Spatial Co-variation of Lip and Tongue at Strong and Weak Syllables
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Introduction
➢ The purpose of this present study is to explore evidence of articulatory co-variation during speech production through the analysis of orofacial visual data:
   ➢ To observe opening, spreading, narrowing and protrusion of the lips, and
   ➢ To examine the relationship between those components and tongue surface deformation.
➢ The hypothesis is proposed that the lip and tongue will exhibit certain extent of synergistic co-variation between vowels at different levels of syllable strength in sentences.

Method
Participants
➢ Two females (JL and YXQ)
➢ Native speakers of Chinese
➢ Speak Mandarin without any accent

Movement Recording
➢ Devices:
   ➢ USG: Terason T3000
   ➢ EMA: NDI WAVE
➢ Data acquisition system

Linguistic Materials
➢ Short Chinese sentences having words with three cardinal vowels (/a/, /i/ and /u/).

Participants and linguistic material

Data Post-processing
➢ Lip and tongue information synchronization and alignment

Deformation Analysis
➢ 3D lip model reconstructed from 18 3D lip points
➢ Tongue contour described by 33 points from EdgeTrack program

Results

Lip and Tongue Deformation at Strong and Weak Syllables

Front-views on 3D mean lip

Lateral-views on mean tongue

Co-variation of lip shape and tongue position
Tongue position vs. lip shape at strong and weak vowel /a/
Tongue position vs. lip shape at strong and weak vowel /u/

Discussion
➢ This study attempted to reveal the patterns of articulatory co-variation by comparing lip and tongue articulation of vowels with emphatic variations.
➢ Those observations above support the hypothesis that when the mouth opens wide, the tongue moves back, and when the lips protrude, the tongue is retracted.
➢ The tendency of synergistic co-variation between the lips and tongue suggests their simultaneous extreme articulation at strong syllables than at weak syllables unlike in a previous report[4].

References

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