Change over time in nasal coarticulation: Independent sociodialectal and frequency effects

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Introduction

- US dialect vowel quality well-documented
  - Changes both across and within communities over time (Labov, 1994; Jacewicz et al., 2011; *inter alia*)
- Less attention to other subphonemic patterns, such as coarticulation
  - Variation within and across communities?
  - Evidence for theories of sound change
  - Implications for phonetic representations

Background: Philadelphia

- Philadelphia speech community well studied
  - 40 years of sociolinguistic fieldwork
  - 14 different phonetic-level vowel changes documented (Labov, 2001)
- Is there change in coarticulation over time?

Background: Coarticulation

- Articulatory overlap of discrete phonemes

- Originally thought to be purely physiological and universal (i.e. SPE)
- But, well-documented language-specific patterns of coarticulation
  - Structurally determined?
  - And/or learned and non-deterministic?

Background: Nasality

- Nasal coarticulation shows:
  - systematic intra-language variation (Scarborough, 2013)
  - cross-speaker convergence in degree (Zellou et al., 2013)
  - possible lifespan change (Kwon, 2013)
  - recruitment for stereotype performance (Podesva et al., 2013)

Background: Change & Coarticulation

- Coarticulation to phonology
  - Most discussion of change over time in nasality focuses on reanalysis (Ohala, 1975; Beddor et al., 2001)
- Coarticulatory change
  - Gradient coarticulatory change within the phonetic realm relatively understudied

Background: Change & Frequency

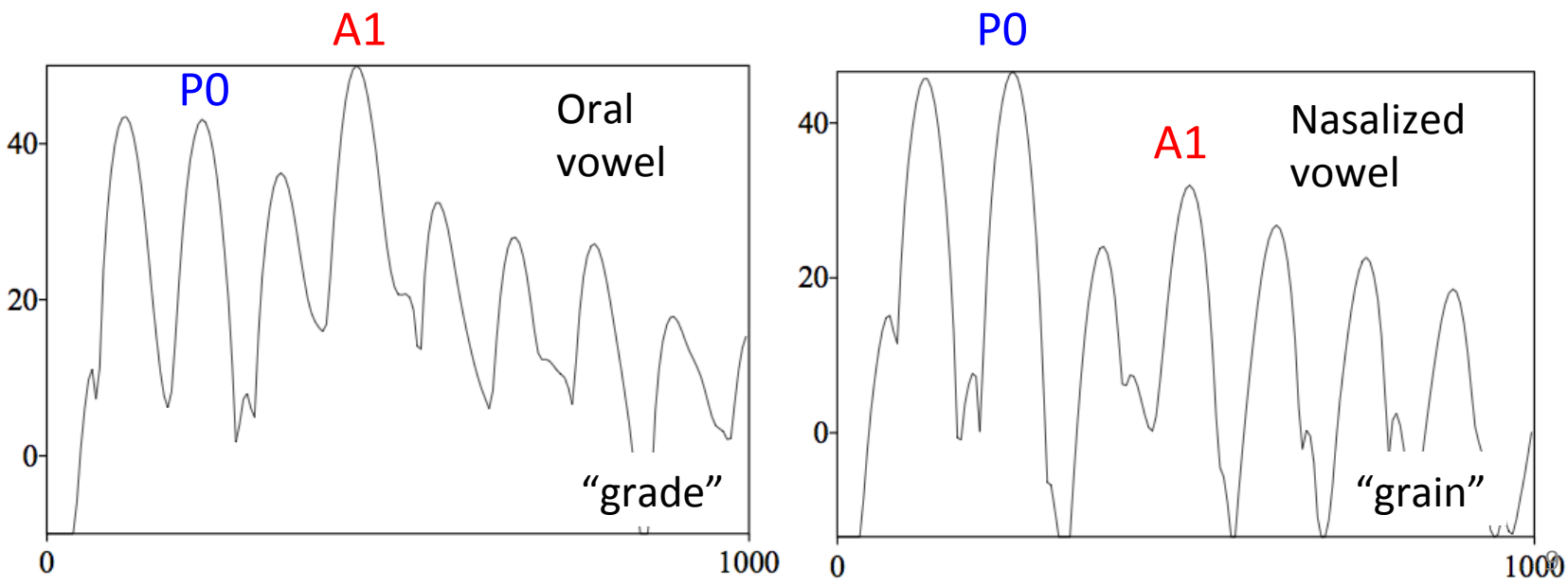
- Lexical frequency is a known determinant of phonetic variation
  - High frequency = more segmental reduction, etc.
- One view: high freq. exemplars accrue and drive sound change (i.e., Bybee, 2002)
- Another view: online adjustment result of cognitive activation and remains stable over time (cf. Pierrehumbert, 2001)

