The University of Manchester

Vowel duration and tongue root advancement in Italian and Polish

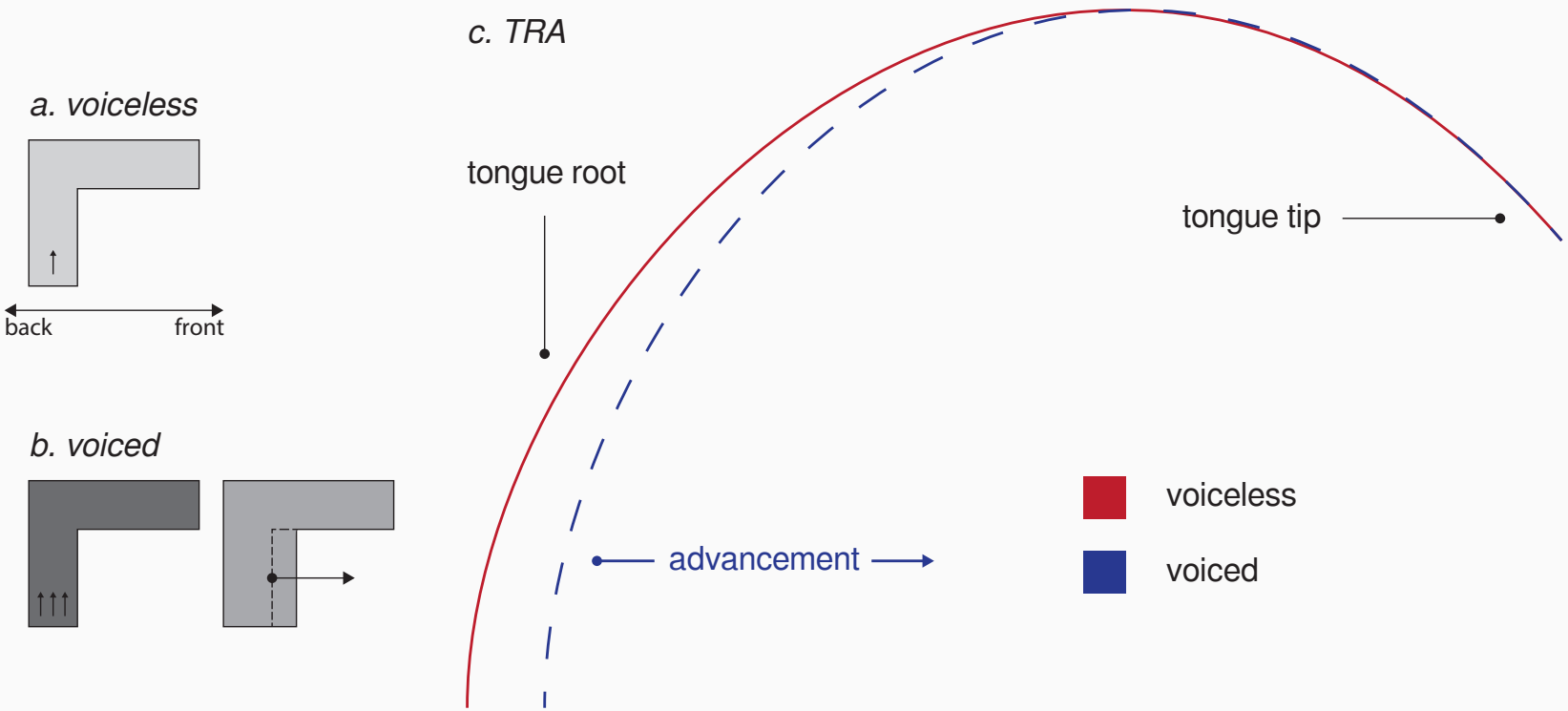
Stefano Coretta

University of Manchester

4 October 2017, Ultrafest VIII (Potsdam)

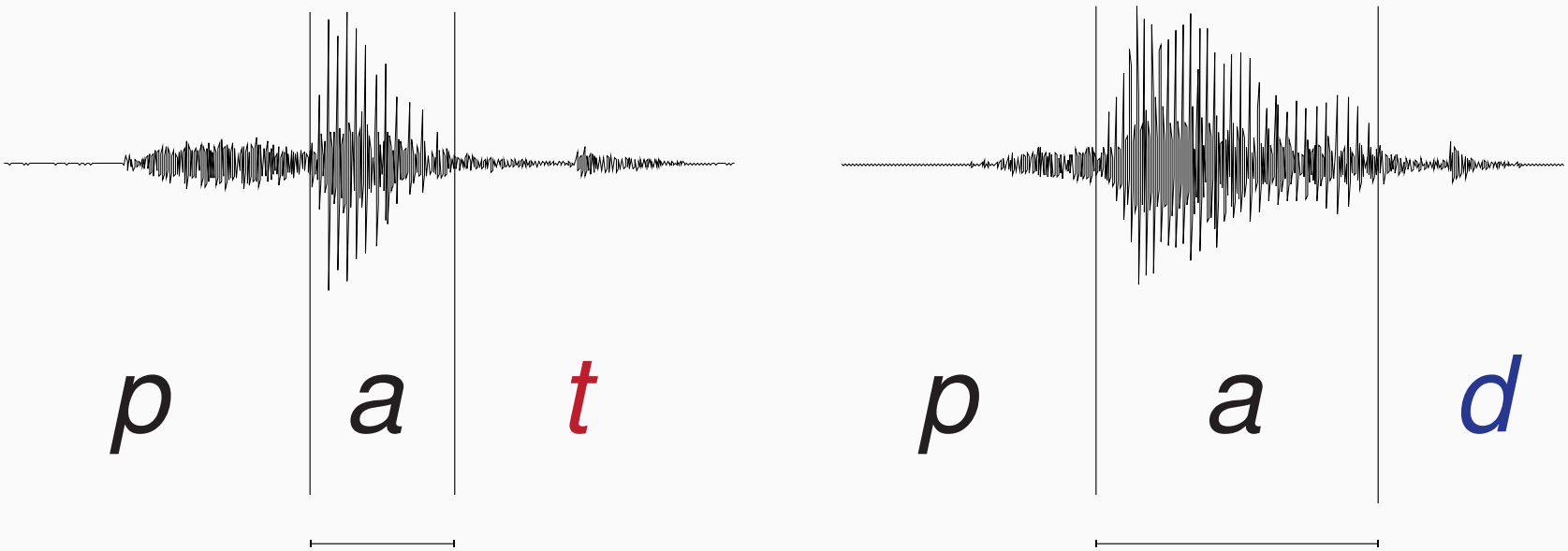
Background

- 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 consesus on which factors play a role



Background

- **Italian** (Farnetani & Kori 1986)
  - +35 msec / __D
- **Polish** (Keating 1984)
  - no difference

→ **H1a**: TRA in Italian.

→ **H1b**: TRA in Polish.

