

Background

- While producing non-native complex sequences can be difficult, American English speakers tend to produce non-native fricative-nasal (e.g., /fn/) clusters more accurately than other types of non-native clusters (e.g., /gd/) (Buchwald et al., 2019; Davidson 2006, 2010).

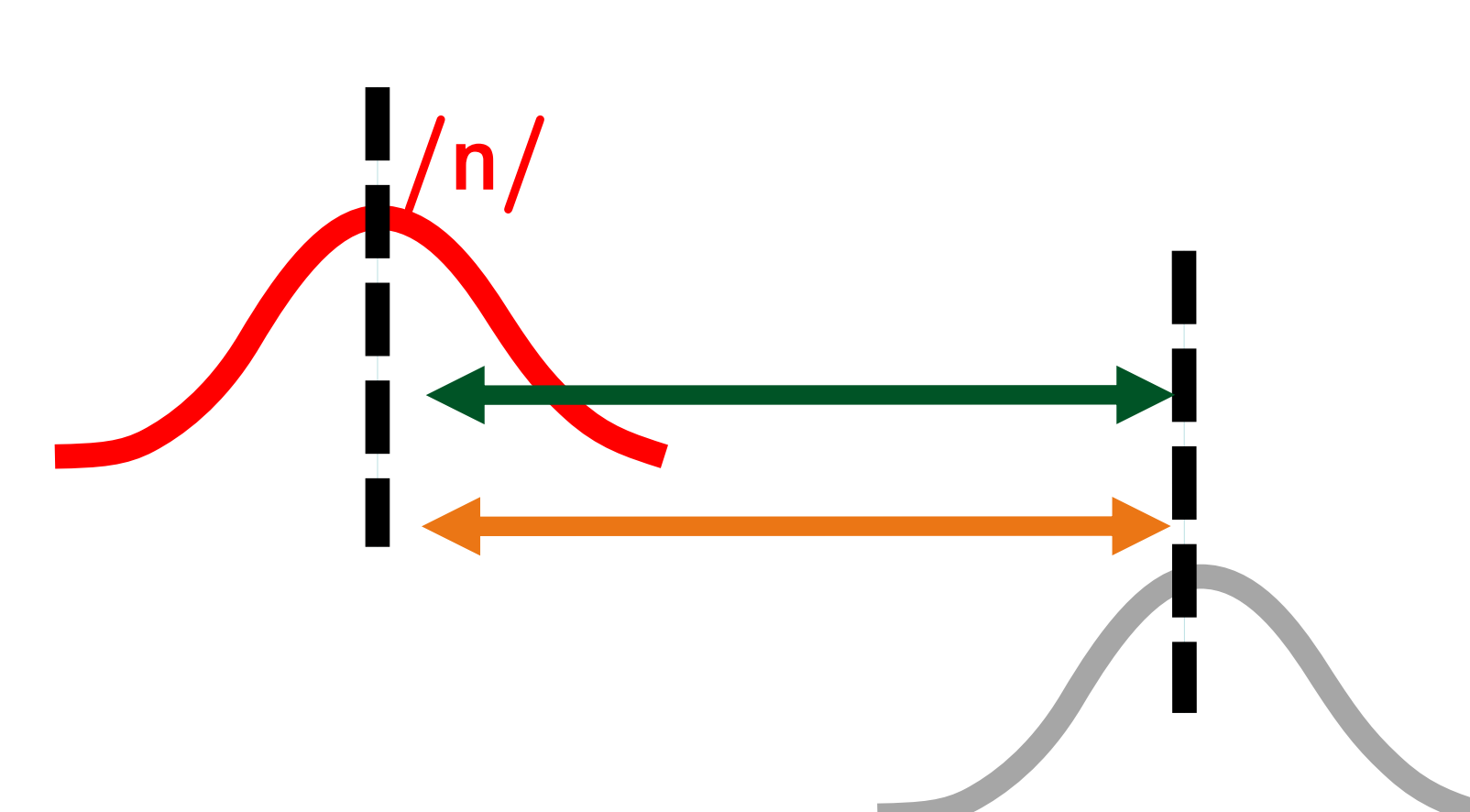
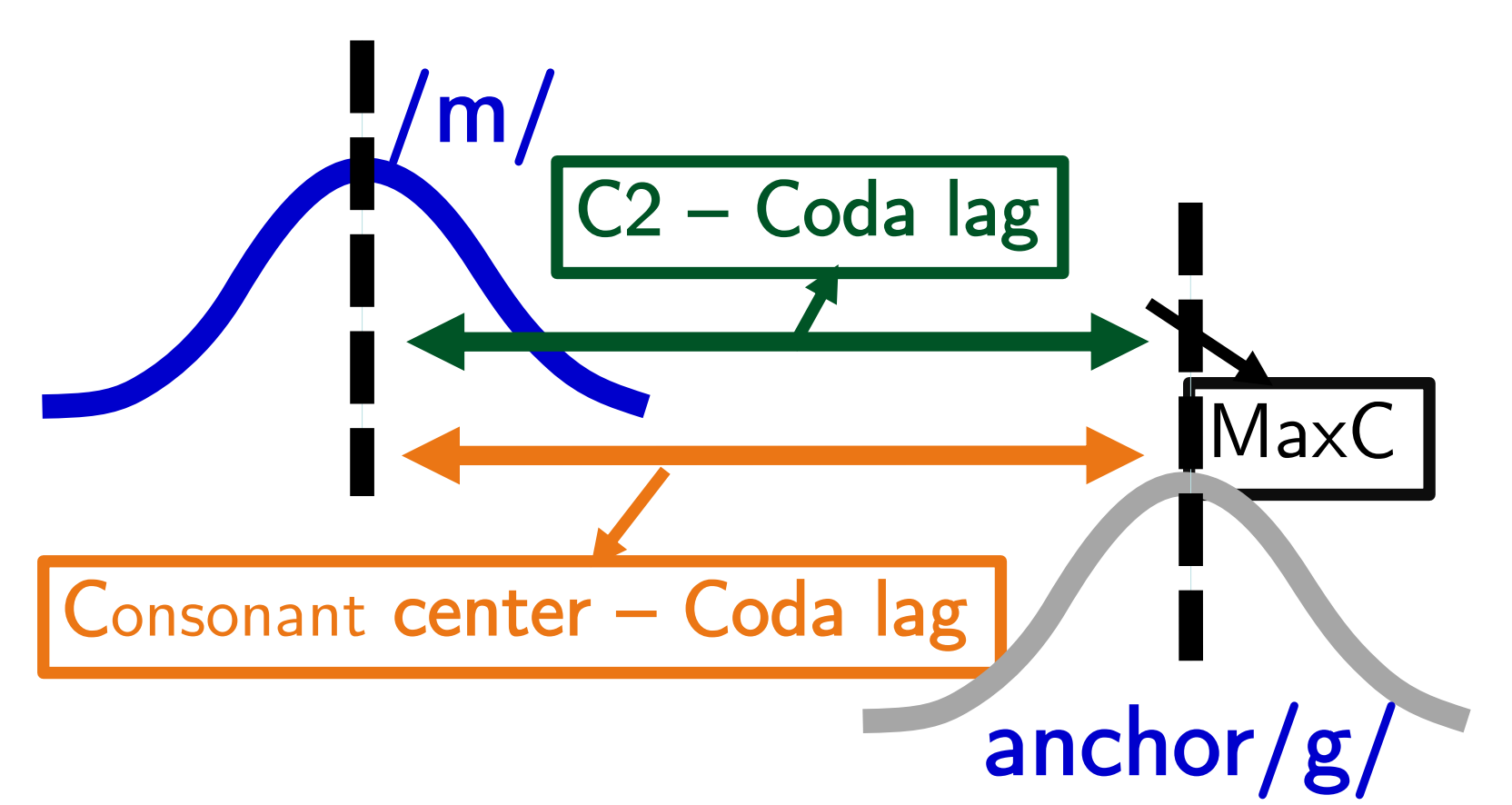
Do non-native /fn/ cluster produced without errors exhibit comparable gestural coordination timing to native English clusters?