Research questions

- Can degree of nasal coarticulation change over time?
  - within speaker and/or across generations
- If so, is the change deterministic?
- And, is it frequency-driven?

Methodology: Nasality

- Degree of nasality measured as A1-P0
  - amplitude of F1 peak – amplitude of nasal formant peak
  - Smaller A1-P0 = more nasal



Methodology: Data

- Measured acoustic vowel nasality
  - in Philadelphia Neighborhood Corpus
- Extracted all monosyllabic/morphemic content words
- Containing exactly one nasal segment
  - only non-high vowels

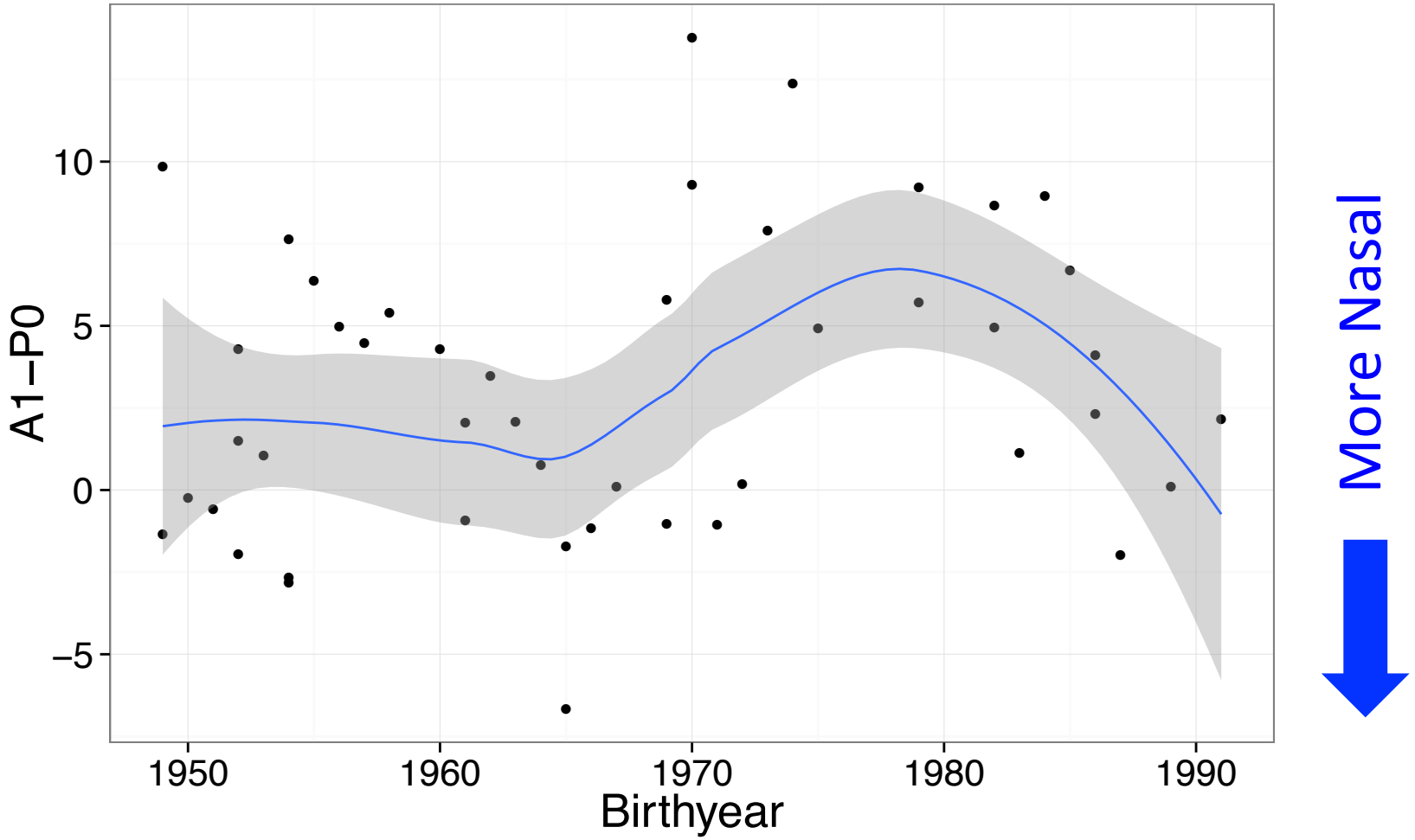
Methodology: Corpus

- Philadelphia Neighborhood Corpus (Labov & Rosenfelder, 2011)
  - Spontaneous, conversational speech
  - 1000+ interviews from speakers born 1888-1991
  - Subset of partially or fully transcribed interviews
  - Aligned using FAVE-align (Rosenfelder et al., 2011)
  - High correlation of age and birthyear
  - Disentangle lifespan change vs. community change

Methodology: Samples

- Real-time sample: Community-level change
  - All **46** PNC speakers under the age of 25
  - Birthyear 1949-1989
- Pseudo-panel sample: Lifespan change
  - All **41** PNC speakers born between 1940-1949
  - Age 30-67
- Apparent-time sample
  - Combine 2 samples + 18 fully transcribed PNC speakers (**105 speakers**)
  - B.Y. 1890-1991: Full century of apparent time

