

# Larynx movement in the production of Georgian ejective sounds

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In this study, we present a new non-invasive method for investigating laryngeal movement in the production of ejective sounds. Being non-invasive this method can be used easily in the study of spontaneous speech.

Ejective sounds are relatively rare in European languages. The production of ejectives involves a non-pulmonal airstream mechanism. The airstream is invoked by raising of the closed larynx. At the same time there has to be a constriction (plosive, fricative) taking place in the supraglottal space, namely in the mouth. The raising of the closed glottis leads to an increase in pressure in the space behind the constriction. Due to the greater pressure drop, ejectives sound more prominent compared to pulmonal sounds (Ladefoged & Maddieson, 1996:78).

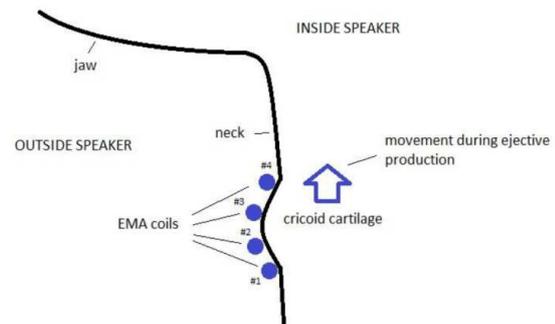
However, although the raising of the larynx is clearly visible from the outside especially in male speakers, the production mechanism of ejective sounds is not very well understood. In a pilot study, we used Electromagnetic Articulography (EMA) to investigate the larynx movement during the production of ejective sounds in Georgian.

Typically EMA is used to monitor tongue and lip movements in speech production. In this study, we placed 4 sensor coils on the outside of the skin just above the larynx in the area of the cricoid cartilage of a male speaker.

A preliminary analysis reveals that there is considerably greater movement of the coils during the production of ejectives as compared to the pulmonal sounds. Contrary to the expectations based on the traditional articulatory description of these sounds the magnitude of the movement in vertical direction (i.e. along the neck surface, up - down) is almost the same

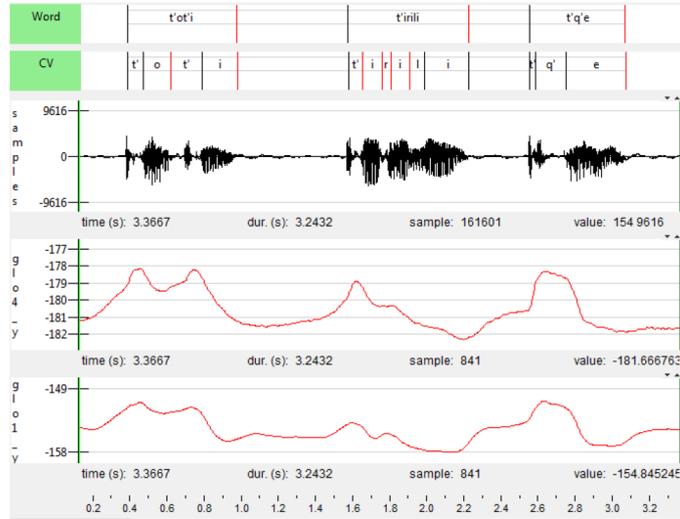
as in horizontal direction (i.e. perpendicular to the neck surface, forward - backward). Moreover the movement of the EMA coils depends on the manner and place of articulation of the ejectives. Affricate ejectives and apical articulation imply stronger movements than plosive ejectives and labial and velar articulation.

For this pilot study, one speaker was recorded, producing various Georgian words which contain ejective plosives, e.g. ტოტო [t'ot'i]. Thereafter, the same words were produced with aspirated voiceless plosives, e.g. თთთო [toti]. Thus, we could analyze a couple of pseudo minimal pairs, contrasting real words containing ejectives with nonsense words having aspirated plosives at the same spot in the word.

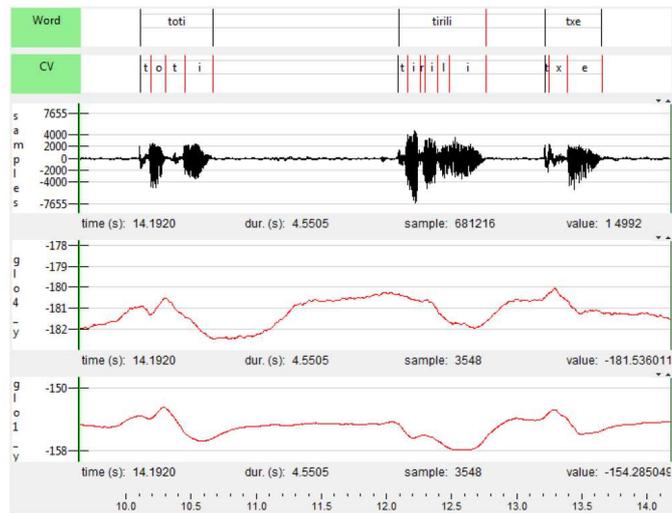


**Figure 1:** Position of the EMA coils on the outside of the neck just above the larynx in midsagittal plane

We will present a detailed analysis of the movements of the EMA coils and show how this method can help to understand ejective production mechanism.



**Figure 2:** Oscillogram and tracks of coils 1 and 4 coping movement perpendicular to the neck surface pronouncing the Georgian words ტოტი [t'ot'i], ტირილი [t'irili], ტყე [t'q'e].



**Figure 3:** Oscillogram and tracks of coils 1 and 4 coping movement perpendicular to the neck surface pronouncing the Georgian nonsense words თოთი [toti], თირილი [tirili], თხე [txe]

### References

Ladefoged, P. & Maddieson, I. (1996). *The Sounds of the World's Languages*. Oxford.