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

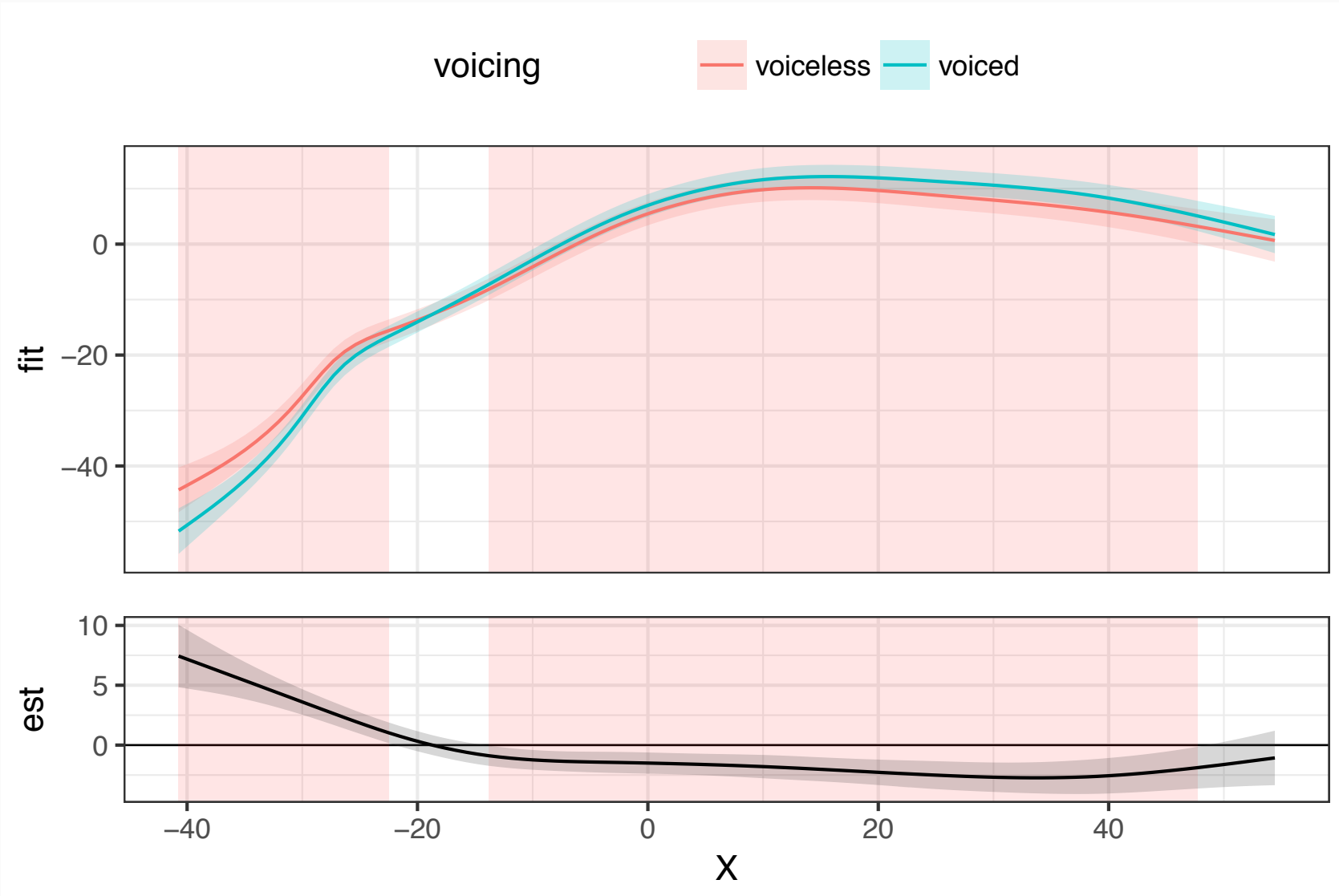
Methods

- **pilot** study
- Italian (*2 males*), Polish (*1 female, 1 male*)
- $C_1V_1C_2V_1$
    - C_1 = /p/, V_1 = /a, o/, C_2 = /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'

