(str) Retraction in Raleigh: "Identical" variants implicated in Two Separate Sound Changes

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Background

(str) Retraction

- Change in progress in English in which /s/ is realized as [ʃ] in /stɹ/ clusters
- Attested across the English speaking world. Among others:
  - New Zealand (Lawrence, 2000)
  - UK (Bass, 2009; Glain, 2014)
  - Philadelphia (Labov, 1984; Gylfadottir, 2015)
  - Ohio (Durian, 2007)
  - Texas (Hinrichs et al., 2015)

(str) Retraction

Female b. 1961	**Female b. 1991**
other part of the street	live down the street
street	street
s	s

Phonetic Motivations

- Lip rounding from following /ɹ/ (Baker et al., 2011; Rutter, 2011)
- Tongue body retraction (also from /ɹ/) (Baker et al., 2011)
- Affricated /t/ (Gylfadottir, 2015; Lawrence, 2000)

Other Environments

- Some evidence that this change may be expanding to other environments (Baker et al., 2011; Gylfadottir, 2015)
  - /skɹ/, /spɹ/
  - /st/, /sk/, /sp/
  - /sɹ/

Word Position

- /stɹ/ clusters can occur
  - Word initially: *Street*
  - Word medially: *Restructure* - *Restroom*
  - Across word boundaries: *This truck* - *Last rites*
- Medial (str) has been shown to be more retracted than initial (str) (Baker et al., 2011; Durian, 2007; Gylfadottir, 2015; Hinrichs et al., 2015)
- Durian (2007) hypothesizes that the change began in medial position and spread to initial.

Sex Effects

- Rapid Anonymous Surveys suggest that retracted variants are produced more by men (Bass, 2009; Durian, 2007; Hinrichs et al., 2015)
- However, sociophonetic analyses of spontaneous corpora have not replicated a sex effect (Durian, 2007; Gylfadottir, 2015)
- Gylfadottir (2015) hypothesizes that in Philadelphia the change has advanced past a visible sex effect; retraction is characteristic of both sexes in younger speakers

Current Investigation

1. What is the status of the (str) sound change in Raleigh, NC?
2. What social and linguistic factors condition this change?

Methodology

Data

- 114 sociolinguistic interviews from a corpus of Raleigh, NC natives (Dodsworth & Kohn, 2012).

Generation	Birthyear Range	Women	Men	Total
1	1919-1954	24	19	43
2	1955-1978	25	19	44
3	1979-1996	15	12	27
		64	50	**114**

Table: Demographic breakdown of Raleigh speakers under analysis

Raleigh, NC

- Raleigh is a large urban center in the American South with a population of around 450,000
- Large influx of workers from the North during the tech boom of the 1960-70s
- Rapid transition away from the SVS and other Southern features (Dodsworth & Kohn, 2012; Dodsworth, 2014)

Processing

- All interviews were first force-aligned using P2FA (Yuan & Liberman, 2008)
- All /s/ and /ʃ/ tokens extracted
- Only speakers with > 4 (str) tokens considered
- Excluding tokens in contact with sibilants.
- Excluding tokens occurring phrase or word finally
  - Cross-word final (str) is an important environment for future work.
  - /st#ɹ/ in our data has lot of CCR, affecting phonetic env.
  - Not enough /s#tɹ/ tokens per speaker at present
- 103,033 tokens remain for analysis

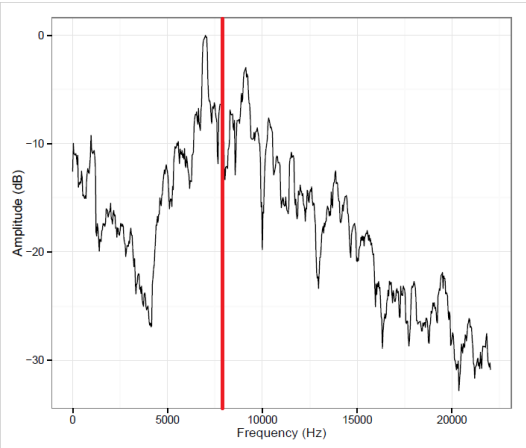
Acoustic Analyses

- Acoustic analyses carried out in Praat (Boersma & Weenik, 2013)
- Band pass filtered: 500-11000Hz
- Power spectrum calculated on 30ms window centered on midpoint
- Center of Gravity (COG) calculated