Native

Non-native

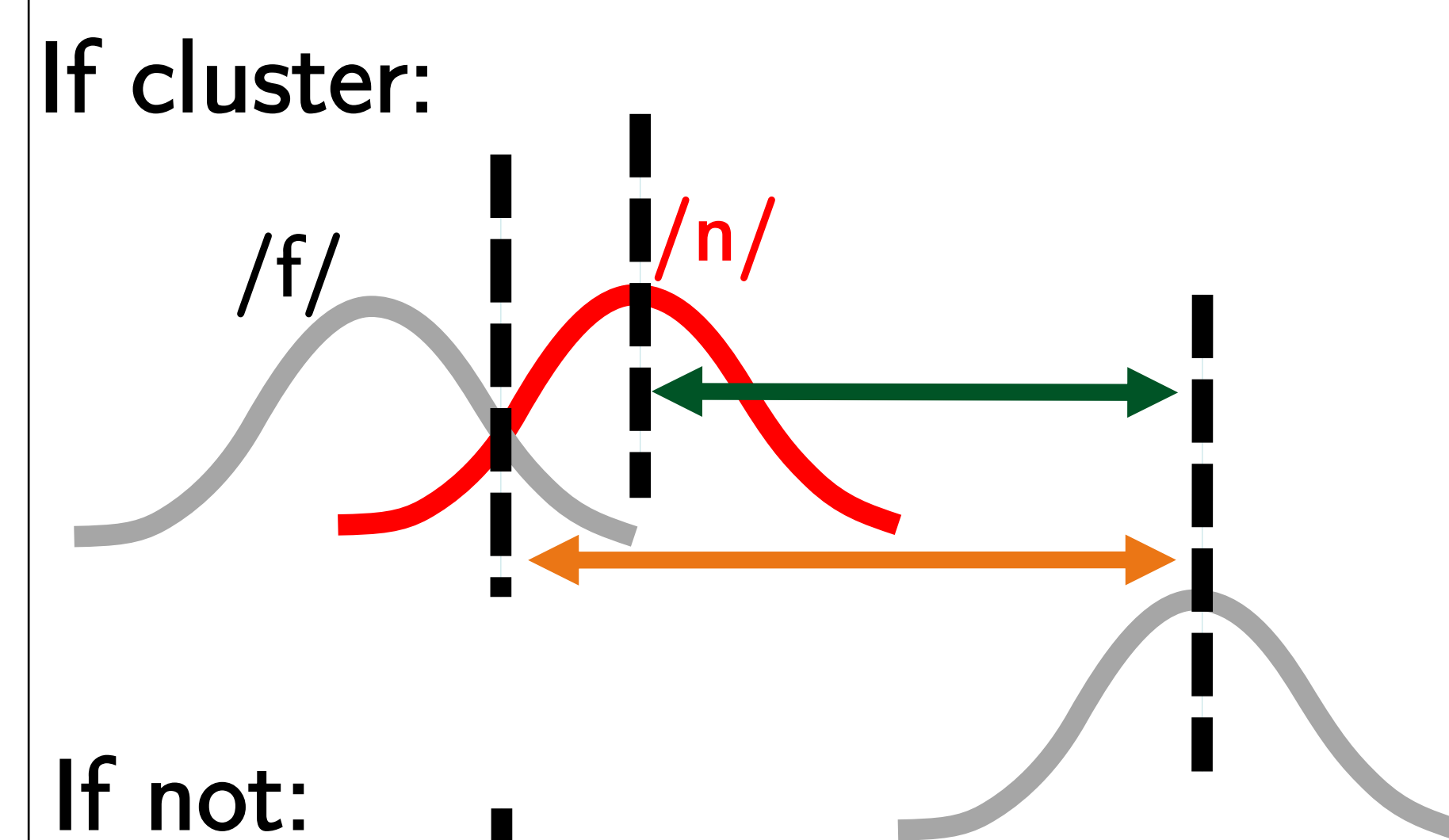
