

Longer vowel duration correlates with tongue root advancement in Italian and Polish: An ultrasound study

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LabPhon

The voicing effect

- shorter vowels before voiceless stops, longer vowels before voiced stops

Heffner (1937); House & Fairbanks (1953); Belasco (1953); Peterson & Lehiste (1960); Halle & Stevens (1967); Chen (1970); Klatt (1973); Lisker (1974); Raphael (1975); Javkin (1976); Maddieson & Gandour (1976); Farnetani & Kori (1986); Kluender et al. (1988); Laeuffer (1992); Fowler (1992); Hussein (1994); Esposito (2002); Lampp & Reklis (2004); Warren & Jacks (2005); Durvasula & Luo (2012)

Still no consensus on source!

Background

Proposed accounts:

- **production**
 - constant articulatory force (Belasco, 1953; Delattre, 1962)
 - durational trade-off (Slis & Cohen, 1969; Lehiste, 1970)
 - laryngeal adjustment (Halle & Stevens, 1967)
 - closing gesture duration (Chen, 1970)
- **perception**
 - misperception (Javkin, 1976)
 - enhancement (Kluender et al., 1988)
- but problems (Maddieson & Gandour, 1976; Fowler, 1992)

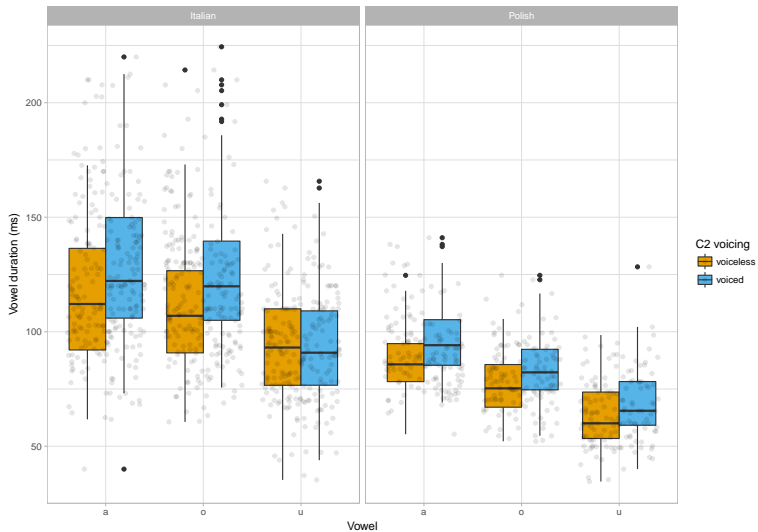
This talk:

- support for *durational trade-off hypothesis*
- link between *vowel duration* and *tongue root position*

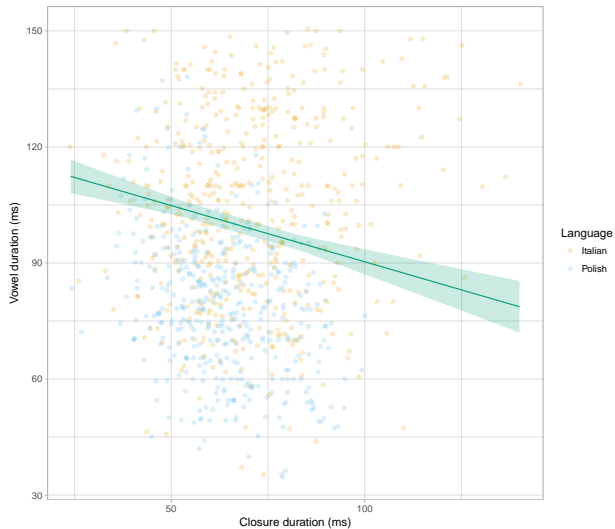
Methods

- **Participants:** 11 Italians (5 F, 6 M), 6 Polish (3 F, 3 M)
- **Targets**
 - $C_1V_1C_2V_1$
 - $C_1 = /p/, V_1 = /a, o, u/, C_2 = /t, d, k, g/$
 - *pata, pada, paka, ..., poto, podo, ...*
- **Frame sentence**
 - *Dico X lentamente*, 'I say X slowly'
 - *Mówię X teraz*, 'I say X now'
- **Data**
 - Durational data from acoustics
 - Tongue root from ultrasound tongue imaging
- **Reproducibility**
 - <https://github.com/stefanocoretta/2018-labphon>

