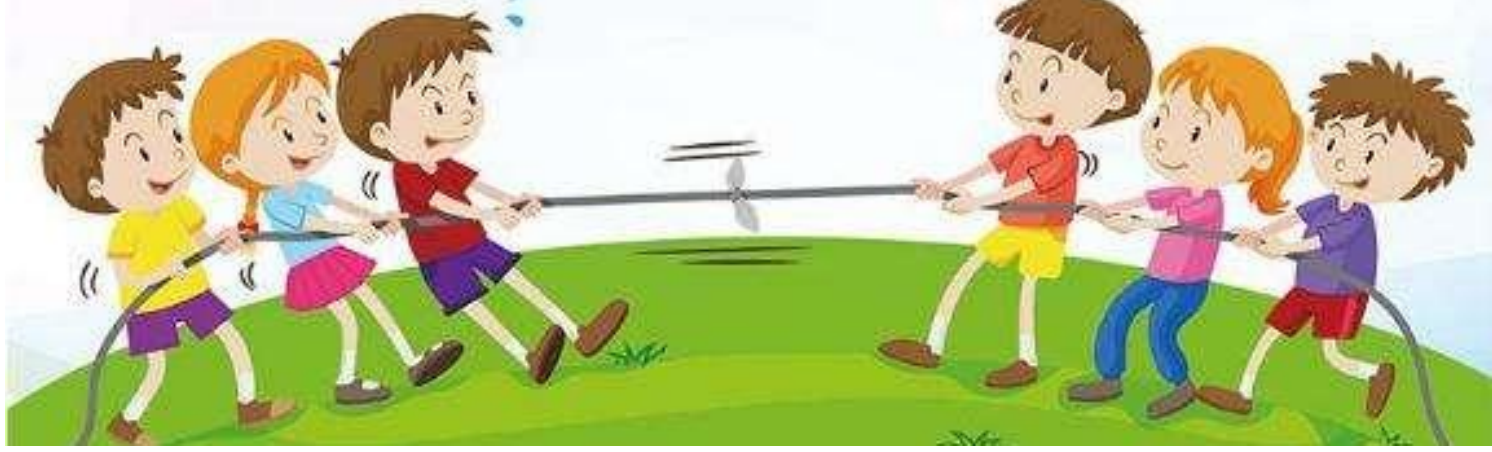# Talking while smiling: Suppression in an embodied model of speech posture

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Introduction

Tug-of-war: Smiling vs labials

- Try to produce [b] when smiling:
  - lip closure fight against opening

- How does our body resolve such conflict

Posture vs movements

- Posture is fundamental to motor control
- A stable reference frame for movement trajectories (Soechting & Flanders, 1991)
- Essential for reaching or walking (Ting, 2007)
- Apart from some pre-speech (Perkell, 1969) and inter-speech (Gick et al, 2004) articulatory settings, speech has not been modeled on a posture basis