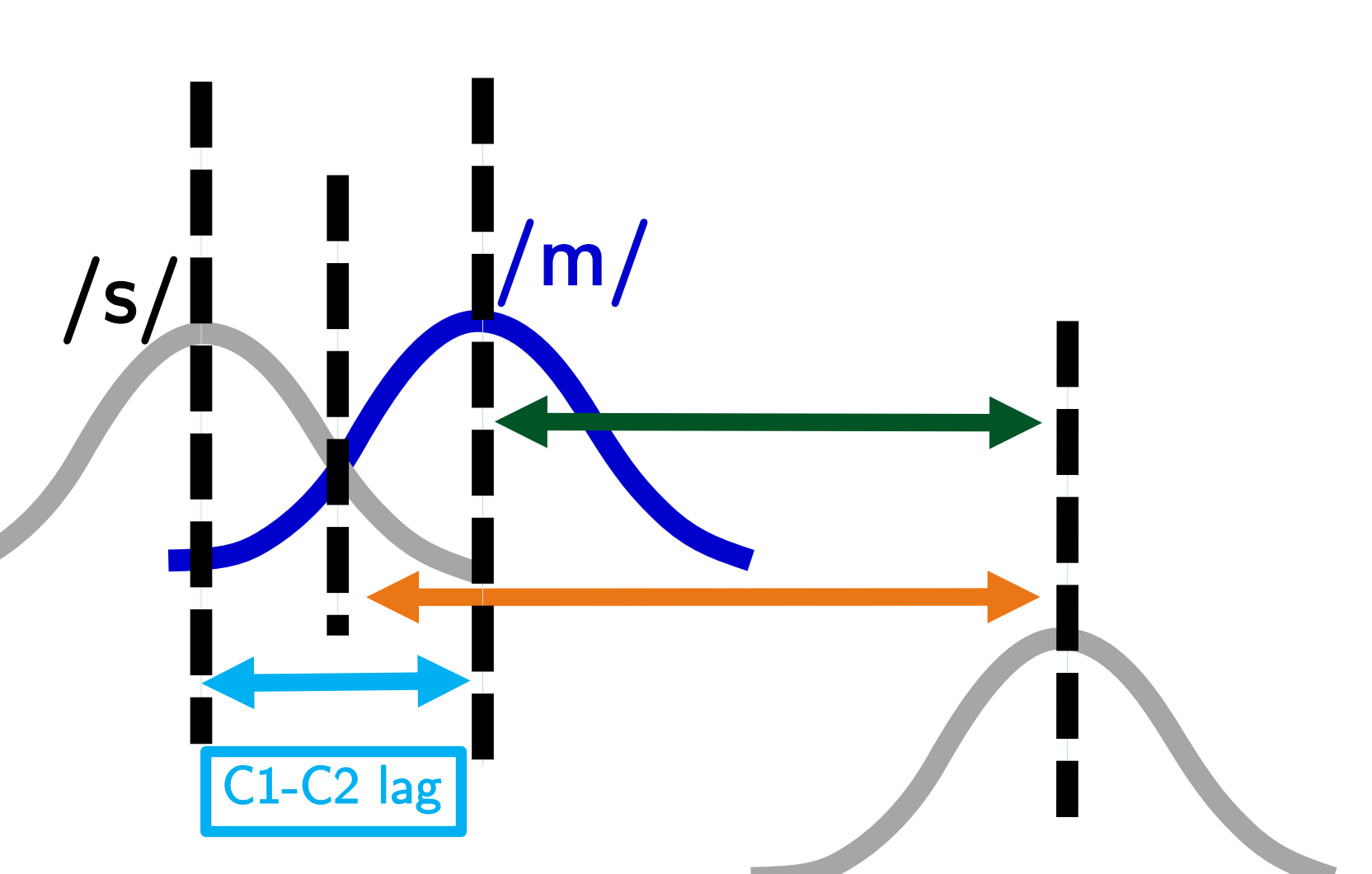
I bus #mægdip again

