Shtreets of Philadelphia

Duna Gyfjadottir
University of Pennsylvania
gug@sas.upenn.edu

Department of Linguistics
University of Pennsylvania

N WAV 43 - Chicago
October 25th, 2014
Introduction

- (str) variable
- Previous work
- Questions
- Limitations

Current study

- Novel applications
- Results

Implications

Further Work
/s/-retraction before /tr/

str → ſtr
Possible motivations

- Long distance assimilation to /r/ (Shapiro 1995, Baker et al. 2011)
- Assimilation to /t/ that is itself alveo-palatal because of /r/ (Lawrence 2000)
- Possible influence of adjacent vowels (Janda and Joseph 2003)
Previous claims

- Widespread change in progress in North America
  - Philadelphia (Labov 1984, Labov 2001)
  - Georgia (Phillips 2001)
  - Columbus, Ohio (Durian 2004, Durian 2007)
  - Louisiana (Rutter 2011)
  - Various parts of the western U.S. (Baker et al. 2011)
Questions

- Is this truly a change in these places? If so,
  - When did it begin?

- How has it progressed?
  - Did it begin in a specific context?
Previous claims

- It may have begun in specific contexts
  - Word-medially (Durian 2007)
  - Word-initially (Rutter 2011)
  - Lexically diffused in children (Rutter 2014)
  - In front of high front vowels (Phillips 2001)
Questions

- Is this truly a change in these places? If so,
  - When did it begin?
- How has it progressed?
  - Did it begin in a specific context?
  - Is the change gradual or abrupt?
Labov (2001) mentions possibility of multiple intermediate forms:

- A hissing [s], used only by cultivated speakers
- A normal sibilant with considerable hushing quality
- A fully hushing sibilant equivalent to the /ʃ/ in sheet
- A even more extreme form with distinct rounding
Center of gravity

- Center of gravity a good proxy for tongue position in sibilants
Labov (2001) mentions possibility of multiple intermediate forms:

- A hissing [s], used only by cultivated speakers
- A normal sibilant with considerable hushing quality
- A fully hushing sibilant equivalent to the /ʃ/ in sheet
- A even more extreme form with distinct rounding

Auditory coding can be misleading (Rutter 2011)
Questions

- Is this truly a change in these places? If so,
  - When did it begin?

- How has it progressed?
  - Did it begin in a specific context?
  - Is the change gradual or abrupt?
  - Is it complete for any speakers?
  - Is it complete for all younger speakers?

- How aware are speakers of this variable?
Previous claims

- Labov (2001) describes this variable as socially stratified
  - Associated with working-class speech in subjective evaluation tests
- Anecdotal evidence suggests that some Philadelphia speakers associate it with Philadelphia speech
- Durian (2007) reports an association with urban speech in Columbus
Questions

- Is this truly a change in these places? If so,
  - When did it begin?

- How has it progressed?
  - Did it begin in a specific context?
  - Is the change gradual or abrupt?
  - Has it gone to completion anywhere?

- How aware are speakers of this variable?
  - What are the gender patterns?
  - Do we see a retreat away from it at any point, suggesting stigma?
  - Do the data confirm social stratification?
Limitations

- Lack of time depth
- Small sample sizes
- Auditory coding that may be problematic
- Time consuming to analyze

Automatic acoustic measurements!
Current Study

- First large-scale corpus study of this variable
- Confirm impressionistic statements that this is a change in progress in Philadelphia
- Apply automated measurement techniques to analyze a consonantal variable across a large corpus
- Answer questions about the trajectory of the change
SOUTH PHILLY
DON'T believe the PIPE!
Data

- 156 speakers
  - Taken from the Philadelphia Neighborhood Corpus (Labov and Rosenfelder 2011) and the Influence of Higher Education on Local Phonology project (NSF #561958)
- Born between 1889 and 2006
- Limited to white speakers for this study
- Data previously FAVE-aligned (Rosenfelder et al. 2011)

<table>
<thead>
<tr>
<th></th>
<th>PNC</th>
<th>IHELP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>62</td>
<td>77</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Speaker breakdown by gender
Center of gravity
Measurements done entirely automatically:

- Center of gravity measurement taken of each sibilant that was longer than 20 ms.
- Mean measurement was taken over all of the frames of a spectrogram generated from the middle 50% of each sibilant.

<table>
<thead>
<tr>
<th></th>
<th>/s/</th>
<th>/ʃ/</th>
<th>(str)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>89103</td>
<td>13761</td>
<td>2290</td>
</tr>
</tbody>
</table>

Table 2: Total Ns measured

- Measurement were z-score normalized to allow for better comparison of each speakers’ own means.
Z-score Formula

\[
\frac{(\text{COG of segment} - \text{mean COG for speaker across types})}{\text{standard deviation for speaker across types}}
\]
Coded variables

- Coded for following vowel frontness, following high front vowel, position in word, word frequency (SUBTLEX), and whether word was 'street'
- Date of birth, sex available for all speakers
- Years of education available for all of the PNC
- Census tract-based income data available for some
- IHELP participants all students - need a better way to compare SEC
Model

- Mixed-effects models with speaker as random intercept
- DOB, sex, street, position, following high front vowel, following vowel backness, *income, *years of education
- P-values from a Kenward-Rogers approximation
Linear mixed model

Formula: \( Z \sim DOB \ast Street + Sex + FollowingFront + FollowingHighfront + Frequency + Position + (1|subject) \)

Fixed effects:

