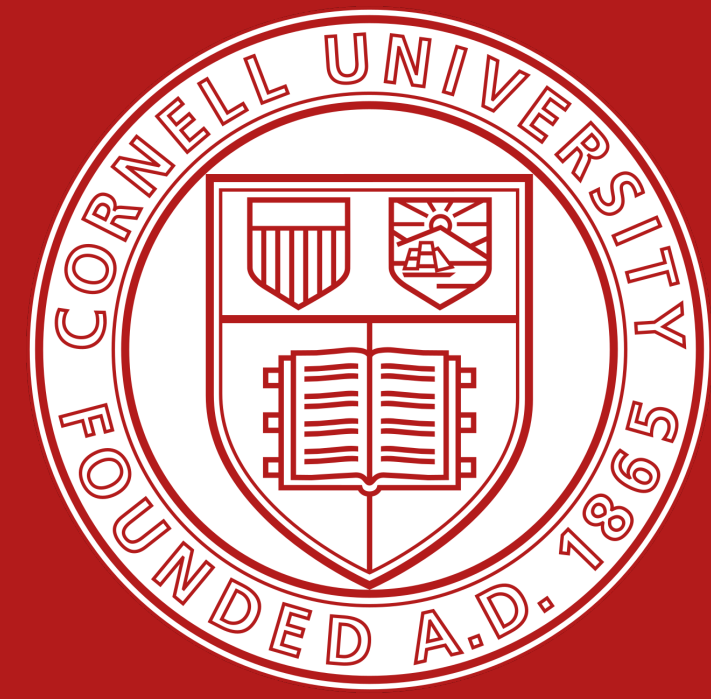


# Functional Load modulates speech production, but not speech perception? Evidence from Thai vowel length



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## Introduction

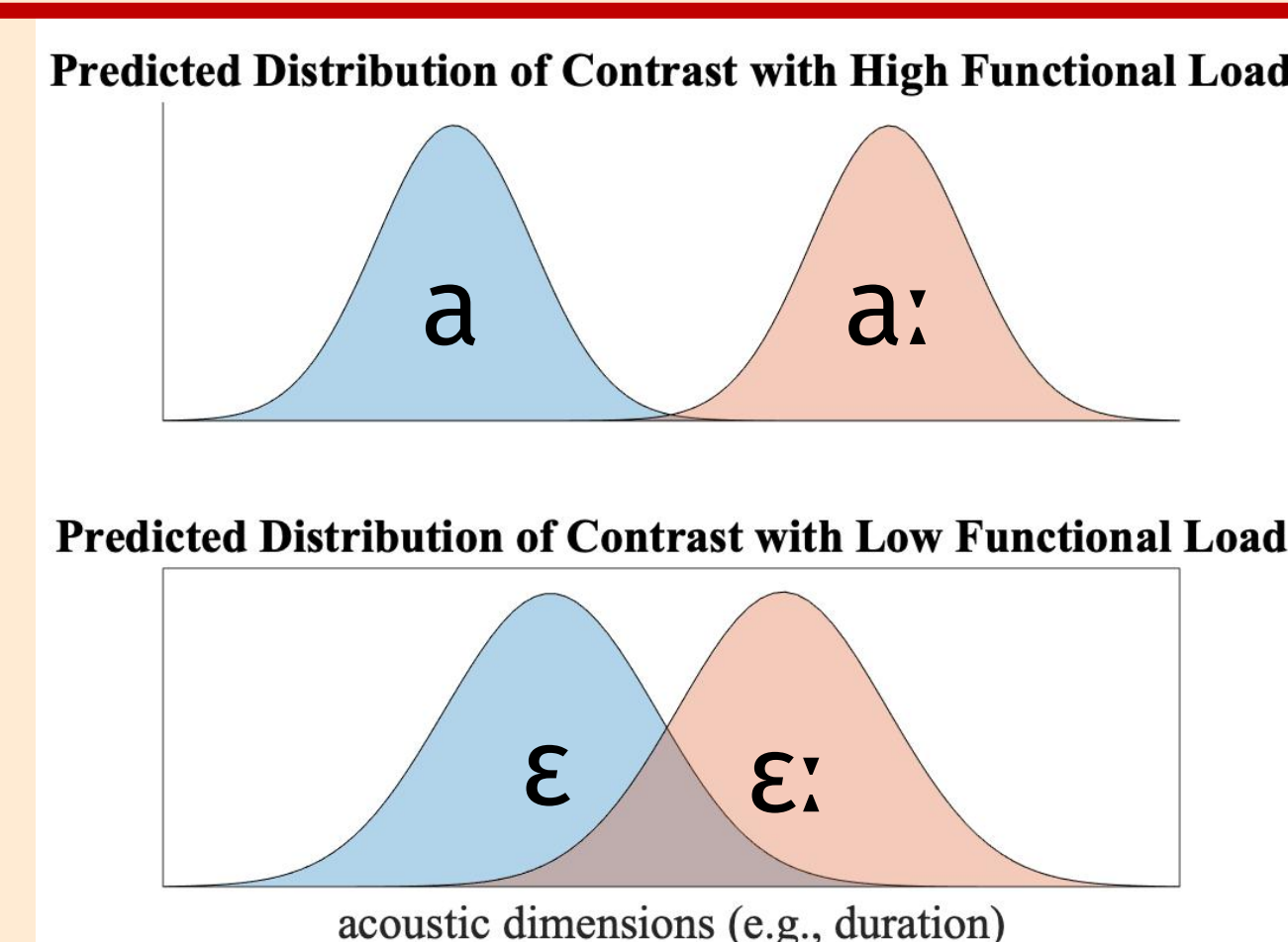
- ❖ High Functional Load (FL) of a phonemic contrast has been shown to correlate with a resistance to mergers (Wedel, Kaplan, & Jackson 2013)
- ❖ Do these diachronic tendencies come about in day-to-day speech?
- ❖ *Example:* FL helps predict singleton/geminate contrast duration ratio (Tang & Harris 2014)