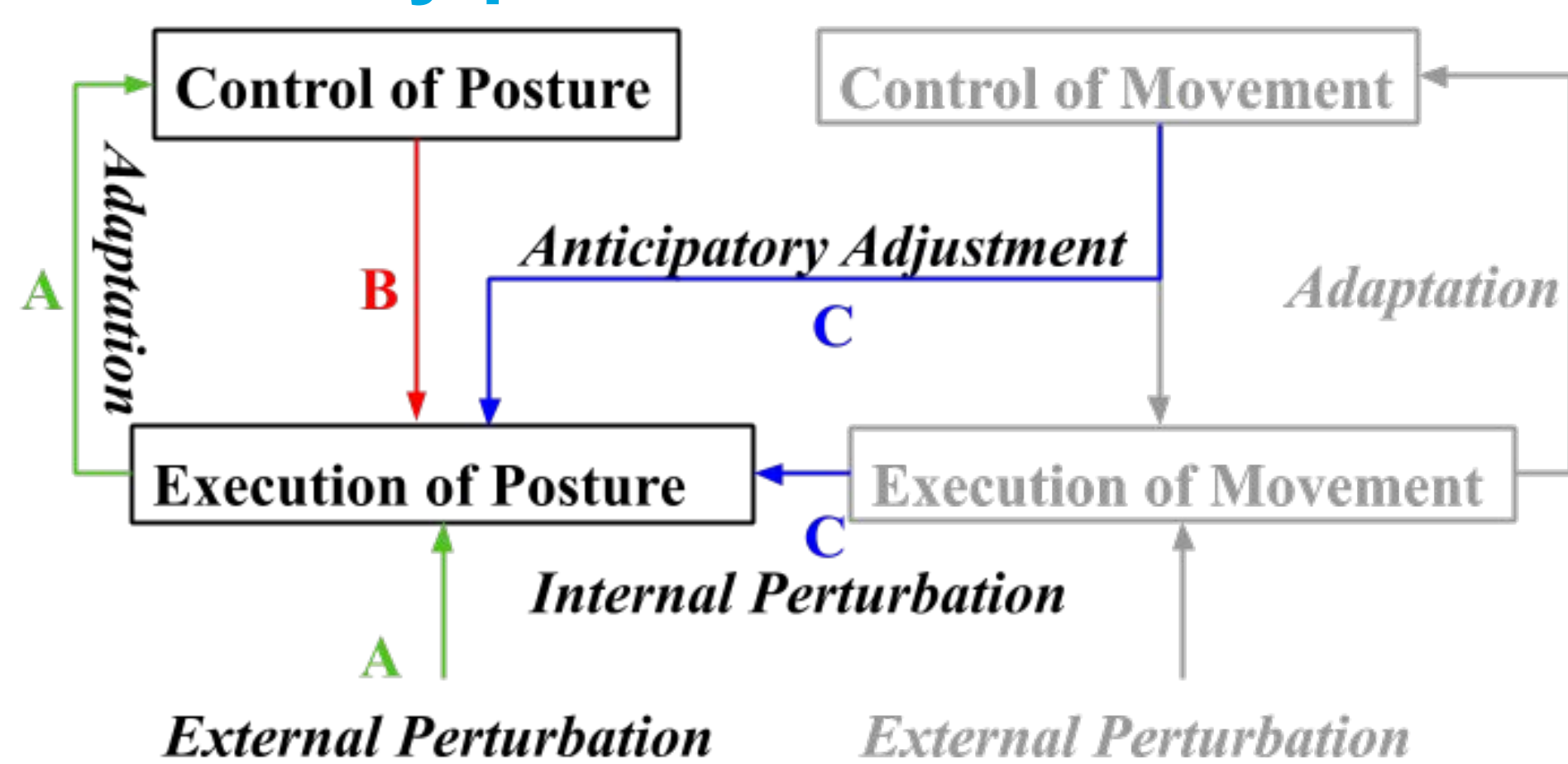### Whole body posture model

Fig.1 control and execution of posture and movement, adapted from Massion et al. (2004)

  A: External perturbation
  B: Tonicity
  C: Internal perturbation: posture **(smiling)** anticipates and responds to internal perturbation from transient movements **(lip closure)**

Simple superposition vs suppression

- Transient muscle activation overlap with postural muscle activation (simple superposition model (Bizzi et al., 1991))
- Suppression of one group of muscle (Benguerel, 1977) (suppression model)

Methods

- 31 different sentences in three different conditions: neutral, smiling, and laughing
- Each sentence contains a word that has a labial stop
- Mini EMG sensor attached to their orbicularis oris (OO) and zygomaticus major (ZM)

