

# Vowel duration and tongue root advancement in Italian and Polish

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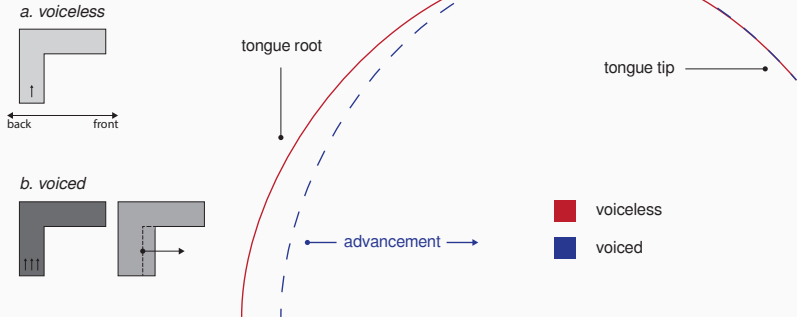
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4 October 2017, Ultrafest VIII (Potsdam)

# Background

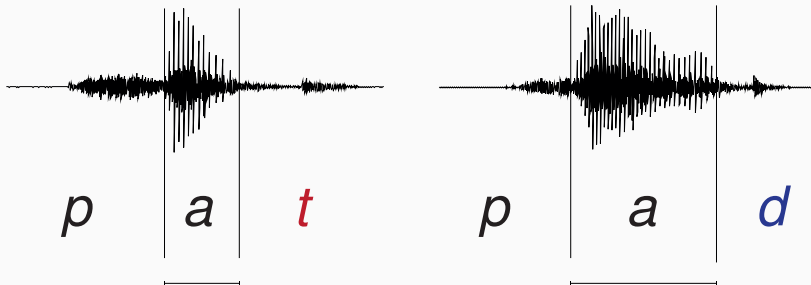
- tongue root advancement (TRA)
  - voicing (Westbury 1983)
  - VOT (Ahn 2015)
  - also *vowel duration*?



# Background

- voicing effect

- House & Fairbanks (1953), Chen (1970), Klatt (1973), Lisker (1973)
- no consensus on which factors play a role



- **Italian** (Farnetani & Kori 1986)

- +35 msec / \_D

- **Polish** (Keating 1984)

- no difference

→ **H1**: TRA in Italian (*a*), no TRA in Polish (*b*).

→ **H2**: TRA increases during closure in Italian.

- **pilot** study
- Italian (2 *males*), Polish (1 *female*, 1 *male*)
- C<sub>1</sub>V<sub>1</sub>C<sub>2</sub>V<sub>1</sub>
  - C<sub>1</sub> = /p/, V<sub>1</sub> = /a, o/, C<sub>2</sub> = /t, d, k, g/
  - *pata, pada, paka, ..., poto, podo, ...*
- frame sentence
  - *Dico X lentamente*, 'I say X slowly'
  - *Mówię X teraz*, 'I say X now'

- **equipment**

- Articulate Instruments set-up: Echo Blaster 128, C3.5/20/128Z-3 ultrasonic transducer (2-4 MHz), probe stabilisation headset (Articulate Instruments Ltd 2011)
  - frame rate = 55-65 fps

