How consistent is the Voicing Effect across dialects of English?

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UK Language Variation & Change 12, QMUL & UCL, London, 3-5th September 2019

Background

- Voicing effect (VE): vowels preceding voiced obstruents longer than before their voiceless counterparts (House 1961)
  - e.g., bead vs beat
- Little studied in spontaneous speech, where vowel duration is also affected by speech rate, frequency, etc; not clear how robust the VE is across contexts
- Focused mainly on North American English; little is known about variability across English dialects (Tauberer & Evani 2009, Rathcke & Stuart-Smith 2016)

Research Questions

1. How robust is the Voicing Effect across phonetic and phonological contexts?
2. How variable is the Voicing Effect across dialects?

Methods

- Extraction of monosyllabic phrase-final vowels from 8 corpora (Buckeye, CORAL, ICE-Canada, Modern RP, Raleigh, Santa Barbara, SCOTS, Sounds of the City) corresponding to 15 dialects across British and North American English using ISCAN
- Removed tokens < 49ms (Dodsworth 2013)
- In total 58,571 tokens (1,233) types analysed from 498 speakers (247 female)

Model

- Bayesian linear mixed-effects regression fit using brms (Büchener 2017); an R interface for the Stan programming language (Stan Development Team 2018)
- Bayesian models provide a distribution of model parameters; possible to examine the range of values for a parameter
- Dependent variable: vowel duration
- Independent variables:
  - Following consonant voicing (the VE), manner, vowel height, mean and local speech rate, word frequency
  - Interactions between voiceing and all other terms
  - Maximal random effects structure for speakers, intercepts for words & vowel labels
  - Random effects correlation between intercept, voicing, manner, and voicing: manner included for speakers

Research Questions

RQ1: Voicing Effect is robust across phonetic and phonological contexts

- The Voicing Effect is observed, but the effect size is smaller than previously reported (median = 1.08; between 1 and 1.16)
- Vowel duration longer before stops than fricatives, but little evidence of a manner effect on VE size
- Vowel height modulates vowel duration with high vowels shorter than non-high; vowel height also affects VE size, with larger VE for non-high vowels
- More reduced and more predictable words have smaller VE values (Klatt 1973, Cuartero 2002)

RQ2: Voicing Effect is variable across dialects

- Dialect-level variability in VE size, roughly as large as population level VE size (median = 0.09, between 0.08 and 0.19)
- Dialects appear to differ gradually from each other, ranging from effectively-null to approximately 1.4
- Dialects with small/null VE are all Scottish varieties, whilst others (ENE, RP, NYC) have broadly positive (but possibly null) VE
- African American English (AAE) speakers in Washington DC have largest VE in sample (approximately 1.4), similar to previous observations in AAE read speech (Holt et al. 2016)

Conclusions

- Voicing Effect in spontaneous speech is smaller than previously reported for lab speech, and in line with other spontaneous speech studies (Tauberer & Evani 2009)
- VE size is modulated by manner, vowel height, speech rate, and word frequency
- English dialects demonstrate a continuum of potential VE sizes
  ➔ This suggests that Voicing Effect size is dialect-specific, as opposed to a single ‘English’ feature

Acknowledgements

- Anne Fabricius, Data Guardian of the Modern RP corpus
- 2019 Montreal-Ottawa-Toronto Phonology & Phonetics Workshop
- Michael McAuliffe for programming assistance
- ESRC ES/R003963/1, NSERC RGPDD 501771-16, SSHRC 869-2016-0006, NSF SMA-1730479

Paper available:


Tools

Polyglot/ISCAN
Python command line library/ Graphical User Interface

Tool for user friendly, large-scale, ethically non-invasive automated acoustic analysis of speech datasets

McAuliffe et al. (2019) Proc 19th ICPES

ISCAN inspection interface

Data analysis and visualization

Data import
type

Database

import database

export
data file

Sort of linguistic objects

Data file (CSV)

Enrichment
e.g. acoustic and prosodic
textual and speaker metadata

query, export

Log file

Speech datasets

Database

import, enrichment

External tools/resources

Database

Import speech datasets

Export

Download

Speech datasets

Buckeye

ICE-Canada

SCOTS

Lexicons

Other

Data file (CSV)

Database

import, enrichment

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Data file (CSV)