Experiment setup

Fig. 2 A participant producing [m] during smiling
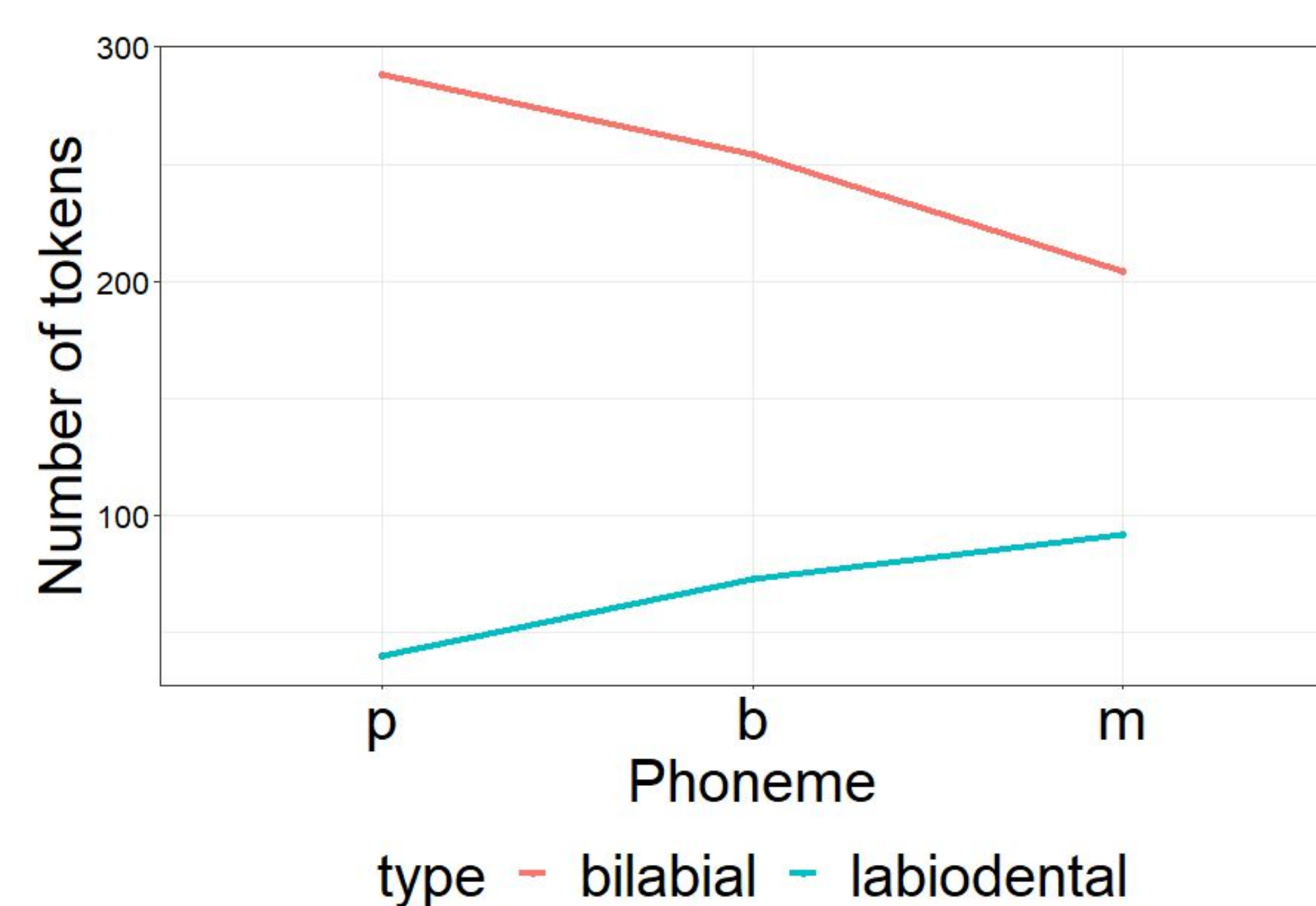
Results

