

# Tongue root advancement and vowel duration: a gradient effect?

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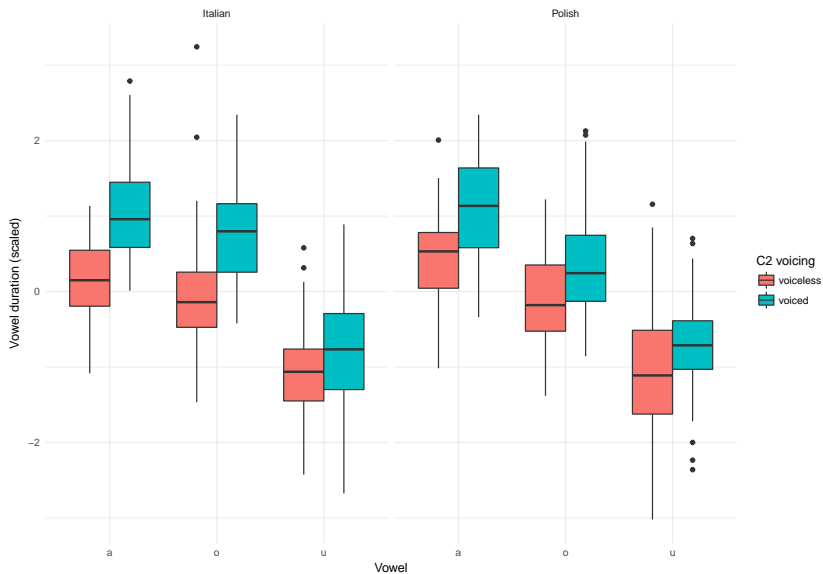
- **correlates of voicing**
  - shorter VOT (Westbury, 1983; Davidson, 2016; Abramson & Whalen, 2017)
  - tongue root advancement TRA (Westbury, 1983; Ohala, 2011)
  - correlation VOT ~ TRA (Ahn, 2015)
  - longer vowel duration (House & Fairbanks, 1953; Peterson & Lehiste, 1960; Chen, 1970; Klatt, 1973; Lisker, 1974; Fowler, 1992; Lampp & Reklis, 2004)
- *relation between vowel duration and TRA*

- **voicing effect:** vowels are longer when followed by voiced stops
  - *Italian:* voicing effect of 35 msec (Farnetani & Kori, 1986)
  - *Polish:* mixed results
    - Keating (1984): no effect
    - Nowak (2006) PhD dissertation: 4.5 msec effect
- timing of laryngeal and tongue activity
  - simultaneous UTI + EGG + audio

## Methods (a summary)

- **Participants:** 4 Italians (2 F, 2 M), 4 Polish (2 F, 2 M)
- **Procedure:**
  - simultaneous ultrasound tongue imaging and audio recording
  - stabilisation headset (Articulate Instruments Ltd™, 2008)
- **Materials:**
  - $C_1V_1C_2V_1$ 
    - $C_1 = /p/$ ,  $V_1 = /a, o, u/$ ,  $C_2 = /t, d, k, g/$
    - *pata, pada, paka, ..., poto, podo, ...*
    - stress on first syllable
  - frame sentence
    - *Dico X lentamente*, 'I say X slowly'
    - *Mówię X teraz*, 'I say X now'
    - no pauses between words

# Results: Vowel duration



## Results: Vowel duration

- linear mixed-effects models (Bates et al., 2015; Kuznetsova et al., 2016)
- Italian
  - voicing + place + vowel + sentence duration + voicing:vowel
  - (1+voicing|speaker) + (1|word)
  - $\beta = 22$  msec,  $\chi^2(3) = 15.8$ ,  $p = 0.0012434$
- Polish
  - voicing + place + vowel + sentence duration + voicing:vowel + place:vowel
  - (1+voicing|speaker) + (1|word)
  - $\beta = 12$  msec,  $\chi^2(3) = 12.39$ ,  $p = 0.0061556$

## Results: Vowel duration

	Intercept	Voiced
it01	9.9	15.8
it02	16.8	31.2
it03	0.3	19.6
it04	6.7	20.5

	Intercept	Voiced
pl02	13.6	9.7
pl03	12.2	8.8
pl04	14.0	10.0
pl05	25.6	17.8

- **tongue contours polar coordinates** (Heyne & Derrick, 2015b,a; Mielke, 2015)
  - at acoustic closure onset
  - at maximum displacement (within closure, Strycharczuk & Scobbie, 2015)
- **generalised additive mixed effects models** (Wood, 2006; Sóskuthy, 2017; van Rij et al., 2017)
  - **rticulate** R package (Coretta, 2018a,b)
- **general trends**
  - idiosyncratic use of TRA
  - speakers with robust appreciable TRA have stronger voicing effect



### References

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