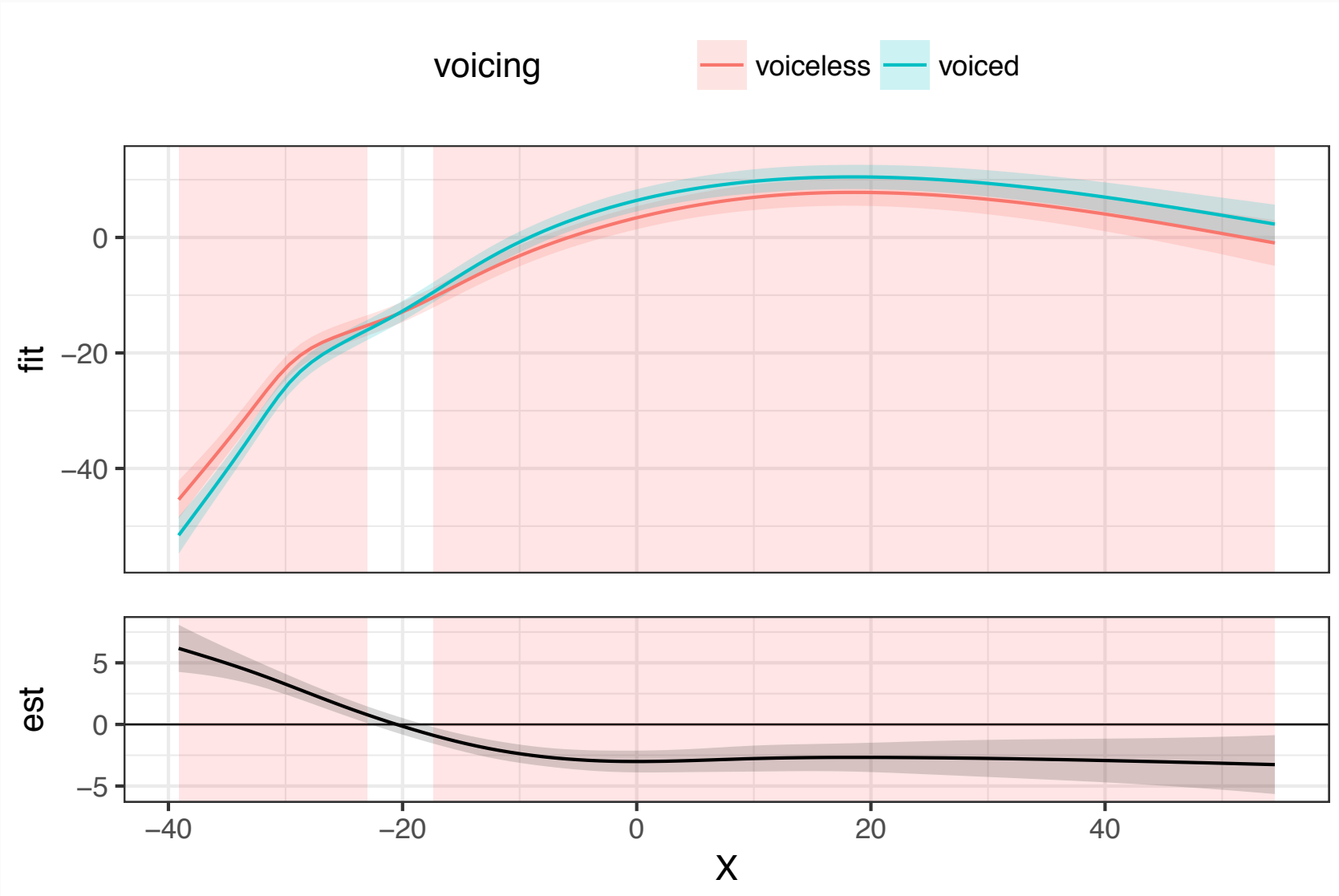
Methods

- equipment
  - Articulate Instruments set-up with probe stabilisation headset (Articulate Instruments Ltd 2011)
    - Echo Blaster 128, frame rate = 60 fps
- data
  - tongue contours
    - 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`