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.46139</td>
<td>0.07812</td>
<td>-5.906</td>
</tr>
<tr>
<td>DOB</td>
<td>-0.19785</td>
<td>0.04463</td>
<td>-4.433***</td>
</tr>
<tr>
<td>SexM</td>
<td>0.09010</td>
<td>0.08658</td>
<td>1.041</td>
</tr>
<tr>
<td>PositionMedial</td>
<td>0.05377</td>
<td>0.04838</td>
<td>1.111</td>
</tr>
<tr>
<td>FollowingFront</td>
<td>0.02232</td>
<td>0.05579</td>
<td>0.400</td>
</tr>
<tr>
<td>Street=Yes</td>
<td>-0.02388</td>
<td>0.05738</td>
<td>-0.416</td>
</tr>
<tr>
<td>Frequency</td>
<td>0.01902</td>
<td>0.02209</td>
<td>0.861</td>
</tr>
<tr>
<td>FollowingHighfront</td>
<td>-0.12100</td>
<td>0.06367</td>
<td>-1.900</td>
</tr>
<tr>
<td>DOB:Street=Yes</td>
<td>-0.09175</td>
<td>0.03477</td>
<td>-2.639**</td>
</tr>
</tbody>
</table>

Table 3: Fixed effects for main model
Figure 1: (str) and $\int$ across time
Figure 2: (str) across time
Figure 3: Difference across time
Implications

- Strong evidence for a change in apparent time
  - No evidence of a reversal
- Gradual change across time
  - Speakers with fully /s/-like, fully /ʃ/, and intermediate means
  - Evidence for a phonological reanalysis by some speakers
  - Nevertheless preceded by a long period of intermediate means
Linear mixed model

Formula: \( Z \sim DOB \times Street + Sex + FollowingFront + FollowingHighfront + Frequency + Position + (1|subject) \)

Fixed effects:

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.46139</td>
<td>0.07812</td>
<td>-5.906</td>
</tr>
<tr>
<td>DOB</td>
<td>-0.19785</td>
<td>0.04463</td>
<td>-4.433***</td>
</tr>
<tr>
<td>SexM</td>
<td>0.09010</td>
<td>0.08658</td>
<td>1.041</td>
</tr>
<tr>
<td>PositionMedial</td>
<td>0.05377</td>
<td>0.04838</td>
<td>1.111</td>
</tr>
<tr>
<td>FollowingFront</td>
<td>0.02232</td>
<td>0.05579</td>
<td>0.400</td>
</tr>
<tr>
<td>Street=Yes</td>
<td>-0.02388</td>
<td>0.05738</td>
<td>-0.416</td>
</tr>
<tr>
<td>Frequency</td>
<td>0.01902</td>
<td>0.02209</td>
<td>0.861</td>
</tr>
<tr>
<td>FollowingHighfront</td>
<td>-0.12100</td>
<td>0.06367</td>
<td>-1.900</td>
</tr>
<tr>
<td>DOB:Street=Yes</td>
<td>-0.09175</td>
<td>0.03477</td>
<td>-2.639**</td>
</tr>
</tbody>
</table>

Table 4: Fixed effects for main model
Implications

- No evidence for special phonological contexts
  - Except: the word 'street'
  - Possible evidence for enregisterment?
- No evidence for role of frequency
Linear mixed model on a subset of the data

\[ Z \sim \text{DOB} + \text{Income} + \text{Street} + \text{Sex} + \text{FollowingFront} + \text{FollowingHighfront} + \text{Frequency} + \text{Position} + (1 | \text{subject}) \]

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.5627</td>
<td>0.1021</td>
<td>-5.507</td>
</tr>
<tr>
<td>DOB</td>
<td>-0.2549</td>
<td>0.0684</td>
<td>-3.727***</td>
</tr>
<tr>
<td>Income</td>
<td>0.1105</td>
<td>0.0540</td>
<td>2.045*</td>
</tr>
<tr>
<td>SexM</td>
<td>0.1573</td>
<td>0.1052</td>
<td>1.495</td>
</tr>
<tr>
<td>PositionMedial</td>
<td>0.1150</td>
<td>0.0607</td>
<td>1.895</td>
</tr>
<tr>
<td>FollowingFront</td>
<td>-0.0192</td>
<td>0.0701</td>
<td>-0.274</td>
</tr>
<tr>
<td>Street=Yes</td>
<td>0.0188</td>
<td>0.0668</td>
<td>0.281</td>
</tr>
<tr>
<td>Frequency</td>
<td>-0.0073</td>
<td>0.0284</td>
<td>-0.257</td>
</tr>
<tr>
<td>FollowingHighfront</td>
<td>-0.0541</td>
<td>0.0764</td>
<td>-0.708</td>
</tr>
</tbody>
</table>

Table 5: Fixed effects for model with income
**Average Normalized COG by Income**

Figure 4: (str) by income (Census Tract)
Implications

- Says little about awareness
- No gender difference
- Unclear level of social stratification
Further work

- Look at ethnicity
- Palatalization in /tr/
- Retraction in /spr/ and /skr/
- Create proxy to be able to look at SEC across all the speakers
- Evaluate degree of co-occurrence with traditional Philadelphia features, e.g. the short-a system
Contributions

- Utility of automated acoustic measurements in studying variation of a consonant
- First large corpus study of (str)
- Confirmation of existence of a change in apparent time in Philadelphia
- Shows that the change is gradual and ongoing
- Suggests phonological reanalysis by some speakers
- Does not support hypothesis about the change beginning in specific environments
Thank you!
References


