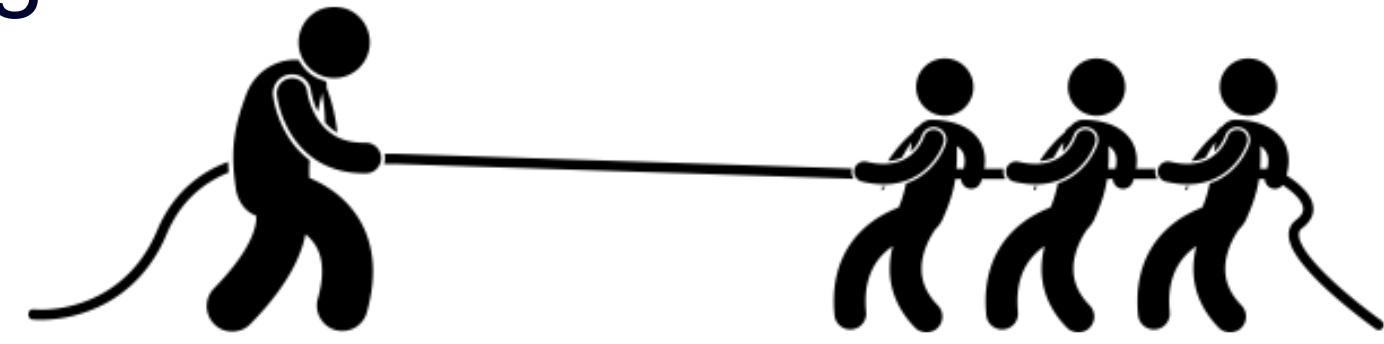


Labiodentalization of Bilabial Stops in Spontaneous English Smiled Speech

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Introduction

The co-occurrence of facial expressions and speech production induces a tug-of-war between opposing muscular activations.



Background

Existing English research indicates a pattern of bilabial stops being resolved as labiodentals during smiled speech [1].

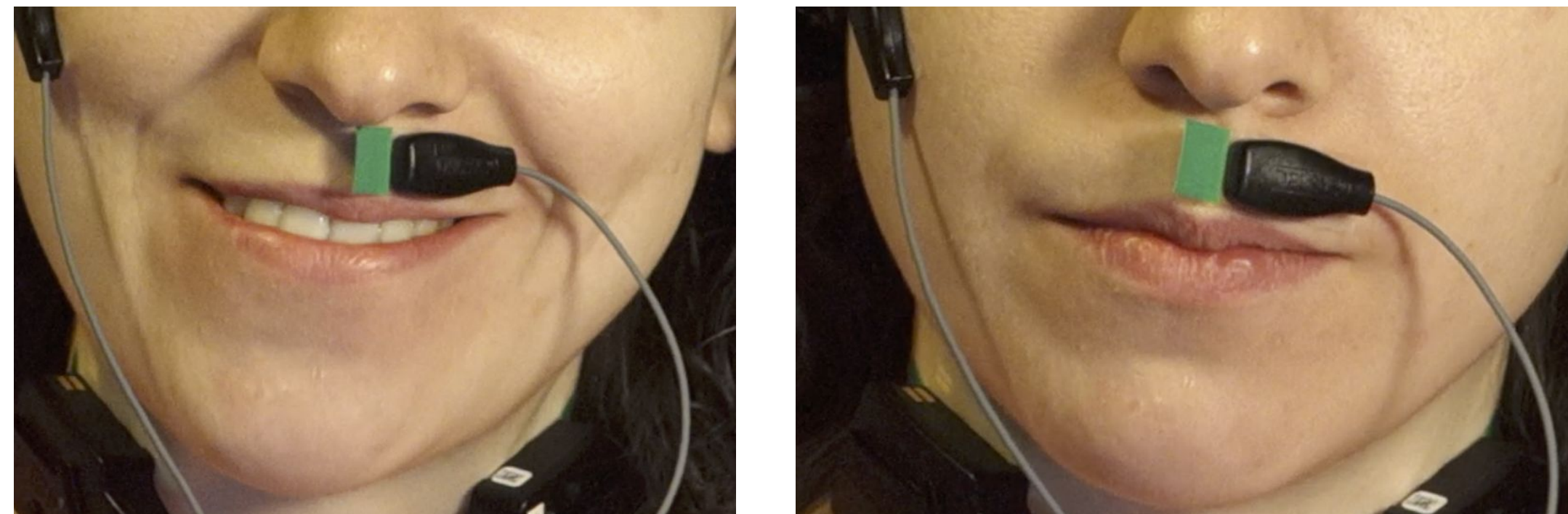


Figure 1. A participant producing /m/ when smiling (left) and not smiling (right)

EMG data shows suppression of one muscle group (smile or bilabial) to resolve the smile-lip closure conflict.