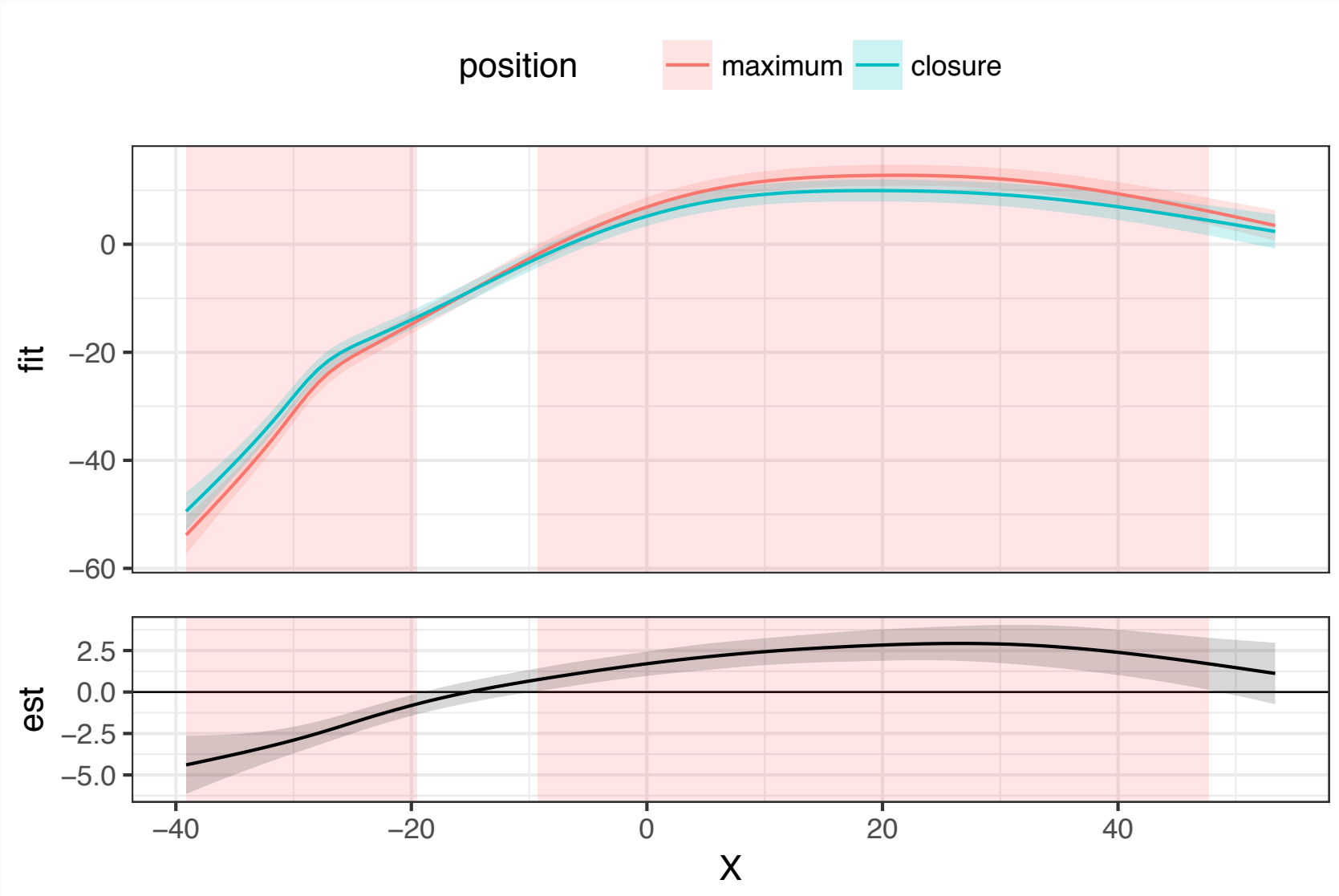
Results: Italian (maximum displacement), speaker IT01