## Research Question

- ❖ Does FL have *real-time* effects on speech production and/or perception?
- ❖ Bangkok Thai vowel length as a case study

## Predictions

### Production



### Perception

Confusion matrices in previous work (Onsuwan et al. 2013) do not seem to reflect modulations of FL

## Production

### Data collection

- ❖ FL is extracted from a unigram model derived from the Thai National Corpus (monosyllabic words only, ~22 mln tokens)

$$FL(x, y) = \frac{H(L) - H(L_{xy})}{H(L)}$$

(Surendran & Niyogi 2006)

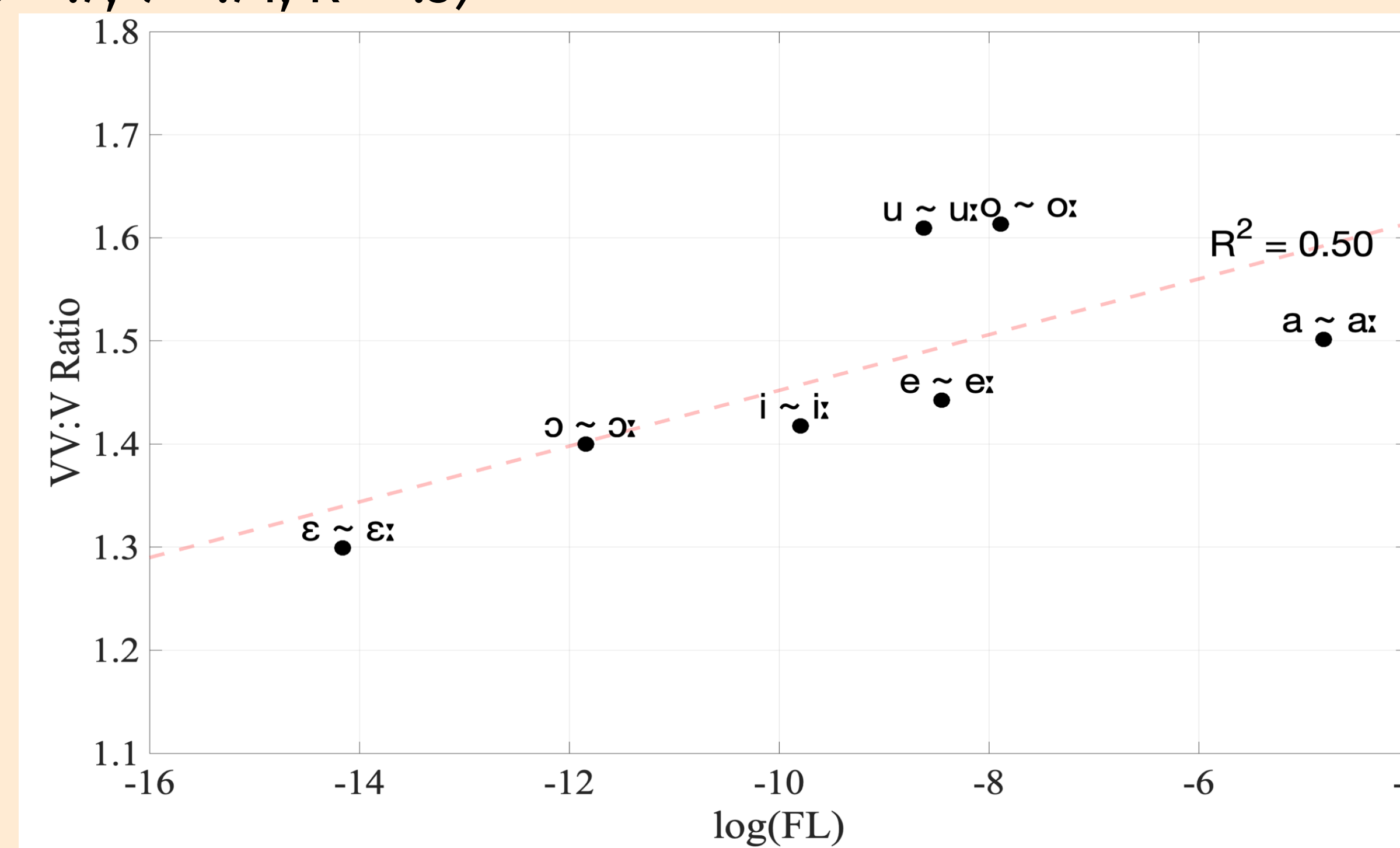
- ❖ 20 native speakers of Bangkok Thai
- ❖ Stimuli: 189 attested Thai words with all licit phonotactic and tone combinations embedded in a carrier sentence