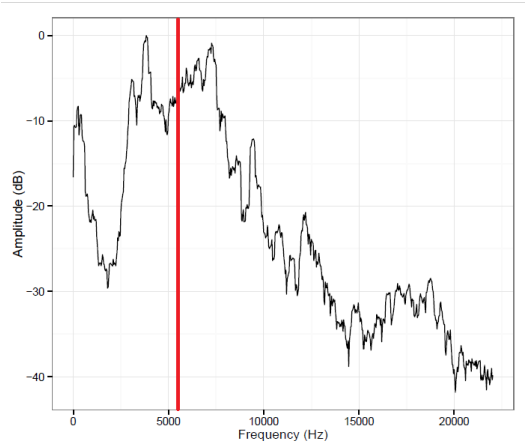
Center of Gravity

- COG has been shown to be a reliable measure of distinction between fricatives (Baker et al., 2011; Jongman et al., 2000) (though c.f. Rutter (2011) for arguments for spectral peak)
- /ʃ/ is typified by lower COG values, /s/ by higher values

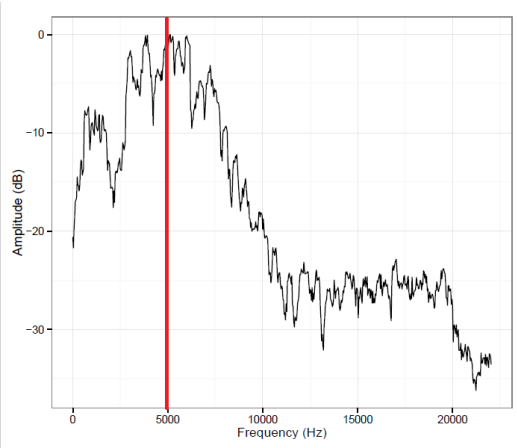
Center of Gravity



"Last"; COG = 7900Hz



"Street"; COG = 5516Hz



"Should"; COG = 4998Hz

On Normalization

- Previous investigations of (str) have used various speaker-internal normalization techniques to transform the dependent measures.
- I'm arguing here for accounting for speaker specific differences in sibilant ranges using model structure.
  - Speaker-intrinsic scaling like z-scores assumes equal degrees of variance (not necessarily true).
  - Alternative: random effect structure, specifically by-speaker random slopes by sibilant type.
  - c.f. Hay et al. (2015) for vowel normalization through model structure

Modeling

- Mixed effects linear models in R (R Core Team, 2015) using *lme4* (Bates et al., 2015).
- Model constructed in nested fashion, incrementally adding variables of interest.
- Improved model fit measured by decrease in AIC (Burnham & Anderson, 2004).

