The Role of Rhythmic and Intonational Cues in Language and Dialect Discrimination

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Background

- Using rhythmic cues - Adults and infants can distinguish two non-native languages.
  - Newborns can only discriminate languages from different rhythm classes (Mehler et al. 1988).
  - French adults discriminate between two unfamiliar languages - English and Japanese using rhythm (Ramus & Mehler 1999)
    - Synthesized 'sasasa' speech (intonation and rhythmic cues)
    - 'flat sasasa' speech (rhythmic cues only)
    - **But not** 'aaaa' speech (intonation cues only)
- Intonational cues can also be used to discriminate languages, but only when one is native.
  - English adults discriminated between English and Dutch using intonational cues (Willems 1982; de Pijper 1983)
- **Can adults discriminate their native language/dialect from a foreign language/dialect:**
  - **Using intonational cues?**
  - **Using rhythmic cues?**

Present Study

Several experiments examining the ability of adults to use rhythmic and intonational cues in discriminating:

- American English and Australian English
- American English and German

Methods

Stimuli –

- 39 sentences, taken from (Nazzi, Jusczyk & Johnson 2000).
- Recorded by 8 American Southern Californian female speakers and 8 Australian female speakers.
- Translated into German; recorded by 8 German female speakers.
- Stimuli was modified in different ways for each experiment.
  - **Experiment 1 –** Low-pass Filtered Speech
    - Sentences were low-pass filtered in Praat at 400 Hz (with 50 Hz smoothing).
    - Full rhythmic and intonational cues, impoverished segmental cues available.
  - **Experiment 2 –** Rhythm + Intonation speech
    - New synthesized ʔaʔaʔa speech sentences created to match recorded sentences share rhythm and intonation.
    - Obstruents in original sentence replaced with silence (/ʔ/); sonorants replaced with /a/.
    - Full rhythmic and intonational cues available. No segmental cues.
  - **Experiment 3 –** Rhythm only
    - Intonation stripped from synthesized Flat ʔaʔaʔa Speech sentences from Exp. 2 and replaced with flat 200 Hz pitch.
    - Only rhythmic cues available.

Task –

- Tested in a between-subjects design:
  - American English vs. Australian English (3 experiments)
  - American English vs. German (3 experiments)
- Sentences played to subjects one at a time.
- Subjects asked to choose label: "American English" or "Other"

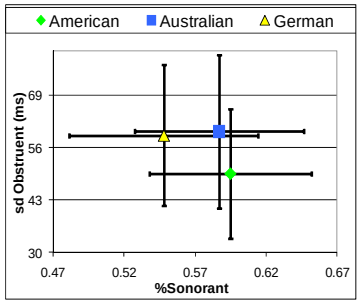
Subjects –

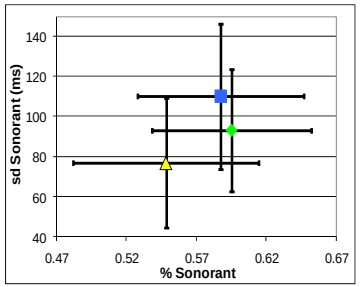
- Between 12-15 native American English listeners for each exp.

Comparison of Languages

Rhythm -

- English and German are both "stress-timed".
- Rhythm of each language and dialect was measured as in (Ramus, Nespor & Mehler 1999).
- American English and German are significantly different on all 3 dimensions
- American and Australian are significantly different in sd S and sd O, but **not** %S.





Intonation -

- English and German are very similar intonationally:
  - Similar ToBI inventories (Grice et al. 2005).
  - Similar contours, differ in pitch accent timing (Atterer & Ladd 2004).
- American and Australian English use the same ToBI system (Fletcher et al. 2005).

Analysis

- Results analyzed two ways:
  - A-prime (A') scores (ANOVA, t-tests)
  - Proportion of subjects above chance (Chi-square)
    - Calculated from A' scores
    - Above chance at greater than 95% confidence level.

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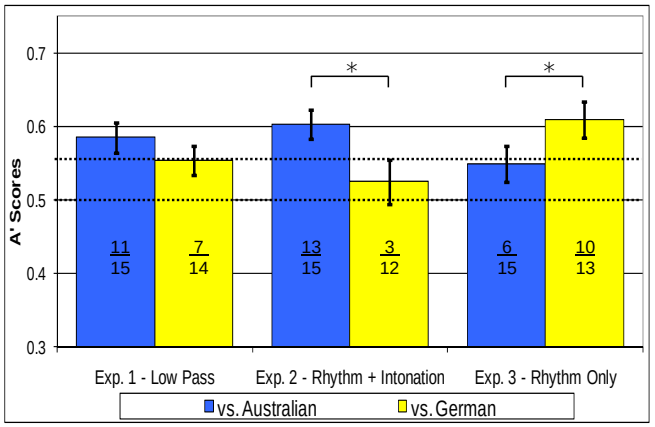
Results



	Exp. 1 - Low Pass	Exp. 2 - Rhythm + Intonation	Exp. 3 - Rhythm only
vs. Australian	✓	✓	✗
vs. German	✓	✗	✓

Table shows whether subjects as a group performed above chance.

Discussion

- Adults rely on intonational cues to discriminate American and Australian English
  - When intonational cues are removed, subjects lose the ability to discriminate American from Australian.
- Adults rely on intonation to discriminate American English and German, too – except the strategy fails!
- In fact, adults weight intonational cues above rhythmic cues.
  - Only when intonational cues are removed, can subjects rely on the subtle rhythm differences to distinguish English from German. Intonation acts as a conflicting cue.

Future Work

- We plan to confirm the importance of intonation by testing discrimination with a scrambled version of Experiment 2, for both Australian and German.
- Infants can discriminate their native language from a foreign language within the same rhythm class, and from a foreign dialect by 5-months (Nazzi, Jusczyk & Johnson 2000)
  - English vs. Dutch
  - American English vs. British English
  - **But not** German vs. Dutch
- Currently testing 5- and 7-month-old infants to determine the age at which infants' can use native language intonation in language/dialect discrimination.