Results: Real-time sample

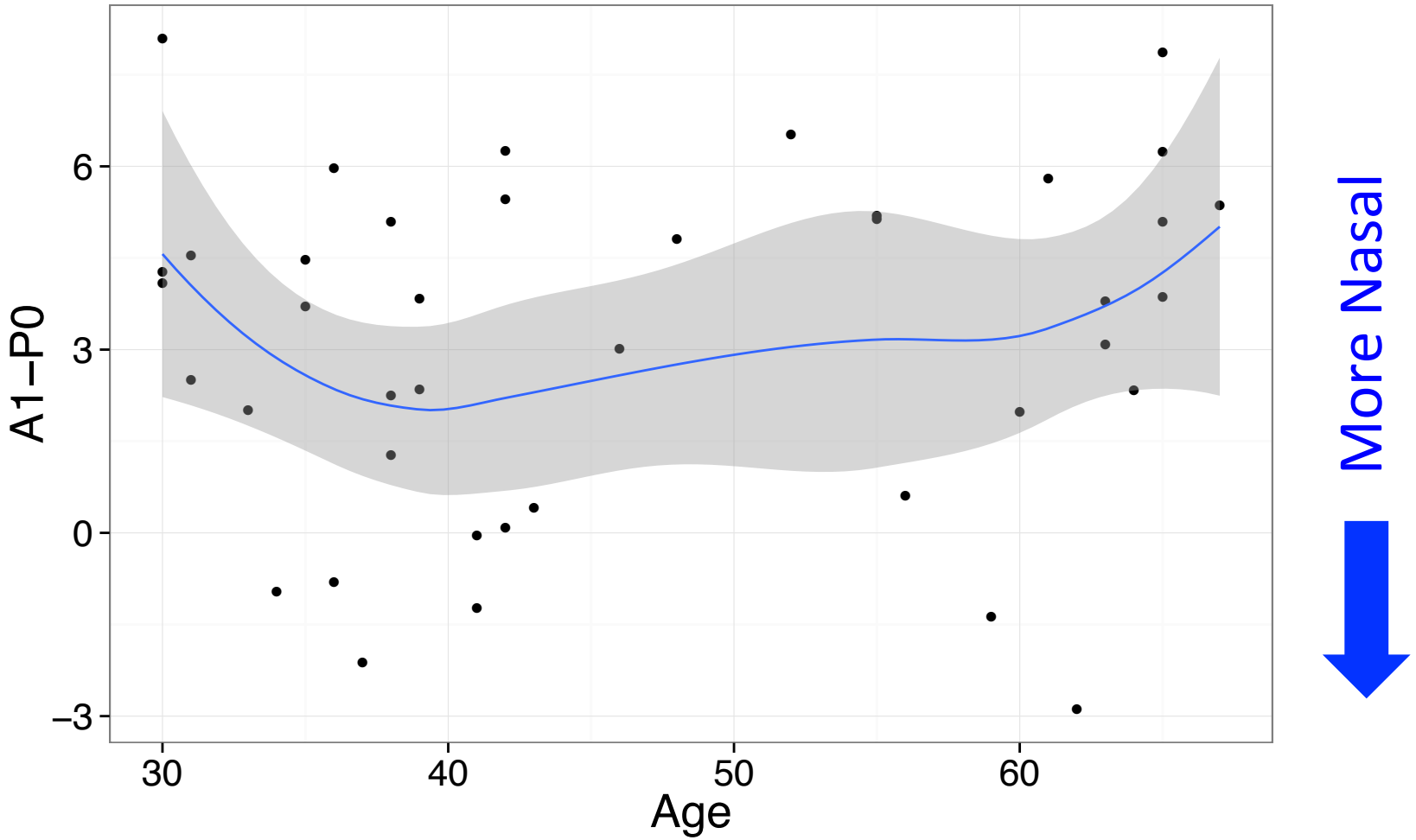


Results: Real-time sample

- Predictors from mixed-effects model:
  - Birthyear (standardized, polynomial) (p=.02)
  - Log vowel duration (p=.001)

  - Non-significant: Age, gender, frequency, vowel height, nasal probability, directionality, neighborhood density, birthyear * frequency, direction * frequency