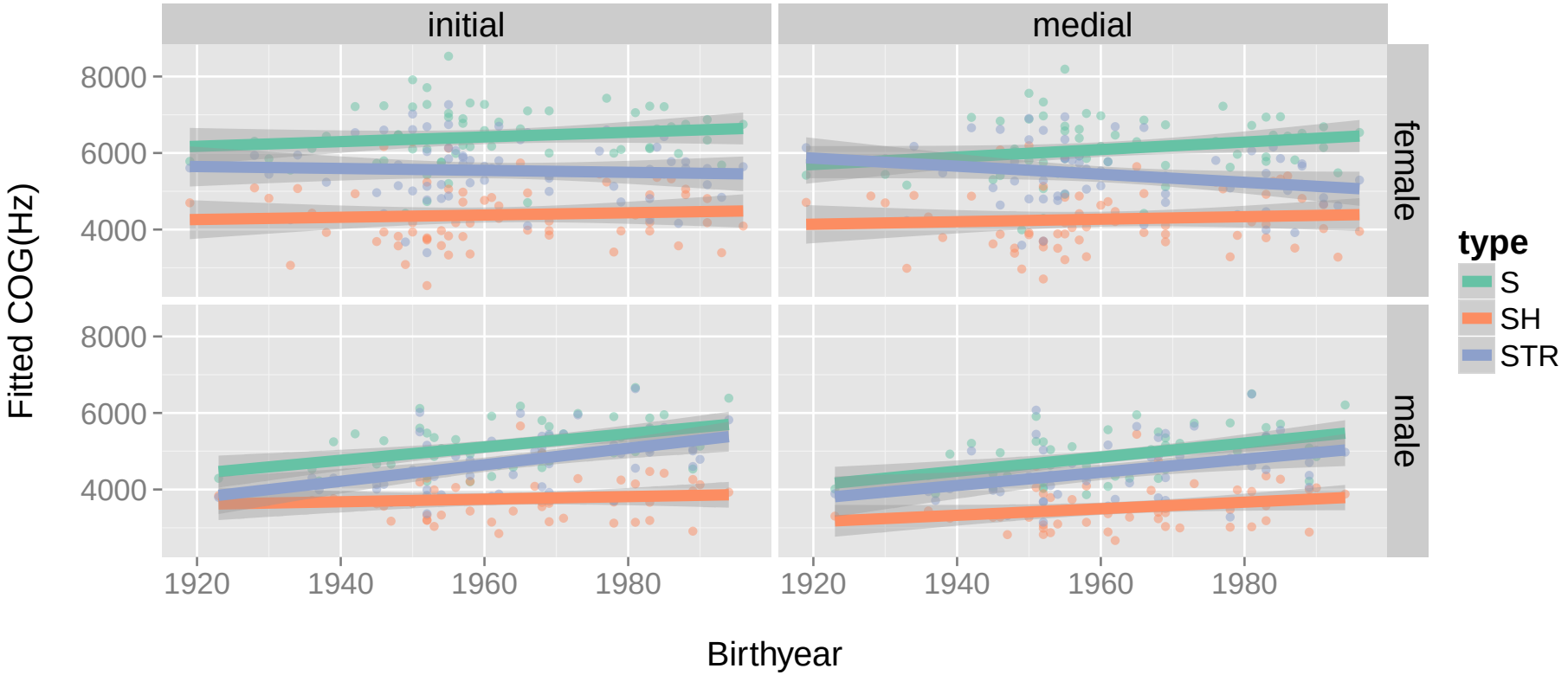
Best Fit Model

Best fit model includes the following predictors:

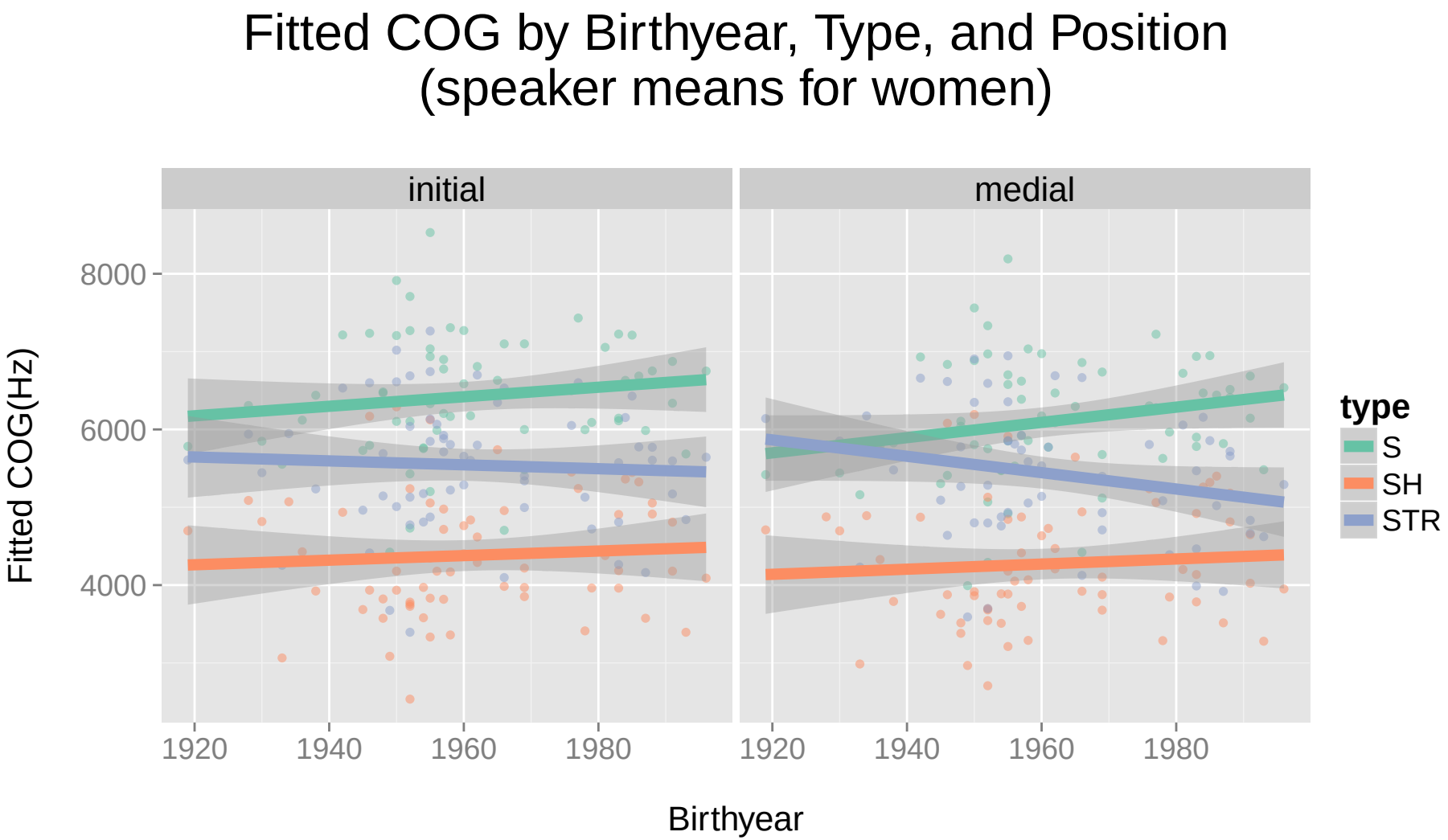
- Five-way interaction between sex, birthyear, position, sibilant type, & log(duration)
- Left and right contexts
- Random by-speaker slope for sibilant type
- Random by-speaker slope for log(duration)
- Random intercept for word

Results

Fitted COG by Birthyear, Type, Sex, and Position (speaker means)