I puff #nægbip again



I gotta #smægdip again

I gotta #fnægbip again



C-center timing (Brownman and Goldstein 1988; Marin and Pouplier, 2010):

- Consonant center - Coda lag remains stable
- Increase C₂V overlap (i.e., decrease C₂ - Coda lag)

Increase onset complexity (mægdip → smægdip)

Increase onset complexity (nægbip → fnægbip)

If cluster-like timing (i.e., c-center timing):

If cluster-like timing:

- a lag ratio < 1

• a lag ratio $\frac{C_2 - coda\ lag_{complex}}{C_2 - coda\ lag_{singleton}} < 1$ (Pastätter and Pouplier, 2017)

If not:

- Singleton timing alignment: lag ratio ≈ 1

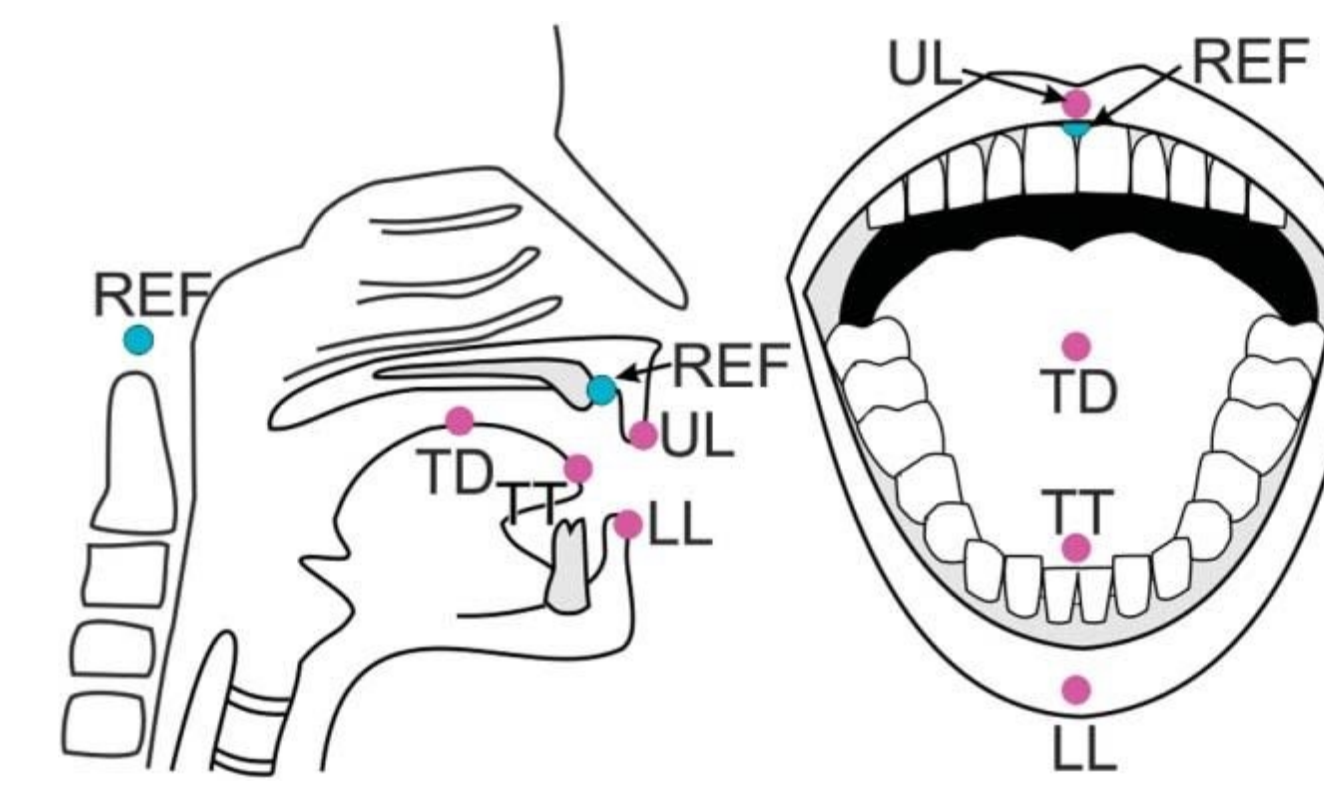
- pulling away from the vowel: lag ratio > 1

Methods & Analysis

- Participants: 12 native monolingual English speakers (4 processed and analyzed, so far)
- Data Acquisition: Speech movements were tracked using Carstens AG501 EMA system (250 Hz sampling rate)

Sensor placement

- Upper lip (LA)
- Lower lip (LL)
- Tongue tip (TT)
- Tongue dorsum (TD)
- Jaw (J)
- Upper incisor (REF)
- Left/right mastoids (REF)