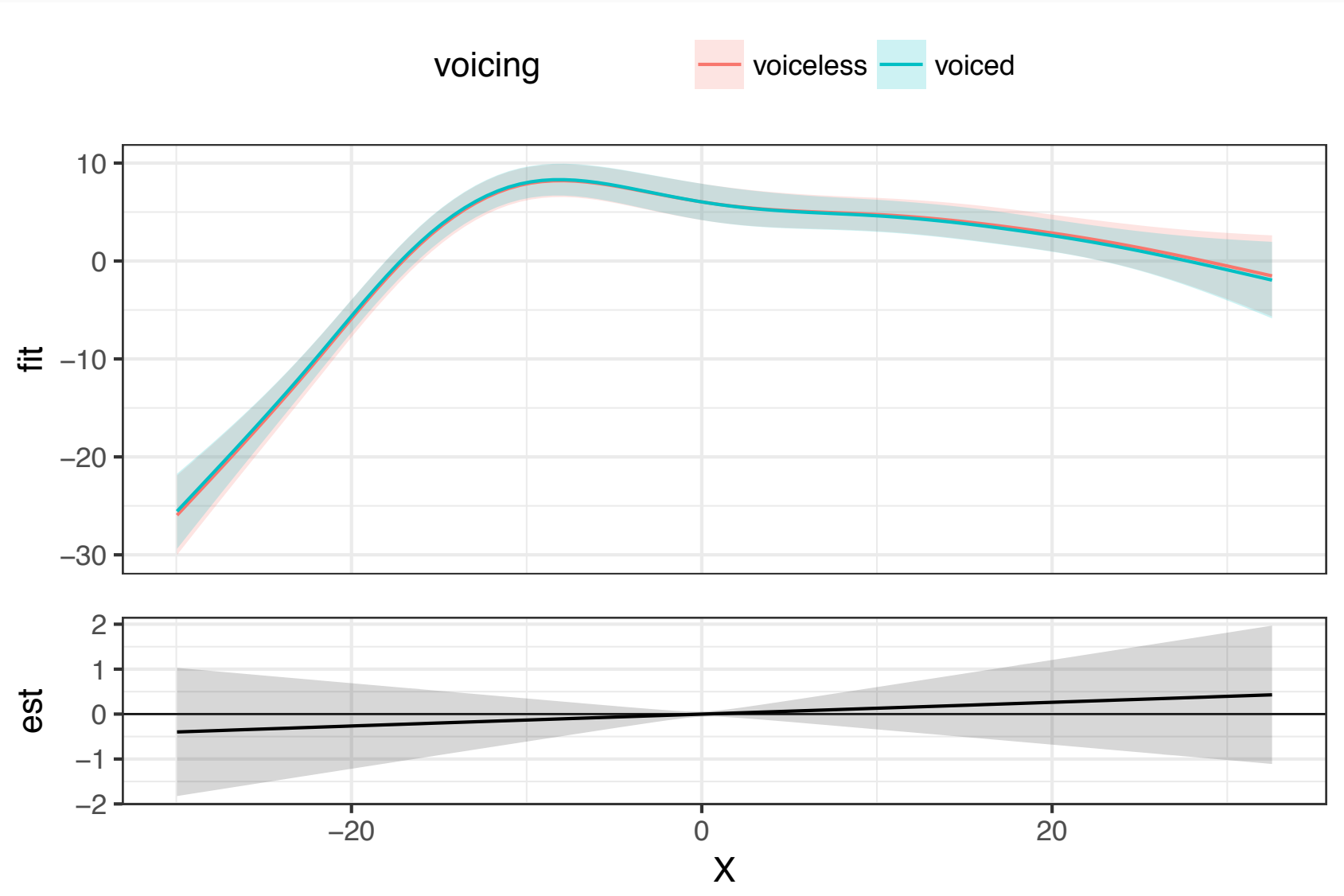
Results: Italian (closure onset), speaker IT01