### Data analyses

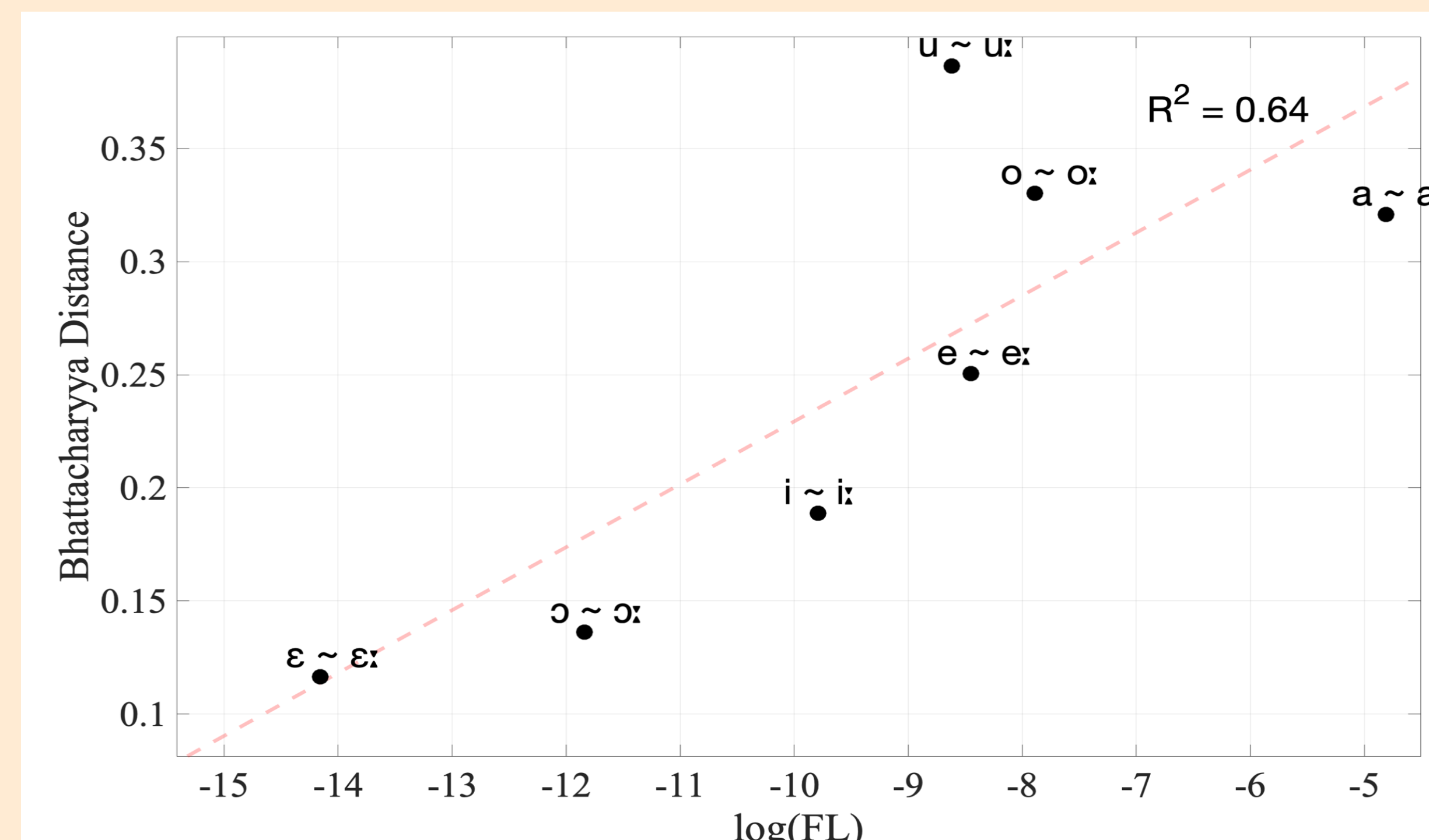
- ❖ Correlations of (i) grand mean vowel duration ratio and  $\log(FL)$  and (ii) Bhattacharyya Distance and  $\log(FL)$
- ❖ Pearson's  $r$  and Kendall  $\tau$  rank correlations

## Results

- ❖ Duration ratio displays a correlation with  $\log(FL)$  ( $\rho = .71$ ;  $\tau = .71$ ;  $R^2 = .5$ )



- ❖ Bhattacharyya Distance displays a correlation with  $\log(FL)$  ( $\rho = .8$ ;  $\tau = .61$ ;  $R^2 = .64$ )



