A phonetic and phonological change across lifespan: a case study of Noam Chomsky

Soohyun Kwon (University of Pennsylvania)
LSA 2014
Sound change at community level

- **Apparent time studies**
  - Sound change at the community level can be found through the synchronic variability in the speech community
  - Accents in younger and older speakers of the same community are compared to each other (Weinreich, Labov and Herzog 1968)
  - The assumption: There is no, or scarcely any, shift of a person’s accent beyond the critical age for language acquisition (Lenneberg 1967)
Sound change across lifespan

- Most speakers tend to have stable sound system after critical period
- However, some speakers DO change their accents significantly well after the critical period (see Harrington 2006; Sankoff and Blondeau 2007; Wagner 2008; Nycz 2011; Wagner and Sankoff 2011) ➔ May underrepresent the rate of community change
- Language change across lifespan has been less extensively studied
- Practical issues
  - Difficulties of tracking the same individuals over a number of years
Why Chomsky?

• Noam Chomsky as an ideal speaker for the study of a long-term accent change
  • Many of his interviews (1970s – present) are readily available online (Acoustically high-quality recordings)
  • Relocated to a region characterized by a different dialect from his native dialect. (Philadelphia, PA ➔ Boston, MA)
  • A highly publicized social figure

• The change in his accent, if any, can shed light on to what extent phonetic and phonological variables an individual speaker can change over the course of their lifetime after a relocation to a different dialect area.
Speaker
Noam Chomsky

• Born in 1928 to Jewish parents in Philadelphia, PA.

• His parents’ first language was Yiddish

• It was a taboo to speak in Yiddish at home. He learned English as his first language.

• His family lived in the affluent neighborhood of East Oak Lane, Philadelphia. His father was a professor of Hebrew at Gratz College.
Noam Chomsky

- Graduated from the Central High School of Philadelphia.
- Began studying philosophy and linguistics at the University of Pennsylvania in 1945.
- Received a doctoral degree in linguistics from the University of Pennsylvania in 1955.
- Joined the MIT in 1955 at his age 26.
- As of 2014, Chomsky has taught at MIT for 59 years and he resides in Lexington, MA.
Linguistic variables

i) Low back vowels /o/ & /oh/ (LOT vs. THOUGHT)

ii) Short a (TRAP)
Cot-Caught merger

- One major unconditioned merger attested in North America
- The loss of contrast between the short-o class (/o/) in got, rock, top etc., and long open-o class (/oh/) in law, talk, caught, etc

( Labov et al. 2006).
Cot-Caught merger

The Phonological Atlas of North America

Linguistics Laboratory
U. of Pennsylvania

Vowel change across lifespan: a case study of Noam Chomsky

LSA 2014, Jan. 4, 2014
/o/ and /oh/ in Philadelphia and Boston

- The North, North Midland and mid-Atlantic States including Philadelphia
  
  : /o/ and /oh/ are kept distinct in these areas.

- Northeastern New England including Boston
  
  : The merger between /o/ and /oh/ predominates.
  
  : The merger is realized in low back rounded position as /oh/
Short-a:
Split system in Philadelphia

- **Phonemic distinction** between a tense /æh/ and a lax /æ/
  (A tense /æh/ is significantly raised and fronted than a lax /æ/. An extreme form may be diphthongized to upper-mid ingliding [iːə].)

- Complex phonological, morphological and lexical conditioning factors.
Short-a: Nasal system in Boston

- **Discrete allophonic** alternation between a tense [æh] and lax [æ] with a simple allophonic rule:
  
  /æ/ becomes tense before nasals, regardless of syllabic or morphological status.

- Nasal system is perhaps the most widespread short-a system in the North America hence is regarded as a default American short-a pattern which occurs in disjoint and unrelated regions across the states (Labov et al. 2006)
### Data

<table>
<thead>
<tr>
<th>‘Government in the future’ in 1970</th>
<th>‘Crisis and hope: Theirs and ours’ in 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>• At the Poetry Center of the New York on February 16, 1970.</td>
<td>• At Riverside Church in Harlem on June 12, 2009.</td>
</tr>
<tr>
<td>• Chomsky articulates a clear, uncompromising vision of social change.</td>
<td>• The global economic crisis, the environment, wars in Iraq, Afghanistan and Pakistan, resistance to American empire.</td>
</tr>
</tbody>
</table>
• Transcribed in ELAN

• Using FAVE (Forced Alignment and Vowel Extraction: an adaptation of the Penn Phonetics Lab Forced Aligner (Yuan and Liberman, 2008),

• Forced alignment was produced with the transcriptions

• A total 10,178 of vowel tokens (4152 in 1970 and 6026 in 2009) were extracted automatically through these phonetic alignments

• The vowel data in each recording were normalized using Lobanov normalization to factor out any physiological changes
## Data