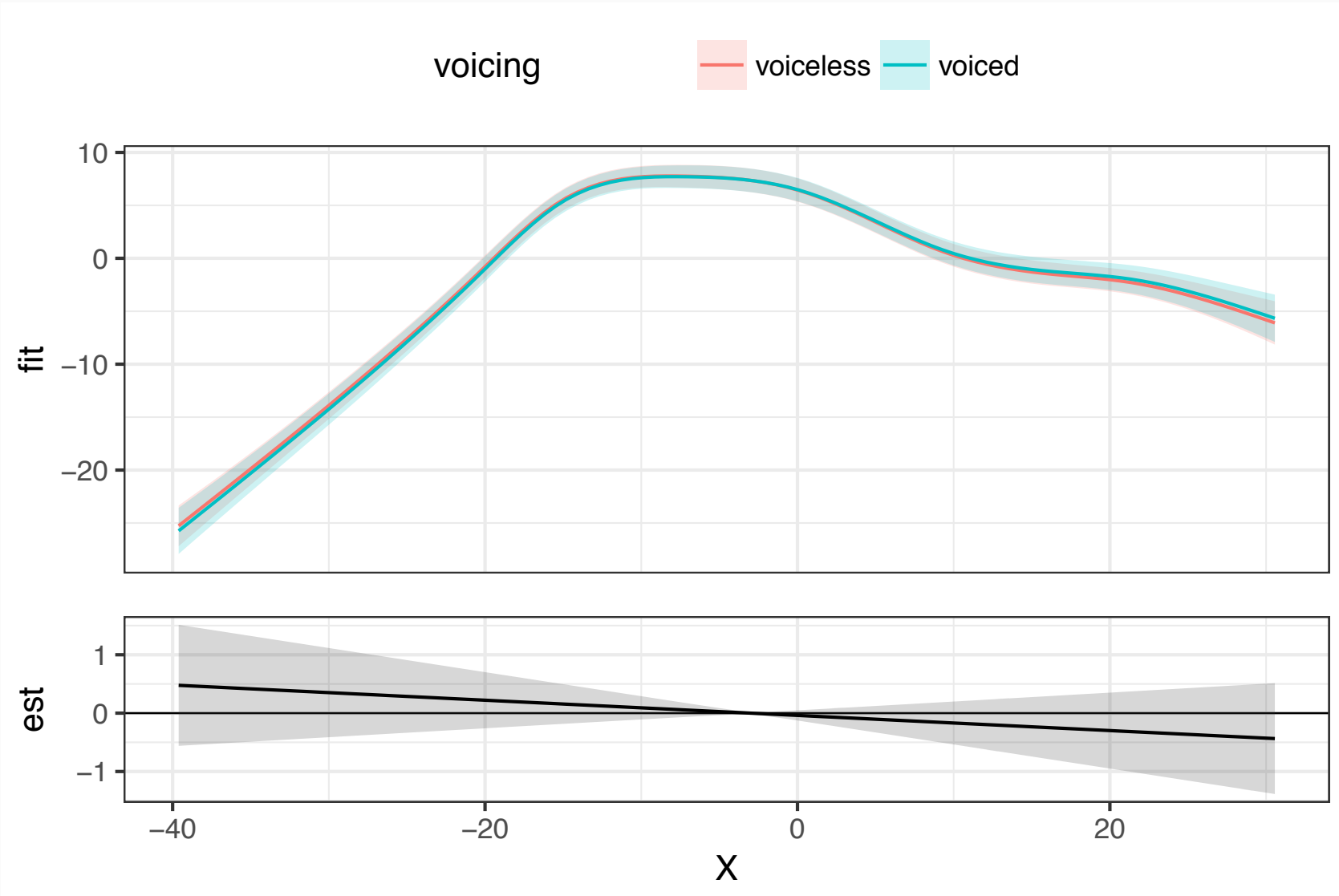
Results: Italian (closure onset vs. maximum displacement), speaker IT01



