A43. Learning Variation in a Second Language: A Cross-language Study of Rate-normalization

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Introduction

Specific Issues
- How do non-native perceivers cope with variability in second language categories?
  - Non-native listeners have been reported to have particularly large intelligibility deficits under non-optimal (non-laboratory) listening conditions.
- What is the nature of phonological categories?
- How do they get modified in the face of experience with a new language?

Types of Variation in Speech Categories
- Bio-physical variations:
  - Variation due to the nature of the articulatory system (e.g. acoustic details of formants, etc.). All experienced listeners have access to this regardless of native language.
- Linguistic variation:
  - Variation due to language (e.g. phonologically specified allophonic alternations, etc.). Listeners must acquire the ability to account for these when learning a second language.
  - For example, VOT at the boundary to distinguish voicing categories differs across languages (e.g. English vs. Japanese vs. Korean).

Research Questions
- How do second language learners respond to highly rate-sensitive tokens in judging non-native voice categories?
- How is this effect modulated by increased experience with the second language?

Hypothesis
- If rate-induced variations are accounted for by a general auditory mechanism, we would expect no deviations from native perceptions in non-native perceptions.
- If normalization is based on the distribution of consonants that the listeners have experienced, we expect deviations from native perceptions. This deviation is less if the listeners have experience of consonant distributions in both native and non-native languages.
- If the internal structure of phonological categories is based on prototype matching, deviations should be most clear in low extreme rates.

Methods

Listeners
- Non-native listeners (L2-English)
- Native listeners (Control):
  - 18 speakers of American English

Stimuli
- 4 Speakers of American English
- From the Northern Midwest
- All in late 20’s

Speech corpus
- Speakers repeated /b/ and /p/ with increasing rate.
- Rates were controlled by a metronome.
- 21 stimuli were split from each repetitive utterance.
- Each stimulus consists of three repeated syllables.

Measurements
- VOT and Syllable duration were measured.
- VOT and Syllable duration for each stimulus were based on the middle syllable in the stimulus.

Procedure
- Task: 4 forced-choice identification test
  - 'bee', 'pea', 'eeb', and 'eep' (for Japanese)
  - 'bi', 'pi', 'ib', and 'ip' (for Japanese)

Analysis
- VOT and Syllable duration of the middle syllable were used for a logistic regression analysis.

Results

1. Boundary shift
- Japanese vs. English perceptions

2. Rate effects
- Native vs. Non-native perceptions

Summary
- Non-native and native listeners show same rate normalization effects.
- Experiment provides evidence that rate normalization is not a general auditory mechanism. It is based on the distribution of consonants that the listeners have experienced.
- Even contrasts believed to be ‘easy’ could be misperceived when non-native encounters rate-related variations.
- Distribution of deviations across the entire range of tokens suggests a generalized criterion function, which gets shifted for the second language.
- However, the large number of error increases in the wrong direction (p -> b) for Japanese and b -> p for Korean indicate another aspect of second language perception: generalized uncertainty.

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References