014). Vowel nasalization in American English: Acoustic variability due to phonetic context. *ICPhS XVI* 905-908. Saarbrücken, 6-10 August 2007.