Enriching the Understanding of Glottalic Consonant Production: Vertical Larynx Movement in Hausa Ejectives and Implosives

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INTRODUCTION – GLOTTALIC CONSONANTS

- Vertical aspects of the larynx movement (VLM) in glottalic consonants have rarely been studied.
- VLM is predicted to be larger in glottalic consonants than their pulmonic counterparts (Clements & Osu 2002, Kingston 1985, Ladefoged & Maddieson 1996).
- Due to their specific aerodynamic demands, gestures in glottalic consonants may be more tightly coordinated (stable) than gestures in pulmonic consonants.

Q How can we distinguish implosives from voiced pulmonics?
   i) Degree of larynx lowering?
   ii) Asynchronous coordination with its concurrent oral gesture?
Q Is VLM in glottalic consonants phase-locked with oral closure to change air pressure?

METHOD

- Real-time MRI data produced by a female Hausa speaker
- Target consonants: word-initially in LH bi-syllabic words, /CoCV/
  Implosives  Voiced pulmonics  Ejectives  Voiced ejectives
  /b, d/ / k, k'/ / s, s'/  / k, k'/
- Region-of-Interest (ROI) analysis for oral constrictions
- A centroid tracking tool (Oh & Lee 2018) is used for VLM, which quantifies the centroids of the larynx in a given rectangular ROI for each time frame.

RESULT 1 – DISPLACEMENT

Larynx raising

- Voiceless pulmonics < ejectives
- Voiced pulmonics < implosives

No difference in VLM’s magnitude between voiced stops and implosives

Larynx lowering

RESULT 2 – RELATIVE TIMING

Oral closure–Larynx onset Lag

- Near zero in ejectives & implosives
- Negative lag in voiced pulmonics

Synchronous production of oral constriction gesture and VLM in voiced pulmonics

- VLM is more tightly coordinated with oral closure in ejectives and more variable in implosives

Larynx onset–Larynx onset Lag

- Near zero in voiced pulmonics
- Positive lag in ejectives & implosives

Voiced stops

CONCLUSIONS

- VLM is found to be larger in ejectives than in voiceless consonants.
- Among ejectives, ejective fricatives show larger VLM than ejective stops, possibly due to maintaining sufficient airflow for turbulence.
- Contrary to the prediction, vertical larynx lowering is not larger in implosives compared to voiced stops.
- Difference between implosives and voiced stops is found in the lag between oral constriction gesture and VLM. Implosives exhibit larynx lowering at oral closure achievement, whereas voiced stops show simultaneous initiation of oral closure and larynx lowering.
- Based on the findings, we propose the following coordination structures for the glottalic consonants, extending coupled oscillator model of syllable structure (Goldstein et al. 2009) to gestures within a complex segment:

Glosses

Implosives
Ejectives
Voiced stops
Larynx raising
Larynx lowering

References


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