Results: Vowel duration



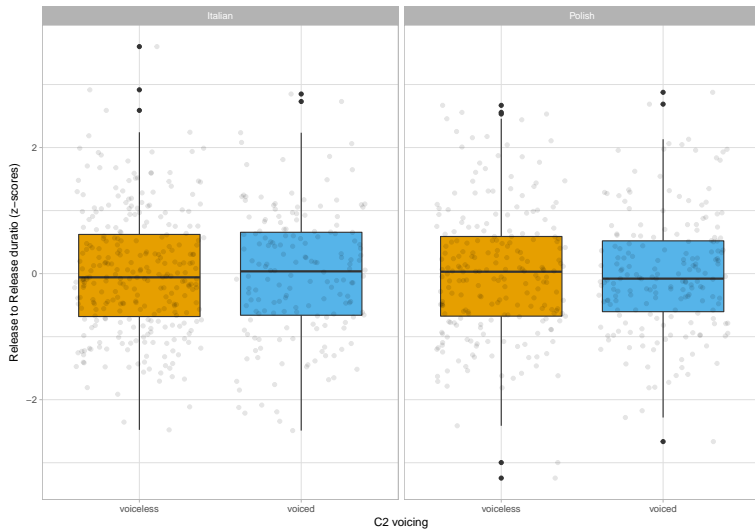
Results: Vowel and closure duration



Results: Vowel and closure duration

[figure of invariant interval]

Results: Release to Release duration



References

- Belasco, Simon. 1953. The influence of force of articulation of consonants on vowel duration. *The Journal of the Acoustical Society of America* 25(5). 1015–1016.
- Chen, Matthew. 1970. Vowel length variation as a function of the voicing of the consonant environment. *Phonetica* 22(3). 129–159.
- Delattre, Pierre. 1962. Some factors of vowel duration and their cross-linguistic validity. *The Journal of the Acoustical Society of America* 34(8). 1141–1143.
- Durvasula, Karthik & Qian Luo. 2012. Voicing, aspiration, and vowel duration in Hindi. *Proceedings of Meetings on Acoustics* 18. 1–10.

- Esposito, Anna. 2002. On vowel height and consonantal voicing effects: Data from Italian. *Phonetica* 59(4). 197–231.
- Farnetani, Edda & Shiro Kori. 1986. Effects of syllable and word structure on segmental durations in spoken Italian. *Speech communication* 5(1). 17–34.
- Fowler, Carol A. 1992. Vowel duration and closure duration in voiced and unvoiced stops: There are no contrast effects here. *Journal of Phonetics* 20(1). 143–165.
- 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.
- Heffner, R.-M.S. 1937. Notes on the length of vowels. *American Speech* 12. 128–134.

- 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.
- Hussein, Lutfi. 1994. *Voicing-dependent vowel duration in Standard Arabic and its acquisition by adult american students*: The Ohio State University dissertation.
- Javkin, Hector R. 1976. The perceptual basis of vowel duration differences associated with the voiced/voiceless distinction. *Report of the Phonology Laboratory, UC Berkeley* 1. 78–92.
- Klatt, Dennis H. 1973. Interaction between two factors that influence vowel duration. *The Journal of the Acoustical Society of America* 54(4). 1102–1104.

Kluender, Keith R., Randy L. Diehl & Beverly A. Wright. 1988.

Vowel-length differences before voiced and voiceless consonants:
An auditory explanation. *Journal of Phonetics* 16. 153–169.

Laeuffer, Christiane. 1992. Patterns of voicing-conditioned vowel
duration in French and English. *Journal of Phonetics* 20(4). 411–440.

Lampp, Claire & Heidi Reklis. 2004. Effects of coda voicing and
aspiration on Hindi vowels. *The Journal of the Acoustical Society of
America* 115(5). 2540–2540.

Lehiste, Ilse. 1970. Temporal organization of spoken language. In
Working papers in linguistics, vol. 4, 96–114.

Lisker, Leigh. 1974. On “explaining” vowel duration variation. In
Proceedings of the Linguistic Society of America, 225–232.

Maddieson, Ian & Jack Gandour. 1976. Vowel length before aspirated
consonants. In *UCLA Working papers in Phonetics*, vol. 31, 46–52.

- Peterson, Gordon E. & Ilse Lehiste. 1960. Duration of syllable nuclei in english. *The Journal of the Acoustical Society of America* 32(6). 693–703.
- Raphael, Lawrence J. 1975. The physiological control of durational differences between vowels preceding voiced and voiceless consonants in English. *Journal of Phonetics* 3(1). 25–33.
- Slis, Iman H. & Antonie Cohen. 1969. On the complex regulating the voiced-voiceless distinction II. *Language and speech* 12(3). 137–155.
- Warren, Willis & Adam Jacks. 2005. Lip and jaw closing gesture durations in syllable final voiced and voiceless stops. *The Journal of the Acoustical Society of America* 117(4). 2618–2618.