Tongue root advancement and vowel duration: a gradient effect?

Stefano Coretta

05/03/2018

Background

- 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 []
- *relation between vowel duration and TRA*

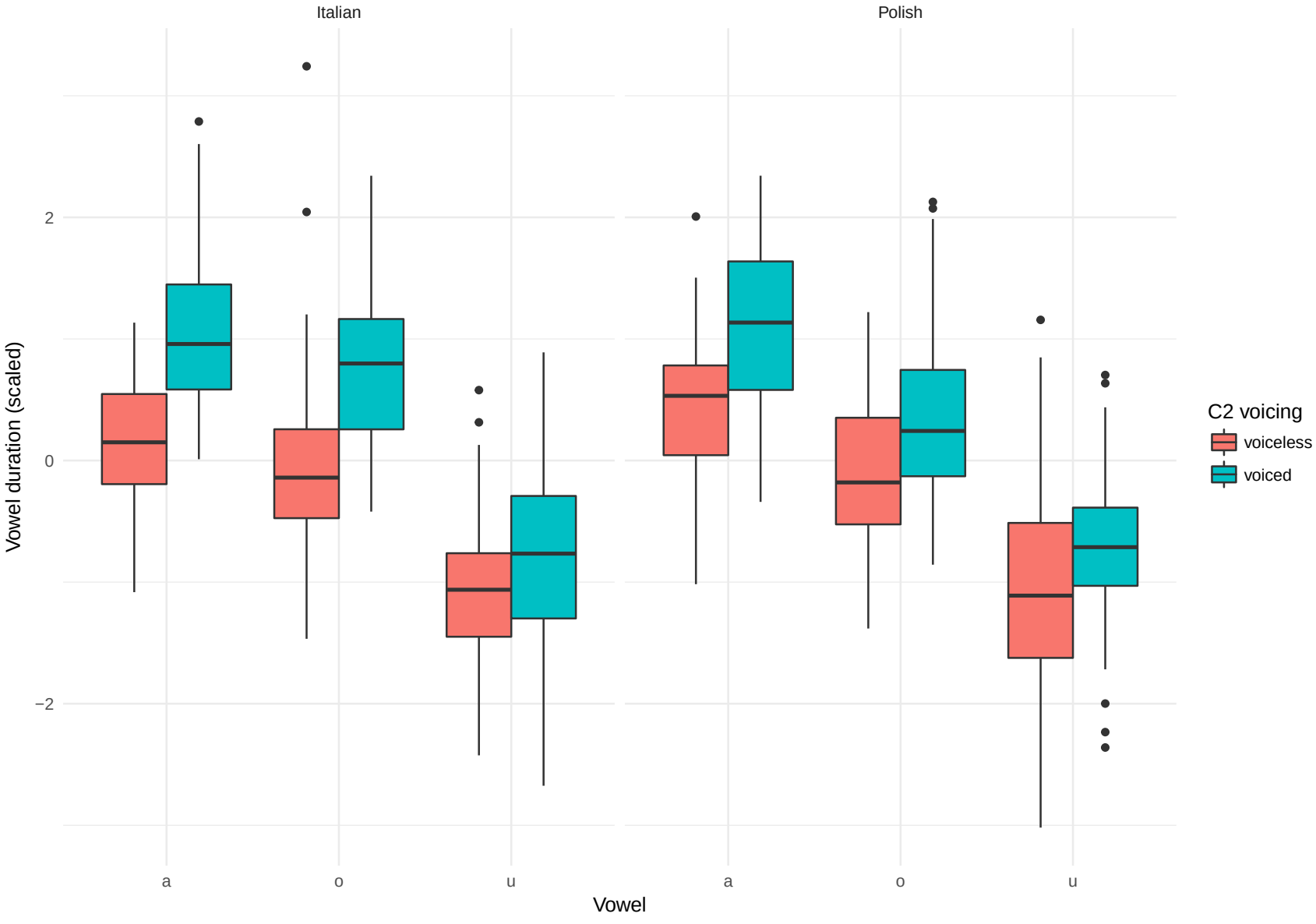
Background

- **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): 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)`
  - β = 22, χ^2(3) = 15.8, p = 0.0012434
- Polish
  - `voicing + place + vowel + sentence duration + voicing:vowel + place:vowel`
  - `(1+voicing|speaker) + (1|word)`
  - β = 12, χ^2(3) = 12.39, p = 0.0061556

Results: Summary

	IT01	IT02	IT03	IT04	PL02	PL03	PL04	PL05
TRA [closure onset]	yes	yes						
TRA [within closure]	yes	yes	yes (/a/)					yes

Discussion

greater TRA in voiced stops ? relatively stronger VE

	+ TRA+	– TRA+
+ VE+	?	?
- VE+	?	?

References

Abramson, Arthur S. & Douglas H. Whalen. 2017. Voice Onset Time (VOT) at 50: Teoretical and practical issues in measuring voicing distinctions. *Journal of Phonetics* 63. 75–86.

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

Articulate Instruments Ltd™. 2008. Ultrasound stabilisation headset users manual: Revision 1.4. Edinburgh, UK: Articulate Instruments Ltd.

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

Davidson, Lisa. 2016. Variability in the implementation of voicing in American English obstruents. *Journal of Phonetics* 54. 35–50.

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

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

Kuznetsova, Alexandra, Per Bruun Brockhoff & Rune Haubo Bojesen Christensen. 2016. `lmerTest`: Tests in linear mixed effects models. https://CRAN.R-project.org/package=lmerTest. R package version 2.0-33.

Nowak, Pawel. 2006. *Vowel reduction in Polish*: University of California, Berkeley dissertation.

Ohala, John J. 2011. Accommodation to the aerodynamic voicing constraint and its phonological relevance. In *Proceedings of the 17th International Congress of Phonetic Sciences*, 64–67.

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.