Earbuds

A new method for measuring nasality in the field

Jesse Stewart
Martin Kohlberger

Universiteit Leiden
University of Saskatchewan

Introduction

- Even though nasality has long been a primary topic in phonetics, it is notoriously difficult to measure objectively
- It has been researched using a wide range of techniques, including:
  - Physiological: EMG, MRI, fiber optics, fleshpoint tracking
  - Aerodynamic: airflow, sound pressure
  - Acoustic: spectral measures like A1-P0

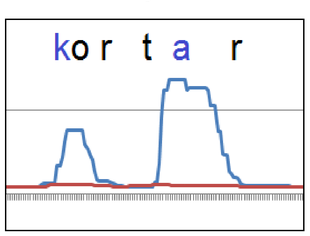
  (Krakow & Huffman 1993, Chen 1996)

BUT:

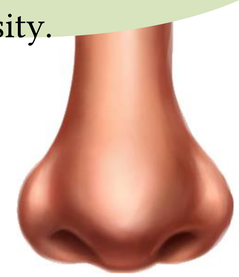
- Physiological and aerodynamic techniques often involve costly equipment which is not easily transportable to remote locations
- Acoustic measures require large quantities of optimally-recorded data and are not suited for cross-speaker or even cross-vowel comparisons
- So far, field linguists have had to rely mostly on impressionistic measures of nasality
- The method presented here provides field linguists with a highly portable and cost-effective tool to empirically measure nasality in the field, as well as the means to analyse the data

Attributes

- Non-invasive and accurate, inexpensive
- Various methods of comparison: Wave forms, intensity curves, LPC intensity.



Spanish *cortar* 'to cut' (completely oral)



Materials

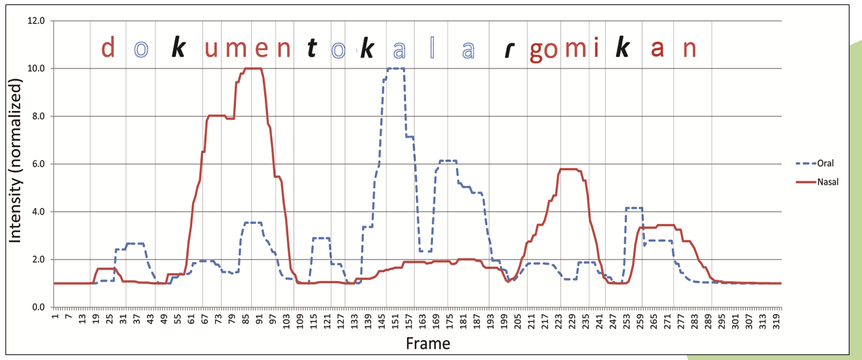
- Low impedance earbuds (20,000 ohms)
- Praat & R

Method

- Participants hold each earbud beneath each nostril
- Record mono speech at 44.1 kHz from both tracts
- Time align each tract in a stereo file (Audacity)
- Extract channels in Praat, annotate data in textGrid

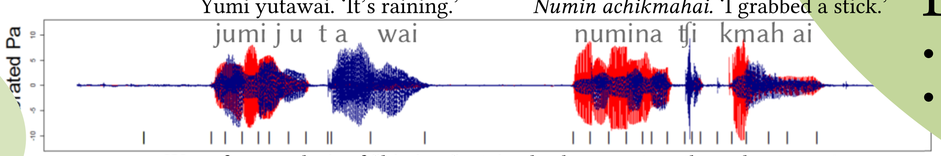
Analysis

- Praat Picture Window
- Normalisation and calibration in R (scripts provided)



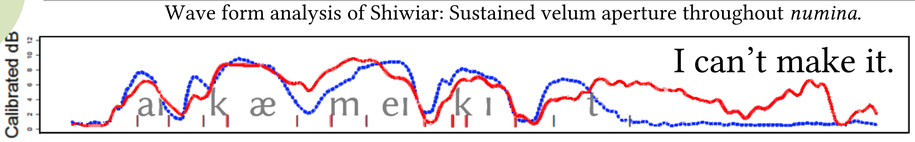
LPC analysis of Media Lengua: We are **not** interested in the overall amplitude of each peak, just the presence of nasal and oral intensity (i.e., the first [a] is more oral than the second, and the same holds true for the nasal segments.)

Yumi yutawai. 'It's raining.'