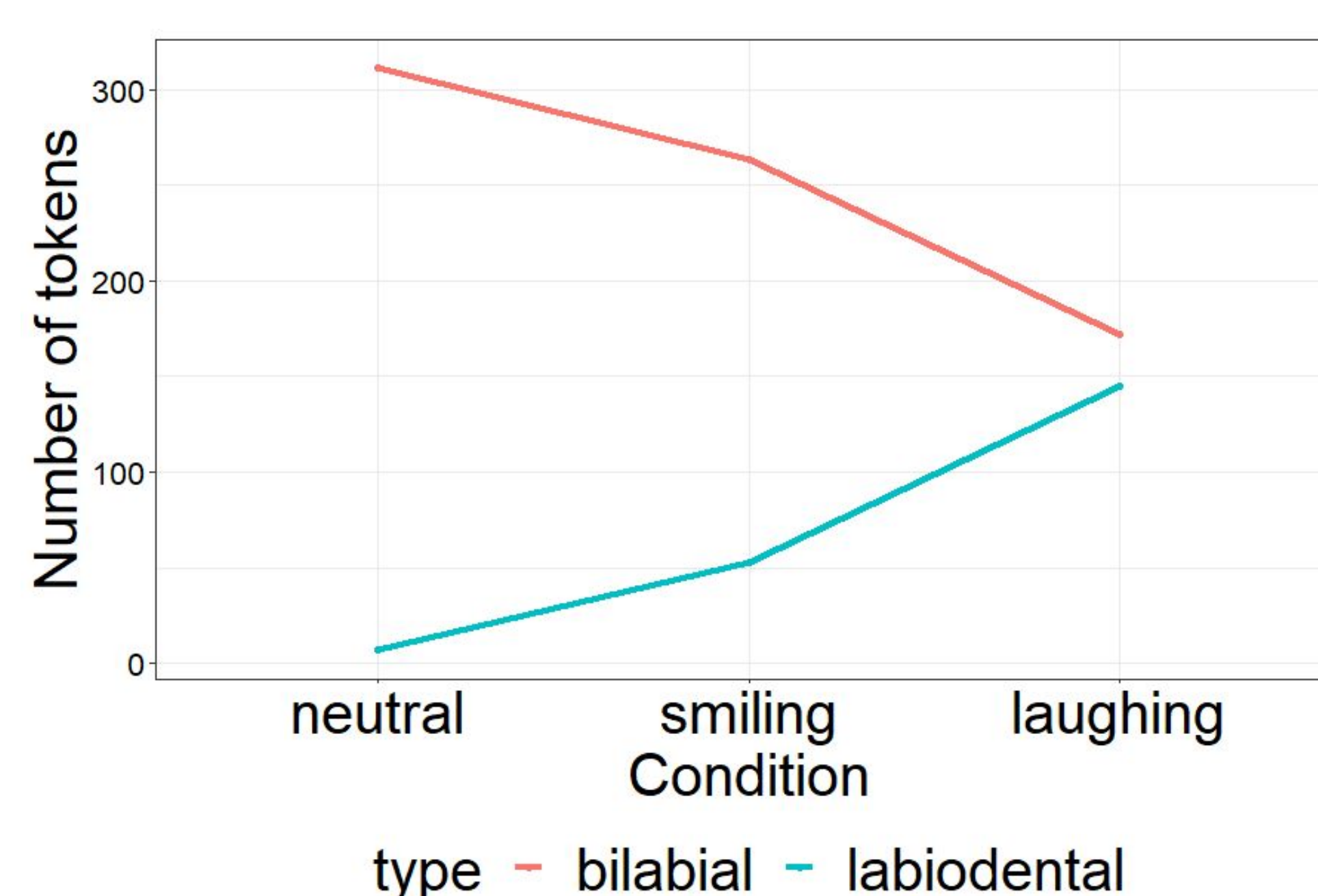Fig. 3 Bilabial and labiodental tokens of [p, b, m]