<table>
<thead>
<tr>
<th>Year</th>
<th>1970</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data source</td>
<td>A public speech titled <em>Government in the future</em></td>
<td>A public speech titled <em>Crisis and Hope: Theirs and Ours</em></td>
</tr>
<tr>
<td>Number of all vowels</td>
<td>4152</td>
<td>6026</td>
</tr>
<tr>
<td>Number of low back vowels</td>
<td>392 (/o/: 245, /oh/: 147)</td>
<td>572 (/o/: 341, /oh/: 231)</td>
</tr>
<tr>
<td>Number of short-a</td>
<td>361</td>
<td>483</td>
</tr>
</tbody>
</table>
The low back vowels

/o/ & /oh/

(LOT & THOUGHT)
/o/ and /oh/

1970

Low Back Vowels in 1970

2009

Low Back Vowels in 2009
/o/ and /oh/

1970

2009
The shift of /o/ and /oh/ between 1970 and 2009?

- lmer() function from the lme4 package (Bates and Maechler & Bolker 2012) in R (R Development Core Team, 2012)

- A **mixed effects model** was fit to the F1 of /o/ and /oh/ in Chomsky’s speech in 1970 and 2009.

  i) F1 of /o/ in 1970 and 2009

  ii) F1 of /oh/ in 1970 and 2009
Nine Predictors and levels


2. 6 Phonological environments
   i) Manner of following/preceding segment (Stops, Fricatives, Affricates, Nasal, Rhotic & Lateral, Glide, None)
   ii) Place of following/preceding segment (Labial, Coronal, Velar, None)
   iii) Voicing of following/preceding segment (Voiced, Voiceless)

3. Stress (primary, secondary and no stress)

4. Duration (continuous)
Significant change in F1 of /o/ between 1970 and 2009

|                     | Estimate | Std. Error | t value | Pr(>|t|) |
|---------------------|----------|------------|---------|----------|
| Intercept           | 787.343  | 32.184     | 24.464  | 0.0000   |
| Year: 2009          | -60.278  | 8.459      | -7.126  | 0.0000   |
| FolManner: Nasal     | -55.438  | 11.101     | 2.542   | 0.0114   |
| FolManner: Fricative | -30.474  | 18.798     | 2.056   | 0.0403   |
| FolManner: Liquid    | -78.266  | 11.930     | 6.560   | 0.0000   |
| Stress: Primary Stress | 44.924  | 31.716     | 1.416   | 0.1573   |
| Stress: Secondary Stress | -7.224  | 34.671     | -0.208  | 0.8351   |
No significant effect of Year on F1 of /oh/

- The predictor Year failed to reach significance on F1 and of /oh/.
No merger between two categories

• /o/ and /oh/ have significant differences in the both F1 and F2 dimension in 2009 (p=4.15e-33 for F1, p=1.71e-16 for F2)

• /o/ and /oh/ still remains as two distinct phonemes even after /o/ has significantly shifted towards /oh/ between 1970 and 2009.
Interim summary

• Noam Chomsky’s low back vowel /o/ has shifted significantly towards /oh/ while his /oh/ remained unchanged.

• No evidence of a merger between two categories even though the distance between /o/ and /oh/ is diminished as /o/ moves towards /oh/.
Short a
Phonological & lexical conditioning of the split system of Philadelphia

**Tense**

Before front nasals (/n/, /m/) in closed syllables
- e.g. man, ban

Before front voiceless fricatives (/s/, /θ/, /f/) in closed syllables
- e.g. gas, half, laugh

In three lexical items before /d/
- mad, bad, glad

**Lax**

Before nasals in open syllables and velar nasals
- e.g. family, bank

Before non-front voiceless fricatives (/ʃ/), voiceless fricatives in open syllable, voiced fricatives
- e.g. international, classes, have

Before all other stops, e.g. sad

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Traditional split system in Philadelphia

Figure 13.6. Split /æ/-/æh/ system of Rosanne V., 30 [1996], Philadelphia, TS 587
Nasal system in Boston
Short a in 1970 based on the split system in Philadelphia

- No split between tense /æh/ and lax /æ/

- All tokens that should be tense /æh/ (red dots) are within the cluster of lax /æ/.
Short a in 2009 based on the **split system** in Philadelphia

- Tense /æh/ emerged!
- No clear boundary between tense /æh/ and lax /æ/
- Significant overlaps
Short a in 1970 based on the **nasal system** in New England

- Does not fit into the nasal system either
- All tokens are within the boundary of lax /æ/
Short a in **2009** based on the **nasal system** in New England

- Hard to say it is a discrete allophonic split
- A tendency for prenasal short-a (red dots) to be in an upper mid position in the phonetic space while non-prenasal ones occupy low position (blue dots).
2009

Split system?

