Phonetic Convergence between Native and Nonnative Speakers

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<table>
<thead>
<tr>
<th>Questions</th>
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<tbody>
<tr>
<td>During a conversation, talkers’ communicative and linguistic behaviors often become more similar to each others’. (Giles, 1973; Pickering and Garrod, 2004; Pardo, 2006)</td>
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<td>Can we observe and compare phonetic convergence in short-term conversations between 2 natives and between a native and a nonnative?</td>
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<td>How are native-native interactions and native-nonnative interactions different?</td>
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<td>Do only nonnative talkers change to adapt to native talkers, or does it happen vice versa?</td>
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<td>Does a nonnative talker’s accentedness affect this process?</td>
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</table>
Why is this question interesting?

3 Implications

1. Connection between speech perception and production (short-term, individual level)
Why is this question interesting?

3 Implications

2. Language change (long-term, population level)

- Perception-production link and language change
  - Language change may be caused in part by spread of individual production changes that follow perception of different patterns of speech input.
- L1 sound change induced by L1-L2 contact
3. Second language acquisition

- **Short-term phonetic convergence**
  - Can even a brief conversation with a native speaker help to get closer to native pronunciation?

- **Accentedness of an L2 learner**
  - When you learn a foreign language, how does your accentedness influence how well you are able to acquire native pronunciation?
How did others answer the questions?

- Pardo (JASA, 2006)
  - Conversational speech: Map task
    - Items embedded as landmarks
    - Giver/receiver role differences
    - Gender differences per pair
  - Read speech: Pretask, Posttask
    - The same items used in the map task
    - Read before and after the task
How did others answer the questions? Pardo (2006)

- Evaluation whether talkers’ speech became similar during the task
  - AXB similarity perception tests
    - “Does A or B sound more similar to X?”
Our Research Questions

- Can we replicate Pardo (2006) with more realistic data?
  - all stimuli from conversational speech
  - different utterances under comparison
  - balanced talker roles for the task
- Can we extend the idea of phonetic convergence between native speakers to native and non-native conversations?
Our Research Plan

- **Snippets**
  - from early part of conversations
  - from late part of conversations

1. **XAB similarity perception tests**
   - perceptual comparison between snippets from the early and late part of conversations

2. **Accentedness Ratings**
   - perceptual rating on accentedness of snippets
Materials
Original Conversations

- Diapix data in Wildcat Corpus (2006)
  - A picture-matching game
  - Balanced talker roles
  - Task-oriented but spontaneous speech
  - lasted from 10 to 20 minutes
Materials
Subjects of Diapix

- **Subjects**
  - 12 female talkers
    - All spoke in English
    - 8 English, 2 Korean, 2 Chinese
  - 6 conversations
    - native-native (n = 2): NN\(_1\), NN\(_2\)
    - native-nonnative
      - English-Korean (n = 2): NK\(_1\), NK\(_2\)
      - English-Chinese (n = 2): NC\(_1\), NC\(_2\)
Materials
Snippets from the Conversations

- 3 snippets taken from the early 1/3 and 3 snippets from the late 1/3 of the conversations per each talker

- **Criteria**: one IP or at the final position of an IP
- All snippets were **different utterances**
- **Duration**: 1 sec < duration < 1.5 sec
- **Examples**: 

  - [EN] E E E L L L
  - [KO] E E E L L L
  - [CH] E E E L L L

12
1. XAB Perception Tests

Overall test design

- XAB similarity perception tests
  - Listeners were told to assume that the second speaker tried to impersonate the model speaker

Which is more similar to the MODEL, A or B?

MODEL

Talker 1 Early

Talker 1 Late

Talker 2 Early

Talker 2 Late

Counterbalanced

A

B

Late %

% of trials on which the late snippet (A or B) is preferred as a match to the MODEL
1. XAB Perception Tests
Subjects and Measurement

- Subjects
  - 67 English native listeners (perceptual judges)
    - NN$_1$, NN$_2$ (English-English) (n = 23)
    - NK$_1$, NK$_2$ (English-Korean) (n = 22)
    - NC$_1$, NC$_2$ (English-Chinese) (n = 22)

- Dependent measure: Late %
  - Late % greater than 50 -> phonetic convergence!
1. XAB Perception Tests
Results from Native-Native

- Phonetic convergence in **both directions**
  - **NN 1**
    - Convergence
      - \( \text{EN}_1 \leftrightarrow \text{EN}_2 \)
  - **NN 2**
    - Convergence
      - \( \text{EN}_3 \leftrightarrow \text{EN}_4 \)

\[ 
\text{Model Snippet} \\
\text{Native - Native} \\
\begin{array}{c}
\text{Early} & \text{Late} & \text{Early} & \text{Late} & \text{Early} & \text{Late} & \text{Early} & \text{Late} \\
\text{EN}_1 & & & & \text{EN}_2 & & & \text{EN}_3 \ast & \ast \ast & \ast \\
\text{NN}_1 & & & \text{MODEL Snippet} & \text{NN}_2 & & & & \\
\end{array}
\]
1. XAB Perception Tests
Results from Native-Korean

- Phonetic convergence from KO₁ to EN₁ (asymmetry)
- An English talker diverged from her Korean partner