Results: Pseudo-panel sample



Results: Pseudo-panel sample

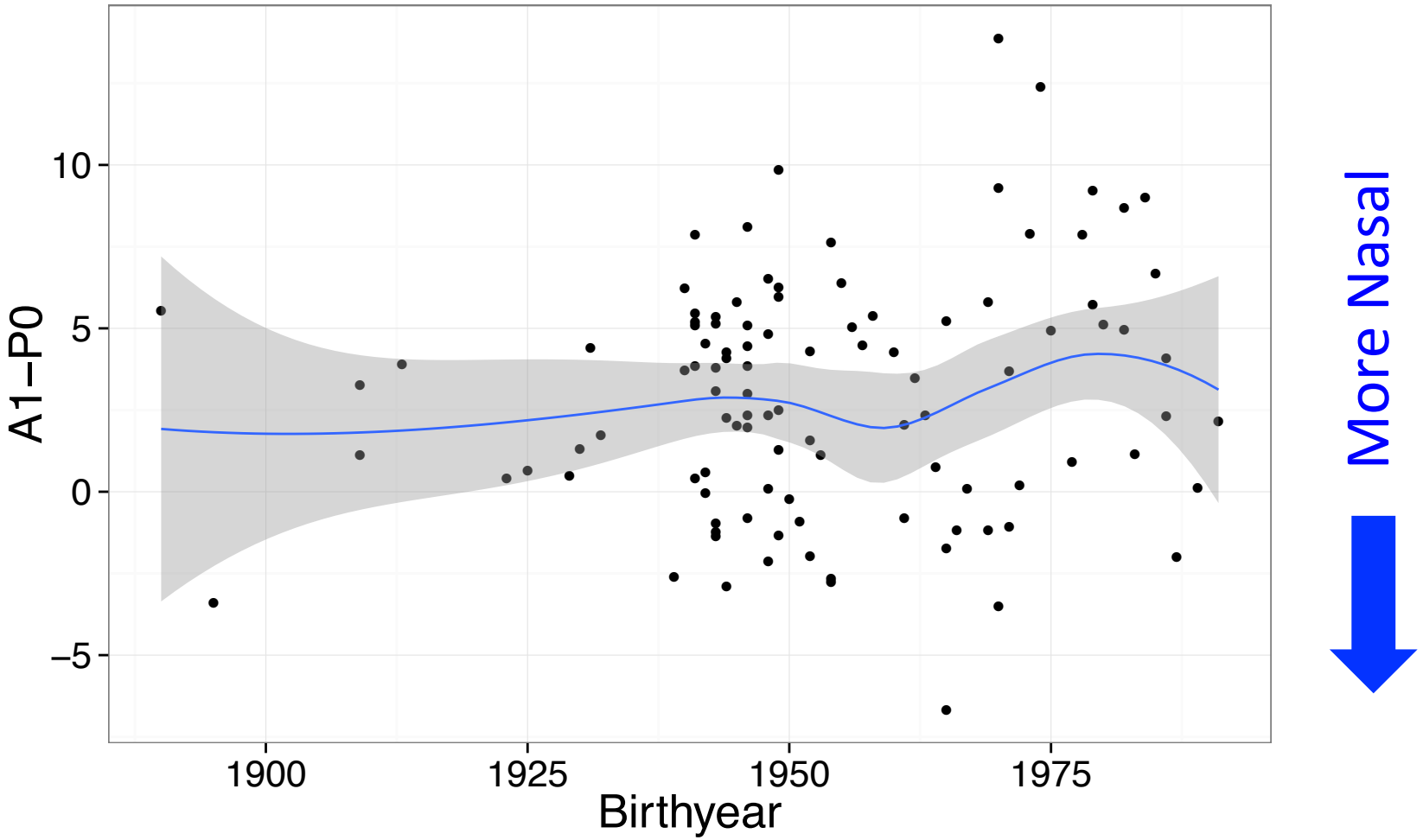
- Predictors from mixed effects models:
  - Log word frequency (p=.004)
  - Log vowel duration (p=.0001)
  - Vowel height (p=.05)

  - Non-significant: Birthyear, age, gender, nasal probability, directionality, neighborhood density, birthyear * frequency, direction * frequency

Interim summary

- Community-level change rather than lifespan change

Results: Apparent-time sample



Results: Apparent-time sample

- Predictors from mixed effects models:
  - Birthyear (p=.09)
  - Log word frequency (p=.01)
  - Log vowel duration (p=.0001)
  - Vowel height (p=.02)
  - Direction * frequency (p=.02)

  - Non-significant: Age, gender, nasal probability, directionality, neighborhood density, birthyear * frequency

Discussion

- Duration
  - Longer vowels less nasal
  - Less gestural overlap when segments are longer
- Vowel height
  - Low vowels more nasal
  - Since velum and jaw are connected, physiological link
- Frequency
  - Higher frequency, greater degree of nasality

Discussion

- Gradient phonetic change over time in degree of nasality in Philadelphia
  - People born after 1965 get less nasal
  - People born after 1980 reverse this trend
- Non-deterministic
  - Change towards less nasality, then more
  - No ostensible phonological trigger for change

Discussion

- Frequency predictor of nasality degree
  - High frequency → greater nasality
  - No evidence for interaction between frequency and birthyear
  - Change is not accumulation of high-freq effect
- Not significant in the real-time sample
  - Where we see the greatest diachronic fluctuations
  - Frequency effect obscured in the course of change?

Conclusions

- Frequency and sound change
  - Phonetic patterns not accruing in high frequency items to drive sound change
  - Instead, change obscures the frequency effect
- Online effect
  - Frequency result of online adjustments
  - Consistent both with empirical findings in lab studies (e.g., Munson, 2007) and theories that propose hybrid models of phonetic representations (Pierrehumbert, 2001)

Conclusions

- Coarticulatory detail is learned and stored
- Nasality is under the purview of diachronic community-level change
- Nasality also frequency-differentiated
- Frequency and sound change effects operate independently
- Change in coarticulation is non-deterministic

Thank you!

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