## Perception

### Data collection

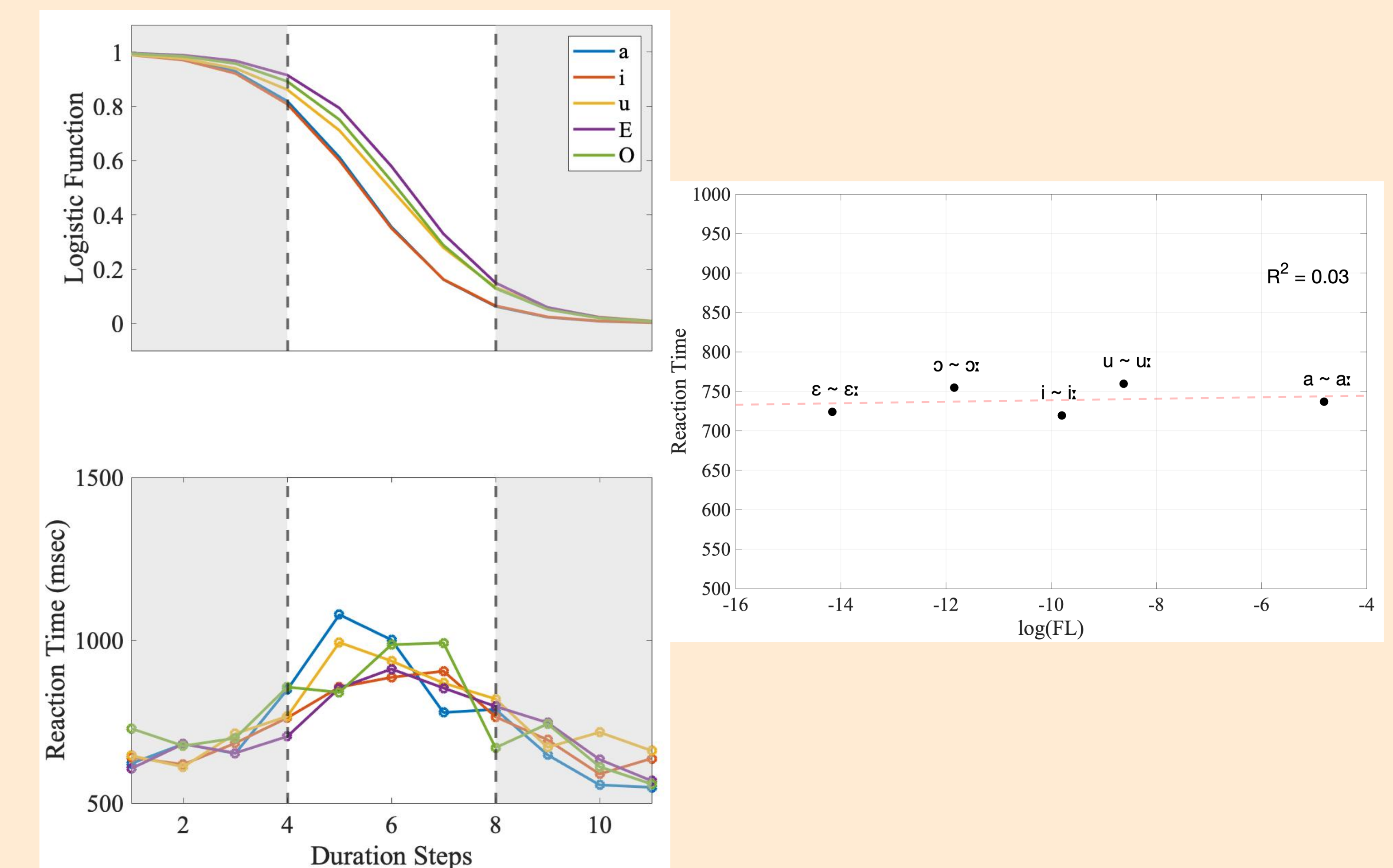
- ❖ 15 native speakers of Bangkok Thai
- ❖ ABX discrimination task
- ❖ Stimuli: nonce words of shape [f (i/u/ε/ɔ/a) p]
- ❖ We modified vowel duration of the stimuli into 11 steps

### Data analyses

- ❖ Mixed effect logistic regression comparing models with and without the interaction of duration step and vowel quality
- ❖ Correlation of the grand mean of the reaction time for step 4-8 (ambiguous stimuli) and  $\log(FL)$

## Results

- ❖ Loglikelihood ratio tests indicates that model structure should include both duration steps and vowel quality ( $\chi^2(4) = 46.423$ ,  $p < .001$ ) but not the interaction ( $\chi^2(40) = 52.553$ ,  $p = .088$ )
- ❖ Mean reaction times *do not* show a correlation with  $\log(FL)$  ( $\rho = .18$ ;  $\tau = .2$ ;  $R^2 = .03$ )



## Conclusion

- ❖ The results show that FL modulates the production of short-long vowel contrast, but it does not affect perception
- ❖ Production  $\neq$  Perception? Different basic units (segments/gestures vs words)?
- ❖ Sound change not based on perception alone, but on "stability" in production, modulated by FL
- ❖ FL may be accommodated in a dynamical model of speech production, like the task dynamic model of Articulatory Phonology, by modulating gestural durations *via* feedback-based suppression (Tilsen 2016)

## References

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