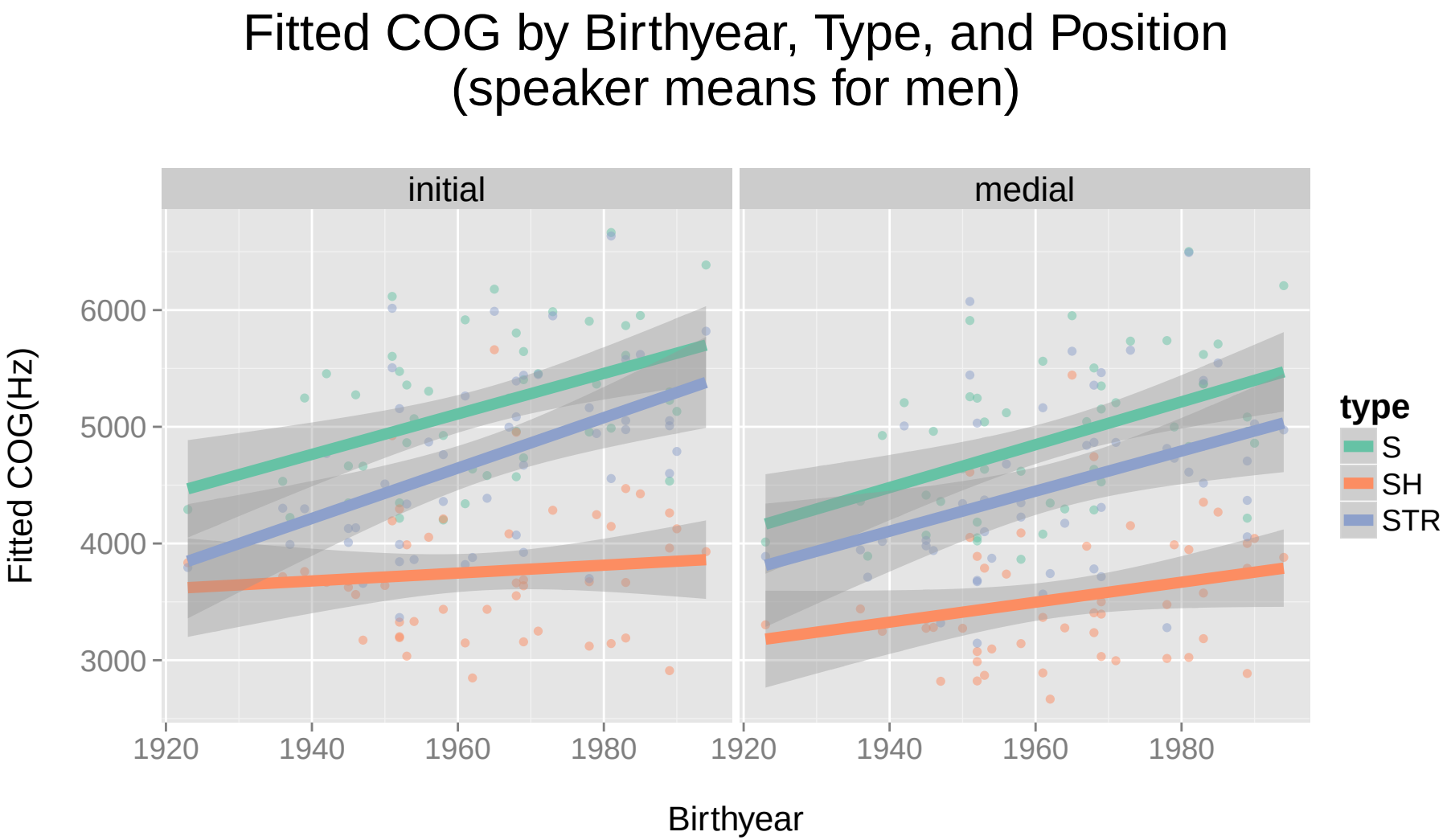
Female Speakers



Female Lead

- Starting in the 2^{nd} half of the 20^{th} cen., female speakers retract (str) in medial position.
- Appears to be expanding to initial position as well.
- Important to consider community level patterns wrt individuals: some speakers have completely retracted, some show no retraction, and many are between

Male Speakers



Male Spectral Range

- Older males in the corpus have extremely narrow sibilant frequency ranges.
- Over time, we observe an expansion of the fricative space.
- Within this expansion, however, no evidence of (str) retraction beyond phonetic baseline.

Male b. 1923

"Nothing is like it used to be, I mean, the only thing **constant** in life is change. And Raleigh has changed but it has changed in a good, positive fashion."

Discussion

Change in Apparent Time

- We've gotten lucky enough to catch (str) retraction as it's just beginning in the community.
- Female lead is consistent with other such changes from below (Labov, 2001).
- (str) retraction in Raleigh appears to be a later introduction than in Ohio or Philadelphia, which would explain the sex effect found in the current data but not in Durian (2007) or Gylfadottir (2015).

Dialect Leveling and Contact

- Introduction of (str) into the community aligns nicely with influx of non-Southern speakers in the mid 20^{th} century.
- Also patterns similarly to the retreat of the SVS and other traditional Southern features (Dodsworth & Kohn, 2012; Dodsworth, 2014).
- Ties to urban networks found in Durian (2007).

Male Spectral Range

- More difficult to interpret is the expansion of the male sibilant space over time.
- Not due to gross measurement error or outlier speakers.
- Impressionistically, not due to articulation difficulties due to aging. (Though ideally we'd have articulatory data).
- To my knowledge, such an expansion is unattested in other regions. Unclear whether this is a quirk of the current data set or reflective of a more wide-spread phenomena.

Future Work

- More sophisticated treatment of position, syllable structure, prosodic influences, etc.
- Link between /tɹ/ affrication and /stɹ/ retraction. Are all affricators retractors and vice versa?
- Articulatory variation: lip rounding, tongue body, etc. How is this change manifested gesturally?
- Perception - a lot we don't know here. How perceptible is this change? What is the role of word position on contrast and variability here? What social meaning is ascribed to this variable?

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Thank You!

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Slides available at

`http://ericwilbanks.github.io/research.html`

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