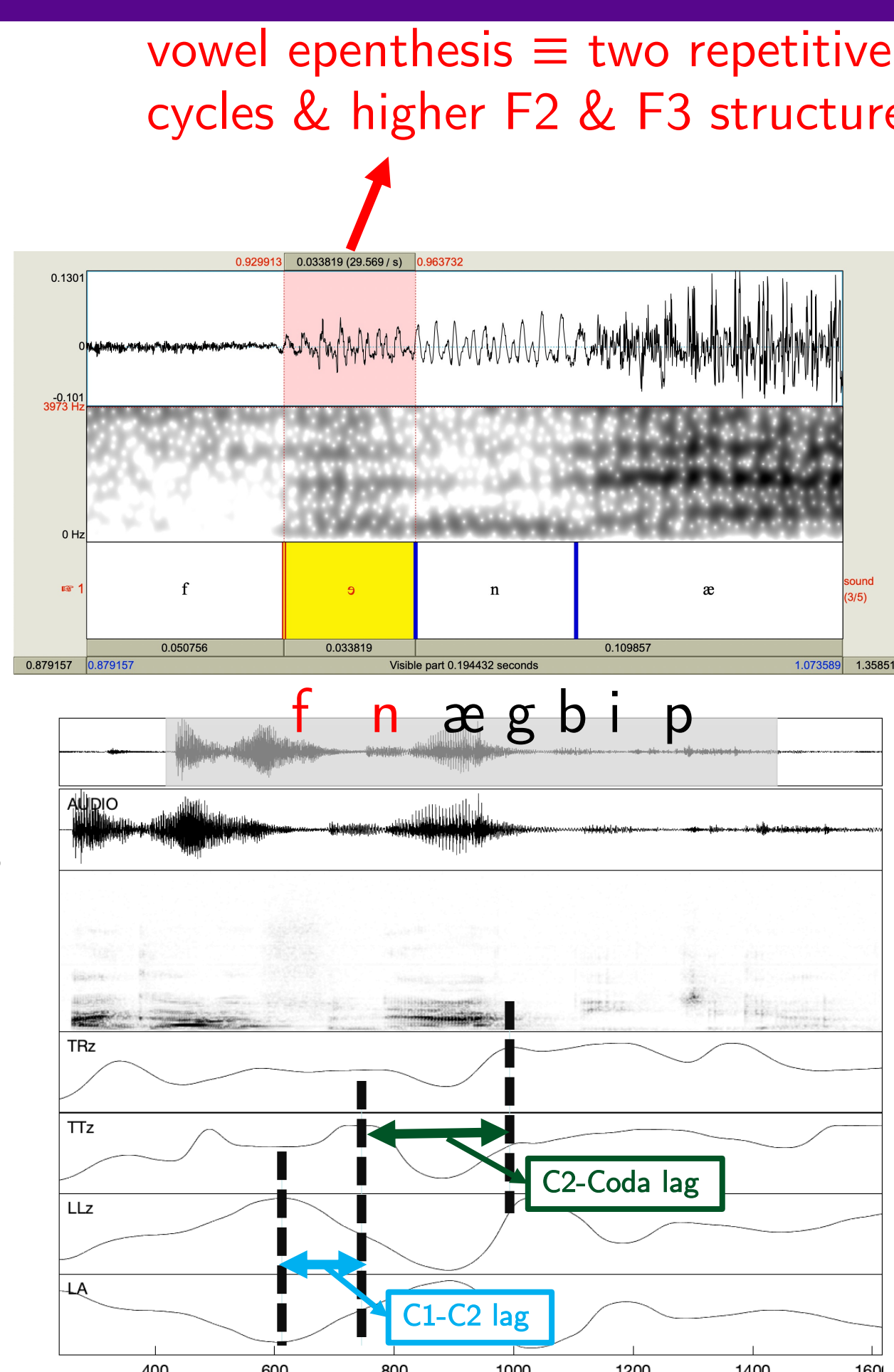
- Stimuli: Disyllabic nonwords with native (i.e., /fl/, /sm/) vs non-native onset clusters (i.e., /fn/) and their corresponding singletons (2 words each).
 - Lexical schwa (CVC control): /fələndə/; /səmæntɪks/; /fənætɪks/
 - Heterosyllabic sequences (C#C control): f#l; s#m; f#n

Acoustic analysis:

- Acoustic-informed transcription (Wilson et al., 2014)
- Cluster accuracy coded for each token
- Clusters produced w/o errors included in the kinematic analysis
- /fn/ cluster accuracy = 70%

Kinematic analysis:

- Coded using MATLAB-based Mview algorithms (Tiede, 2005).
- Using lp_findgest, coders located the timepoint of maximum constriction (i.e., max displacement in vertical dimension; MaxC) for each onset and coda consonant