Previous results are limited:

- EMG data were collected from one speaker
- Laboratory speech (lacks spontaneity)
- Contrived smiles (no genuine emotions)

The present study asks:

In spontaneous speech and smile condition, how does body resolve the smile-lip closure conflict?

Methods

- 22 YouTube videos of native English speakers (11 male) using spontaneous social smile



Figure 2. A YouTuber producing /b/ when smiling

Processing

- Manually identified bilabial productions during neutral and smiled speech
- Ran through Montreal Forced Aligner [2]
- OpenFace 2.0 [3] used to extract frame timing and Facial Action Unit (FAU) intensity information from videos (Fig. 3)
 - FAU 'lip corner puller' = smile activation
 - FAU 'lip tightener' = bilabial closure activation

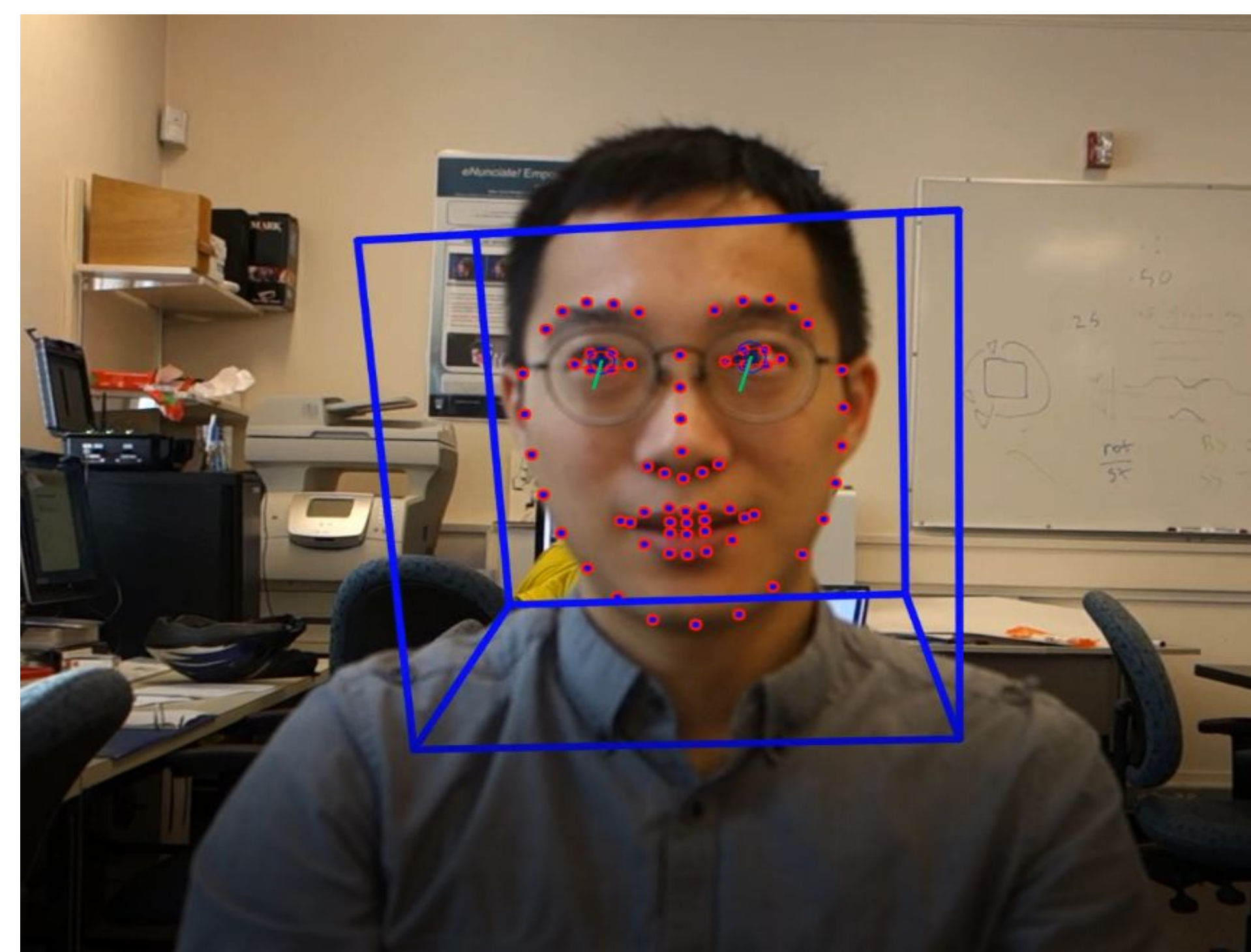
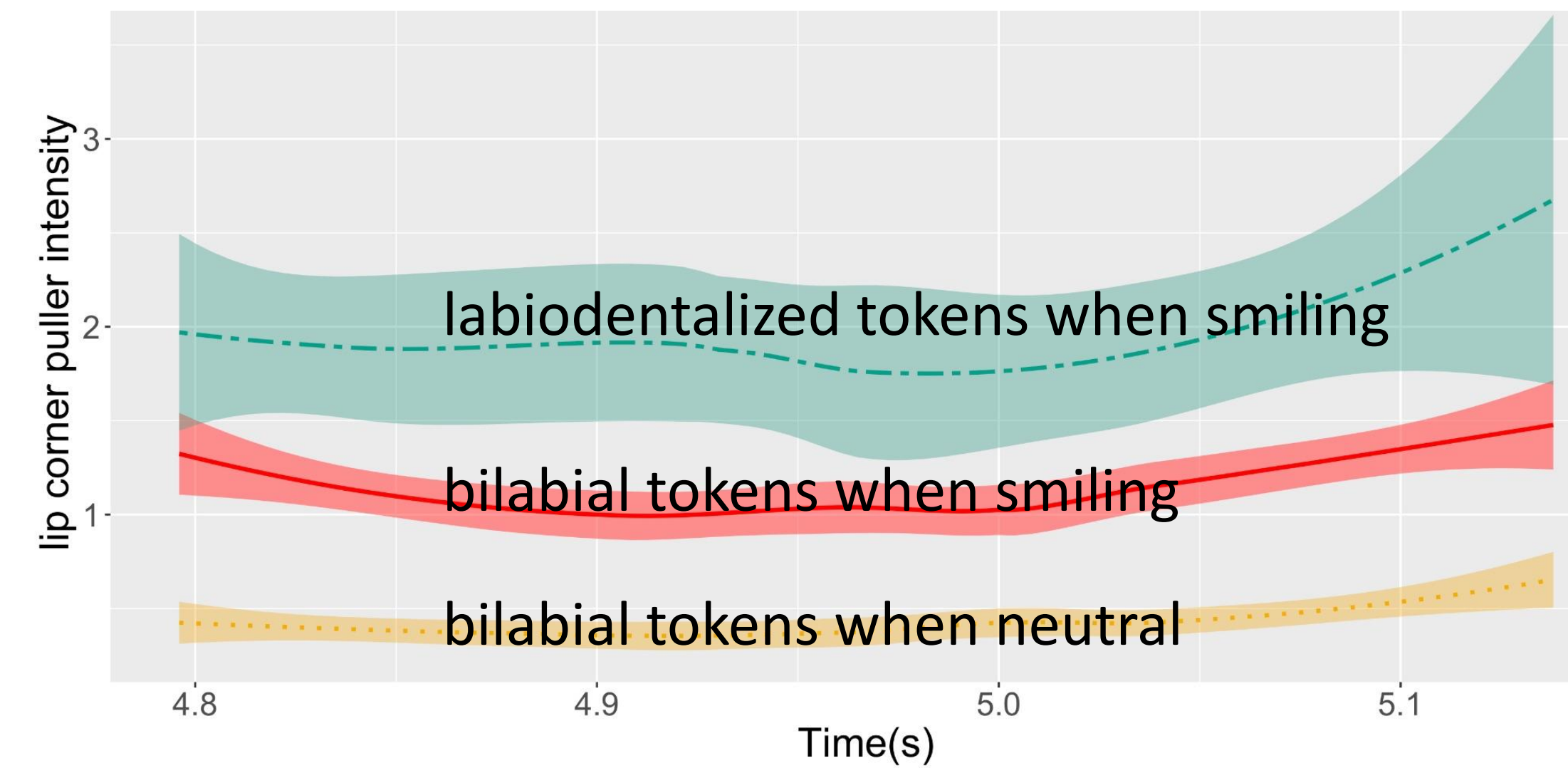


Figure 3: OpenFace Analysis. Pink dots correspond with movement points, which are organized into FAUs corresponding with different emotions.

Results

SMILE:



LIP CLOSURE:



Figure 4: Lip corner puller and lip tightener intensity of bilabial phonemes produced in different conditions by 22 speakers

- Smile intensity
- Bilabial < labiodental in smiled condition
 - Suppression on lip corner puller when producing bilabials in smiled condition
- More variation in labiodentalized tokens than bilabial tokens when smiling
 - Different degrees of labiodentalization realized across tokens
- Lip closure intensity
 - No significant difference is observed across conditions

Discussion

- Smile suppression is observed when lip closure was prioritized over smile.
- Our results show selective muscular suppression is used to resolve conflicts between movements.
- Future directions:
 - Validate whether FAU intensity reflects muscle activations
 - Use biomechanical simulations to model correlation between FAU and facial muscle activation

Acknowledgements

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