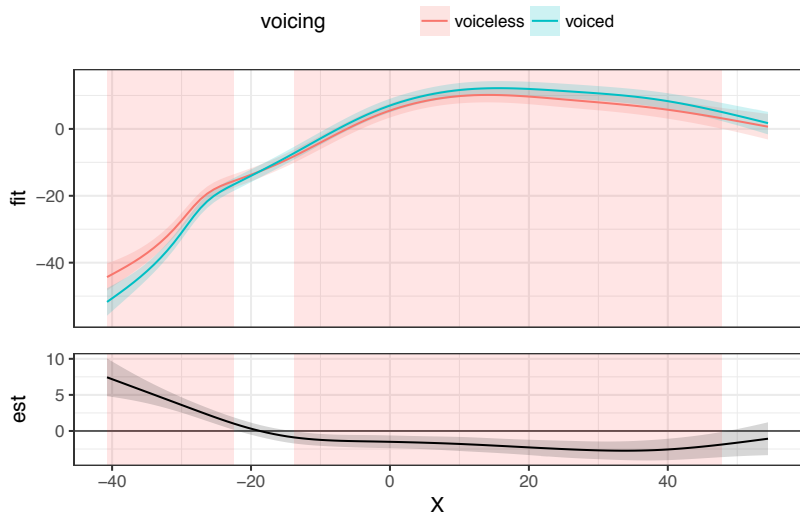
- **data**

- tongue contours with AAA (Articulate Instruments Ltd 2011)
  - at closure onset
  - at maximum tongue displacement (Strycharczuk & Scobbie 2015)

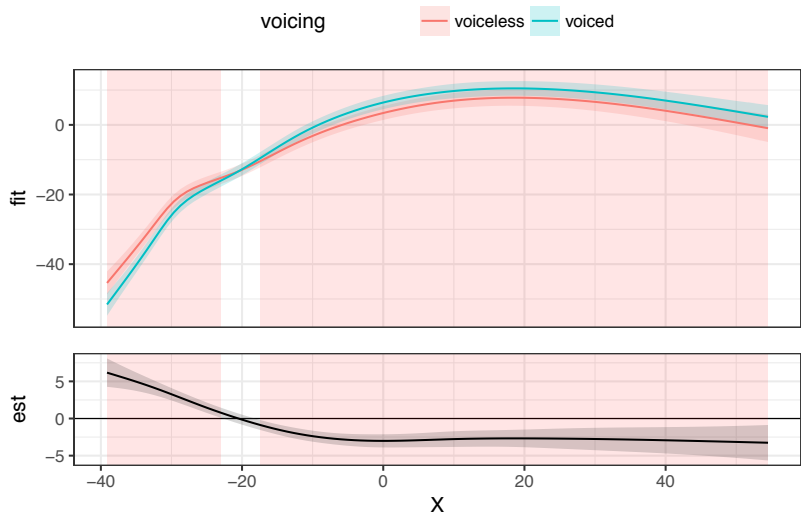
- **analysis**

- generalised additive mixed effects models (Wood 2006, Sóskuthy 2017, van Rij et al. 2017)
- data and code available at <https://github.com/stefanocoretta/2017-ultrafest>