- NK 1
  - Convergence
    - \(\text{EN}_1 \rightarrow \text{KO}_1\)
    - higher than NNs

- NK 2
  - Divergence
    - \(\text{EN}_2 \leftarrow \text{KO}_2\)
1. XAB Perception Tests
Result from Native-Chinese

- No phonetic convergence in any pairs
- A Chinese talker diverged from her native partner

- NC 1
  - nothing
    - EN₁
    - CH₁

- NC 2
  - Divergence
    - EN₂
    - CH₂
  - fatigue for nonnative

![Native - Chinese MODEL Snippet]

![Box plots comparing Early and Late for EN₁, CH₁, EN₂, and CH₂]
1. XAB Perception Tests

Summary

- Convergence in both directions in NN
- Asymmetrical convergence in one NK
- Asymmetrical divergence in one NK and one NC

- Why these asymmetries? Accentedness?
2. Accentedness Ratings
Overall Methods

- **Materials**
  - a larger set of stimuli: all short/mid/long snippets from all the 12 speakers (216 tokens)
  - all snippets randomized

- **Subjects**
  - 20 native English listeners

- **Question**
  - “How foreign is this speaker’s accent?”
  - 1 – 9 scale (native – nonnative)
## 2. Accentedness Ratings
Results from NN, NK, NC

<table>
<thead>
<tr>
<th>Patterns of XAB Results</th>
<th>Nonnatives’ Accentedness</th>
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<tbody>
<tr>
<td>KO₂ ← EN₂ KO₂</td>
<td>7.59</td>
</tr>
<tr>
<td>CH₁ ← EN₁ CH₁</td>
<td>7.34</td>
</tr>
<tr>
<td>KO₁ ← EN₁ KO₁</td>
<td>6.69</td>
</tr>
<tr>
<td>CH₂ ← EN₂ CH₂</td>
<td>4.06</td>
</tr>
</tbody>
</table>

**worst**  
**middle**  
**best**
Overall Summary

- Convergence and divergence found
- Natives in native-native vs. native-nonnative
  - convergence when paired with a native
  - no change or divergence when paired with a nonnative
- Nonnative accentedness and convergence
  - heavily accented – no change
  - moderately accented – convergence to the native
  - barely accented – divergence from the native
Discussions
Perception-Production Link

Psychological

Discursive

Linguistic

Perception

Production

Psychological Goal
Attitude

Discursive Goal
Communicative Efficiency

Accentenedness
Intelligibility
Stability

Variability of
Phonetic Convergence
Discussions
Second Language Acquisition

- Possible speculations
  - It might be required for L2 learners to have certain level of accentedness to be able to converge towards a native speaker.
  - Even if an L2 learner has very close accentedness to native speakers’, we might observe divergence, because nonnative speakers might get easily tired to maintain the accent.
Future Directions

- Explore the acoustic features under this perceptual phenomenon – stability and intelligibility
- Control factors outside perception and production
  - Linguistic factors - more control on accentedness
  - Discursive factors - goal, interaction
  - Psychological factors - attitude, attention
- Explore this phenomenon in a longer term
  - How long does this effect last?
  - Can it be reactivated?
  - Do repetitive conversations make stronger talker adaptation?
Thank you for listening!
And my special thanks to...

- Advisors and coauthors: Ann Bradlow, Sid Horton
- Colleagues in LING 500: Aaron Lee, Arim Choi, Caroline Engstler, Celina Troutman, Tyler Perrachoine
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- All the participants in Diapix, XAB perception tests, and accented ratings
XAB Perception Tests (extra)

- **Structure**
  - When X is talker 1

<table>
<thead>
<tr>
<th>talker 1</th>
<th>talker 2</th>
<th>Number of trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>E (3)</td>
<td>E (3)</td>
<td>L (3)</td>
</tr>
<tr>
<td>E (3)</td>
<td>L (3)</td>
<td>E (3)</td>
</tr>
<tr>
<td>L (3)</td>
<td>E (3)</td>
<td>L (3)</td>
</tr>
<tr>
<td>L (3)</td>
<td>L (3)</td>
<td>E (3)</td>
</tr>
</tbody>
</table>

**Total number of trials per talker**: 108

- **Total number of trials per language type**
- 432 trials = 108 x 2 talkers x 2 conversations
2. Accentedness Ratings
Results from NN, NK, NC

KO1 – moderate accent
KO2 – heavy accent

CH1 – heavy accent
CH2 – closer to native
3. Acoustic Measurements
Speech Rate (extra)

NK1 – Divergence
NK2 – Convergence?

NC1 – Convergence
NC2 – Convergence
3. Acoustic Measurements

Pitch Range (extra)

<table>
<thead>
<tr>
<th>F0 (Hz)</th>
<th>Early</th>
<th>Late</th>
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<tbody>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
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<td>200</td>
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<td>300</td>
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<td>350</td>
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<tr>
<td>400</td>
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**Native-Korean**

- EN1
- EN2
- KO1
- KO2

**Native-Chinese**

- EN1
- EN2
- CH1
- CH2

**NK1** Convergence
**NK2** Divergence?

**NC1** nothing?
**NC2** nothing?