Results: Polish (maximum displacement), speaker PL04



Results: Polish (closure onset), speaker PL04



Summary

- 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 voicing effect and tongue root advancement is supported by the data
  - time to allow TRA → longer vowel (cf. Halle & Stevens 1967)

THANK YOU!

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** (±6) msec voicing effect
    - $\chi^2(3) = 16.61$, $p = 0.00085$ ***
  - Polish: **8** (±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 suprising
    - one speaker had bigger slope

References

Ahn, Suzy. 2015. The role of the tongue root in phonation of American English stops. Paper presented at Ultrafest VII.

Articulate Instruments Ltd. 2011. Articulate Assistant Advanced user guide. Version 2.16.

Bates, Douglas, Martin Mächler, Ben Bolker & Steve Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1–48.

Chen, Matthew. 1970. Vowel length variation as a function of the voicing of the consonant environment. *Phonetica* 22(3). 129–159.

References ii

Farnetani, Edda & Shiro Kori. 1986. Effects of syllable and word structure on segmental durations in spoken Italian. *Speech communication* 5(1). 17–34.

Halle, Morris & Kenneth Stevens. 1967. Mechanism of glottal vibration for vowels and consonants. *The Journal of the Acoustical Society of America* 41(6). 1613–1613.

House, Arthur S. & Grant Fairbanks. 1953. The influence of consonant environment upon the secondary acoustical characteristics of vowels. *The Journal of the Acoustical Society of America* 25(1). 105–113.

Keating, Patricia A. 1984. Universal phonetics and the organization of grammars. *UCLA Working Papers in Phonetics* 59.

Klatt, Dennis H. 1973. Interaction between two factors that influence vowel duration. *The Journal of the Acoustical Society of America* 54(4). 1102–1104.

References iii

Lisker, Leigh. 1973. On “explaining” vowel duration variation. In *Proceedings of the Linguistic Society of America*, 225–232.

Sóskuthy, Márton. 2017. Generalised additive mixed models for dynamic analysis in linguistics: a practical introduction. arXiv preprint arXiv:1703.05339.

Strycharczuk, Patrycja & James M. Scobbie. 2015. Velocity measures in ultrasound data. Gestural timing of post-vocalic /l/ in English. In *Proceedings of the 18th International Congress of Phonetic Sciences*, 1–5.

van Rij, Jacolien, Martijn Wieling, R. Harald Baayen & Hedderik van Rijn. 2017. itsadug: Interpreting time series and autocorrelated data using GAMMs. R package version 2.3.

References iv

Westbury, John R. 1983. Enlargement of the supraglottal cavity and its relation to stop consonant voicing. *The Journal of the Acoustical Society of America* 73(4). 1322–1336.

Wood, Simon. 2006. *Generalized additive models: an introduction with R*. CRC press.