Fig. 4 Bilabial and labiodental tokens in different conditions
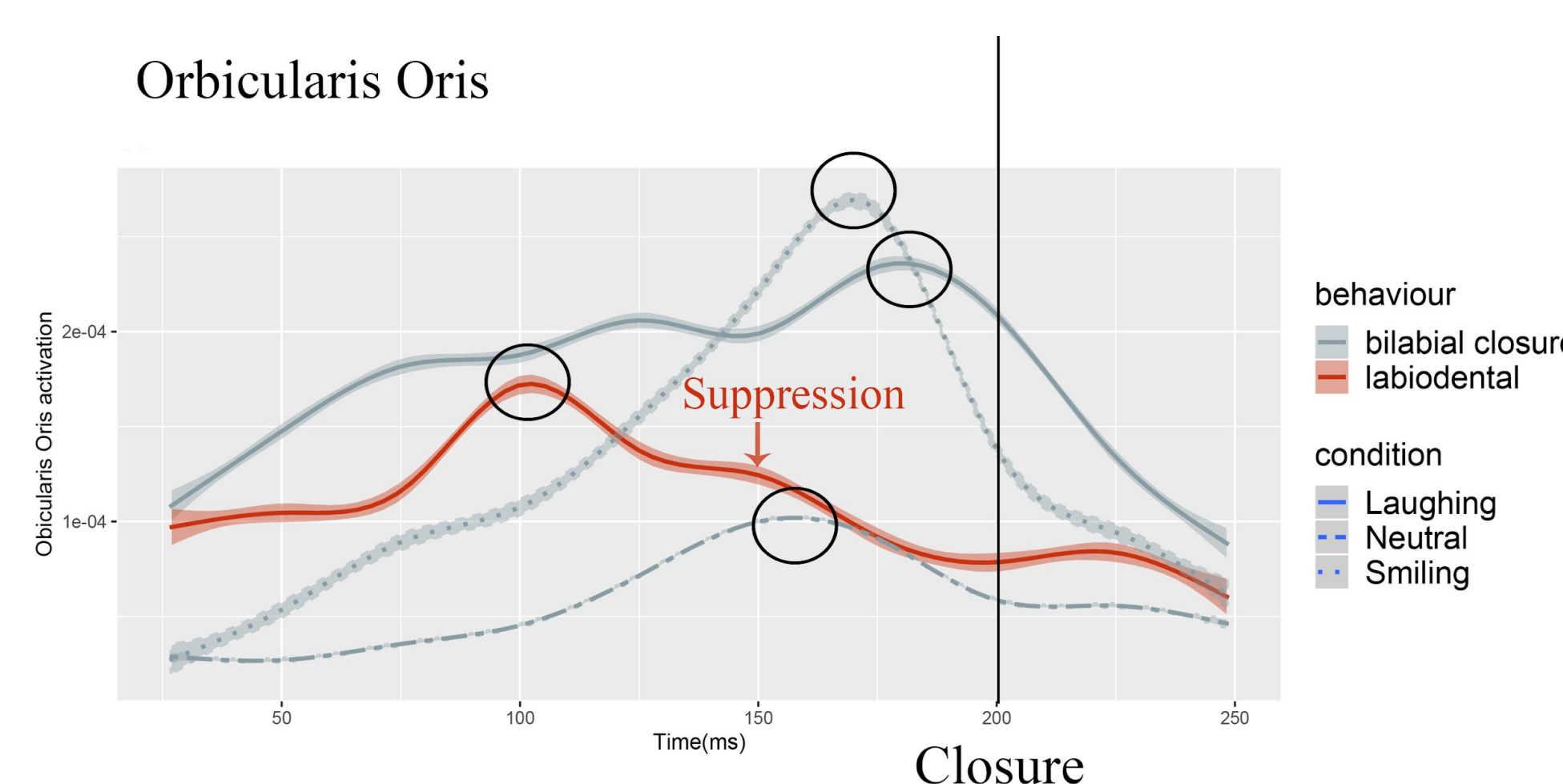

Fig. 5 Orbicularis Oris activation before a bilabial and labiodental closures

Results cont.

- More labiodentalized stops observed in m than b than p
- More labiodentalized stops observed in laughing than simling than neutral condition
- Suppression of OO is observed when producing labialdentalized stops

Discussion

- Stronger muscle activations related with transient movement are less likely to be suppressed
- Stronger muscle activations related with facial posture is more likely to cause lip muscle to be suppressed
- EMG results further support that the lip muscle (OO) get suppressed while laughing
- Our results indicate that when transient lip movement having conflicts with smiling facial expression, lip muscles get suppressed.
- This might because a labiodentalized stop is acoustically close to a bilabial stop.

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