Nasal system?
A closer look at the distribution: Four different environments

<table>
<thead>
<tr>
<th>Following segment</th>
<th>Split</th>
<th>Nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front nasals in closed syllable</td>
<td>Tense</td>
<td>Tense</td>
</tr>
<tr>
<td>Velar nasal /ŋ/, nasals in open syllables</td>
<td>Lax</td>
<td>Tense</td>
</tr>
<tr>
<td>Front voiceless fricatives in closed syllable &amp; in three lexical items <em>bad, mad, glad</em></td>
<td>Tense</td>
<td>Lax</td>
</tr>
<tr>
<td>Stops</td>
<td>Lax</td>
<td>Lax</td>
</tr>
</tbody>
</table>
Before front nasals in closed syllable
(Tense in both systems)
Before nasals in open syllables & velar nasals
(Tense in split system, Lax in the nasal system)
Before voiceless fricatives & *bad, mad, glad*
(Tense in the split system, Lax in the nasal system)
Before stops
(Lax in both system)
## Additional Dataset

<table>
<thead>
<tr>
<th>Year</th>
<th>Data source</th>
<th>1970</th>
<th>1989</th>
<th>2009</th>
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</thead>
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<td></td>
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<td>4152</td>
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1989

Split system?  Nasal system?

[Graphs showing vowel change across lifespan]
F1 - Split or Nasal?

Models:
• Split: $F1 \sim \text{as.factor(Year)} \times \text{Split} + \text{as.factor(stress)} + (1 | \text{word})$
• Nasal: $F1 \sim \text{as.factor(Year)} \times \text{Nasal} + \text{as.factor(stress)} + (1 | \text{word})$

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<tr>
<th></th>
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<th>AIC</th>
<th>BIC</th>
<th>logLik</th>
</tr>
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<tbody>
<tr>
<td>Split</td>
<td>10</td>
<td>7318.7</td>
<td>7363.1</td>
<td>-3649.3</td>
</tr>
<tr>
<td>Nasal</td>
<td>10</td>
<td>7301.1</td>
<td>7345.5</td>
<td>-3640.6***</td>
</tr>
</tbody>
</table>
F2 - Split or Nasal?

Models:
- Split: $F2 \sim \text{as.factor(Year)} \times \text{Split} + \text{as.factor(stress)} + (1 | \text{word})$
- Nasal: $F2 \sim \text{as.factor(Year)} \times \text{Nasal} + \text{as.factor(stress)} + (1 | \text{word})$

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What happened to Chomsky’s short-a system?

• Neither the split nor the nasal system in 1970.
• In 2009, significant tensing of his /æ/ before nasals in closed syllable.
• Possible scenario 1: Chomsky might have corrected his traditional Philadelphia split system and then superimposed the nasal pattern of New England.
• Possible scenario 2: Chomsky didn’t have any short-a pattern and then he learned the nasal pattern after he relocated to Boston.
Loss of the Philadelphia system

- General public perceive the tense/æh/ as a “harsh and nasal” South Philly slang

- A low social value of extremely tensed [iːə] variant: Strongest negative responses on the scale of Job Suitability in Subjective Reaction Tests (Labov 2001)

- An ongoing withdrawal from the split system led by younger speakers with higher education in Philadelphia (Labov et al. 2013)
Acquisition of Nasal system

- All of tense /æh/ in 2009 were mid-level raising.
- Mid-level raising not subject to stigmatization
- Effect of nasality on F1 and F2
- Acoustically, movements of the velum that result in vowel nasalization alter vowel height: a significant F1 lowering (Chen 1997)
- Front vowels were fronter (with a higher F2) for the nasalized variant than for the oral variant (Scarborough and Zellou 2012)
[Possible scenario 2]

No pattern > Nasal system

- Some Jewish speakers in Philadelphia tend not to have any short a pattern (Guy p.c.)
Between 1970 and 2009, Chomsky has exhibited

i) A phonetic shift: Raising of /o/toward /oh/

ii) A phonemic restructuring of short-a pattern

- Malleability of sound system beyond critical period
- Move away from the native system
- Adaptation to the norm of the new speech community
- Phonological restructuring: a major shift in a phonological system induced by reinterpretation of the older generation’s output data by a new, language-acquiring generation (Hayes 2009)
THANK YOU!

- This paper has benefitted from the ideas, feedback, and technical assistance of a number of people whose contributions I gratefully acknowledge. In particular, thanks to Bill Labov, Gillian Sankoff, Georgia Zellou, Jim Stanford, Daniel Ezra Johnson, Hilary Prichard, Aaron Dinkin, Meredith Tamminga, Kyle Gorman, Josef Fruehwald and audience at NWAV42.

- Also, I am very grateful to the subject of this study, Noam Chomsky, who has been my idol since I read his article ‘Responsibility of intellectuals’ in my second year in college.