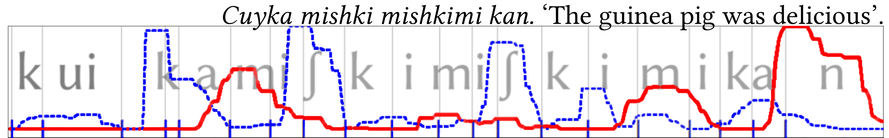
Numin achikmahai. 'I grabbed a stick.'

Wave form analysis of Shiwiar: Sustained velum aperture throughout *numina.*



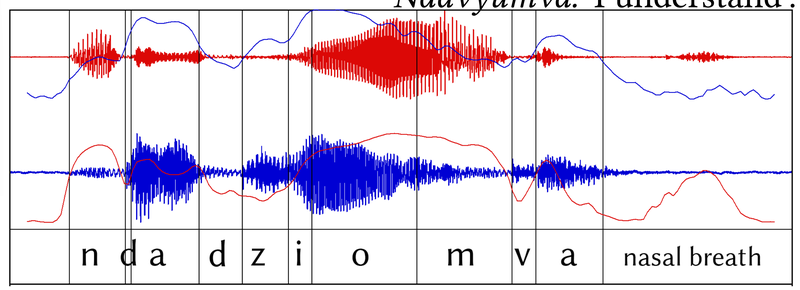
Intensity analysis of English: Allophonic nasalisation on [æ].

Cuyka mishki mishkimi kan. 'The guinea pig was delicious'.



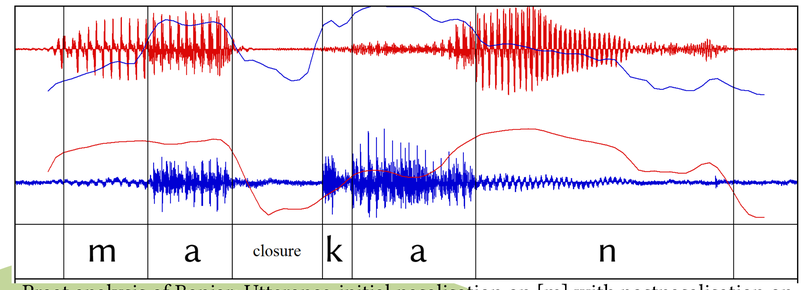
LPC intensity analysis of Quichua: Pre- and postnasalisation across word boundary [ami] and across morpheme boundaries [imi].

Ndavyumva. 'I understand'.

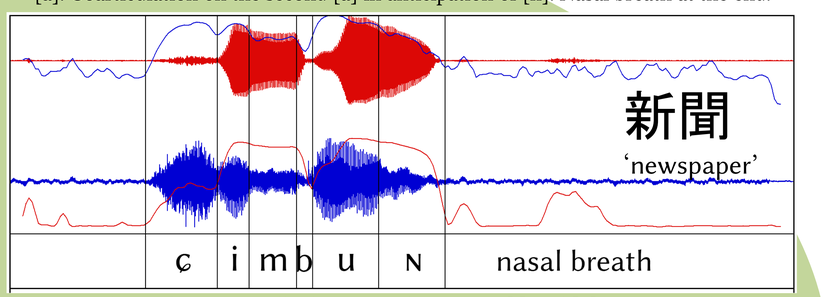


Praat analysis of Kirundi: Utterance-initial prenasalised stop. Anticipatory velum lowering during [o] for [m]. Nasal breath at the end.

Makan. 'to eat'.



Praat analysis of Banjar: Utterance-initial nasalisation on [m] with postnasalisation on [a]. Coarticulation on the second [a] in anticipation of [n]. Nasal breath at the end.



Praat analysis of Japanese: allophonic nasalisation on [i] and [u] – a coarticulation effect caused by the following nasal consonants. Nasal breath at the end.

Discussion

- Identifying nasality and nasalization trends
- Visualizing pre- and postnasalisation, allophonic/ anticipatory nasality, coarticulation, gestural interactions, stop opacity, nasal leakage (lax velum) etc.
- Applications for nasal harmony studies

References

- Krakow, R.A. and Huffman, M.K. 1993. Instruments and techniques for investigating nasalization and velopharyngeal function in the laboratory: an introduction, in Huffman, M.K. and Krakow, R.A. (eds.), *Phonetics and Phonology, Nasals, Nasalization and the Velum V*, San Diego: Academic Press.
- Chen, M. 1996. Acoustic Correlates of Nasality in Speech. PhD thesis. Massachusetts Institute of Technology.