# Results: Italian (maximum displacement), speaker IT01

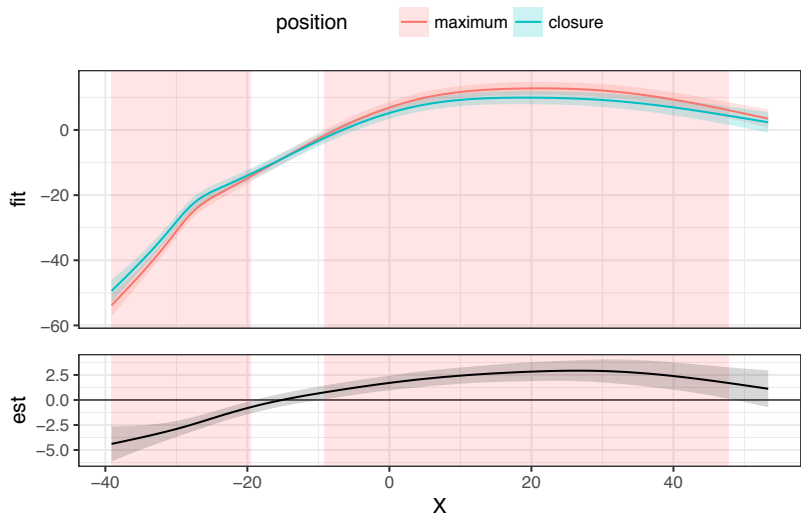


# Results: Italian (closure onset), speaker IT01

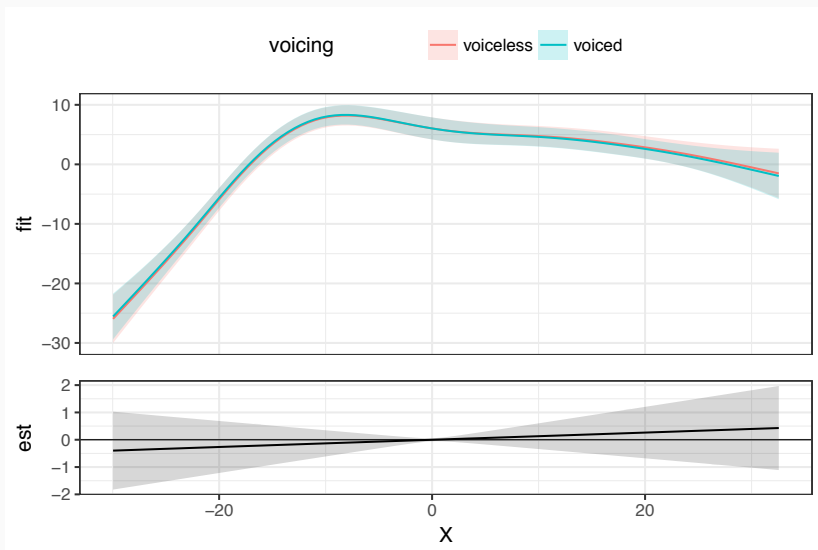




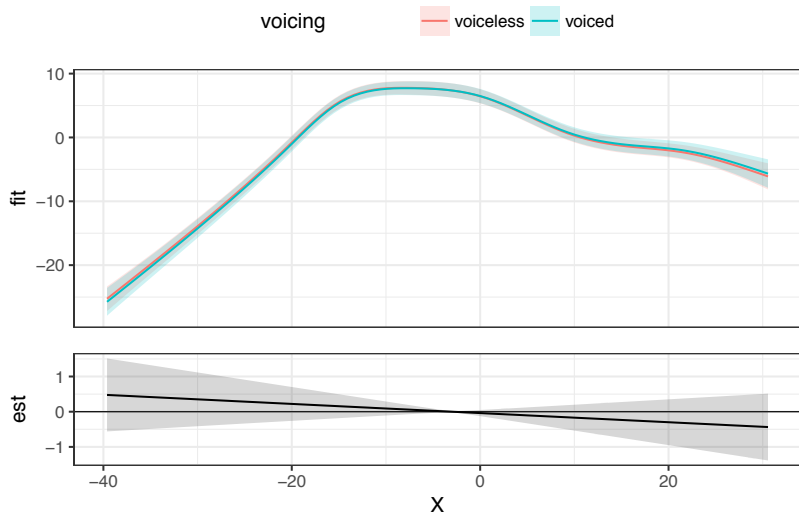
# Results: Italian (closure onset vs. maximum displacement), speaker IT01



# Results: Polish (maximum displacement), speaker PL04



## Results: Polish (closure onset), speaker PL04



- results
  - **TRA in Italian** at closure onset *and* maximum displacement (**H1a**)
  - no TRA in Polish (**H1b**)
  - *increases from closure onset to maximum displacement* (**H2**)
    - TRA is initiated before closure onset
- correlation between vowel duration and tongue root advancement is supported by the data
  - time to allow TRA → longer vowel (cf. Halle & Stevens 1967)

# THANK YOU!

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# Vowel durations

- methods
  - vowel durations from acoustics
  - four speakers per language, /a, o, u/
  - linear mixed effects models (Bates et al. 2015)
- results
  - Italian: 22 ( $\pm 6$ ) msec voicing effect
    - $\chi^2(3) = 16.61, p = 0.00085$  \*\*\*
  - Polish: 8 ( $\pm 3.3$ ) msec voicing effect
    - $\chi^2(1) = 5.4, p = 0.02$  \*
- discussion
  - the Italian estimate is in line with previous work
  - Polish is surprising
    - one speaker had bigger slope

# References

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