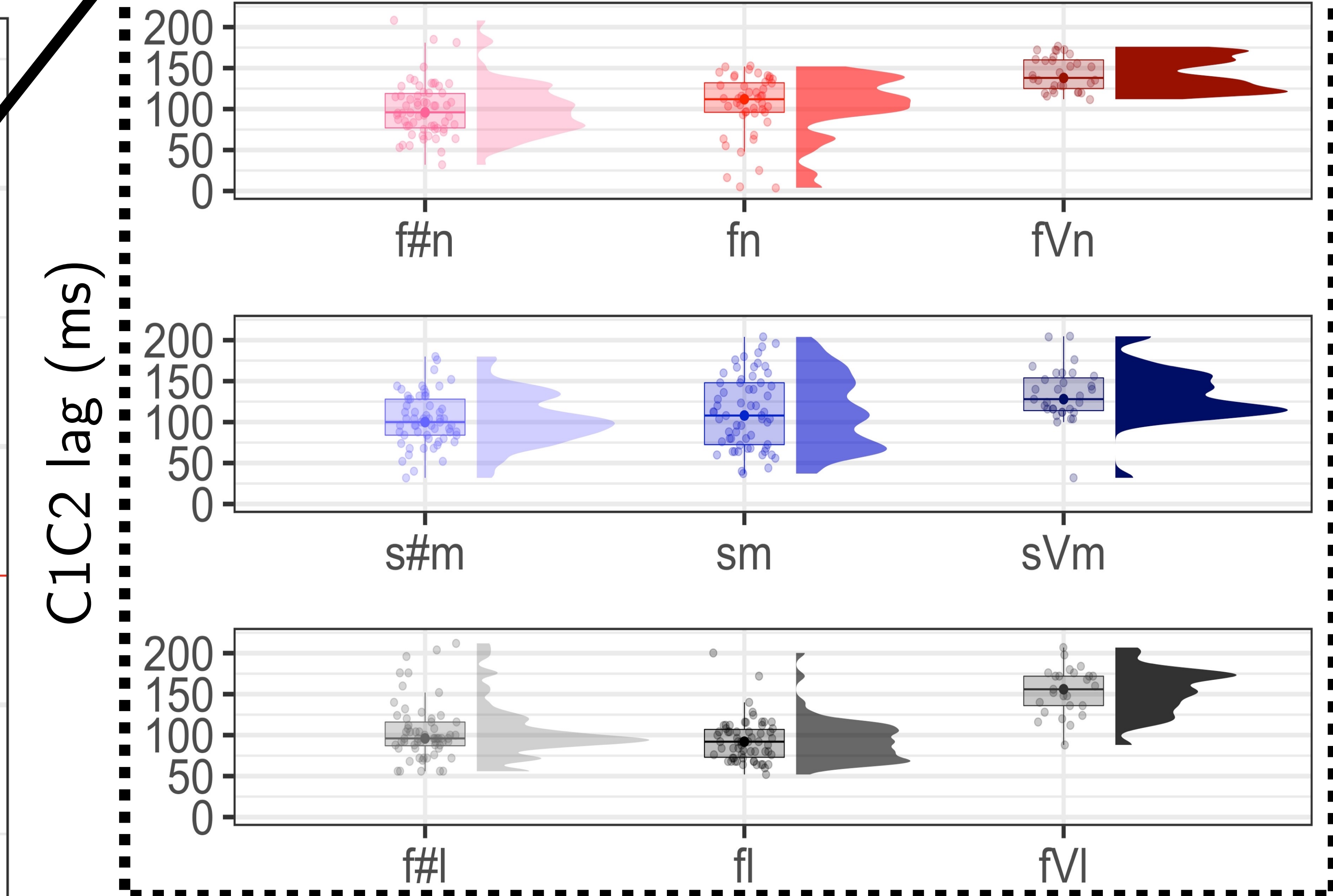
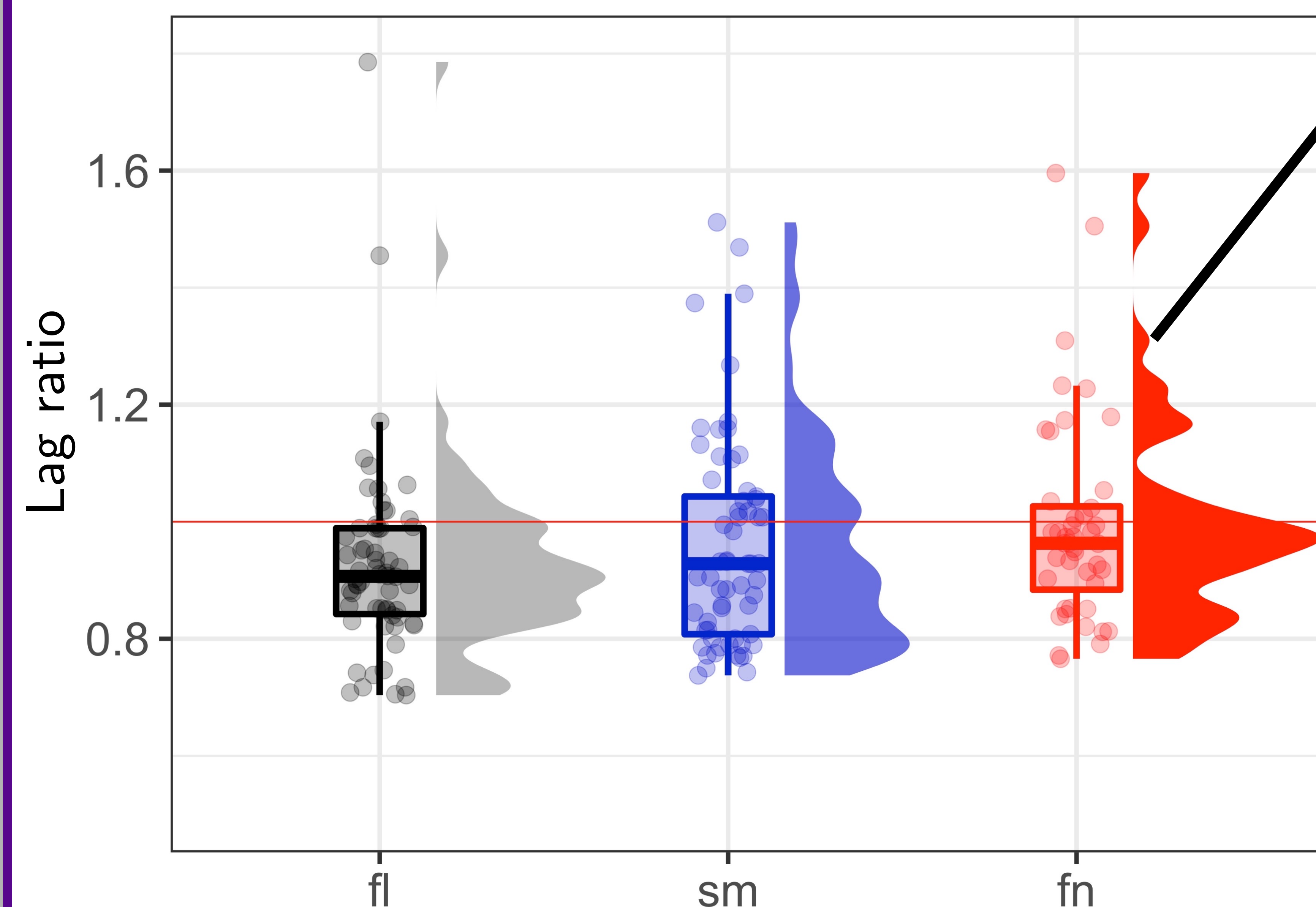


Results & Discussion

Do non-native /fn/ clusters produced without an error showed a comparable cluster-like timing to the native clusters?

Could this difference be accounted for by resyllabification?

- Comparing C1C2 timing in hetero (C#C), tauto (#CC), lexical schwa control (CəC)



- Both native and non-native clusters show evidence for c-center timing (i.e., median lag ratio < 1) exhibit c-center
 - The magnitude was smaller in non-native /fn/ (suggesting this aspect of gestural coordination underlying onset consonant clusters might need to be learned)
- Ongoing EMA experiments are characterizing changes in articulatory timing as a function of speech motor practice

- No evidence for resyllabification for non-native fn cluster
- C1C2 in fn > C1C2 in f#n

- Potential resyllabification from C#C to #CC for native sequences
- A la maximum onset principle

Acknowledgement

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