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Bilinguals generalize from known phonological contrasts in perception of a novel language

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Introduction

❖ To distinguish between sound categories in a novel language, listeners must figure out which acoustic-phonetic dimensions to pay attention to.

❖ People know (implicitly) which dimensions are relevant in the languages they already speak.

❖ **Proposal**: people use this knowledge to predict which dimensions will be relevant to distinguish sound categories in other languages.

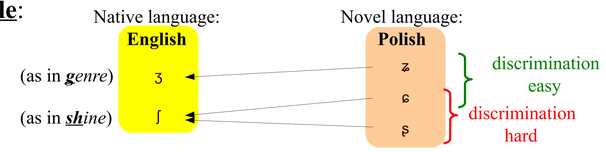
Background

❖ Existing accounts
- Perceptual Magnet Effect (Kuhl 1991)
- Perceptual Assimilation Model (Best 1995)
- Speech Learning Model (Flege 1995)

view nonnative speech perception from a very different perspective.

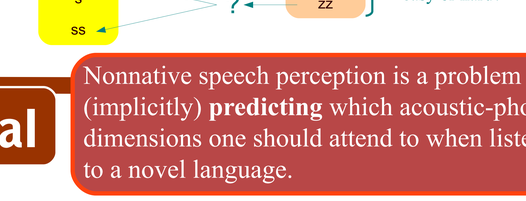
❖ They all assume that perception is mediated by segment-to-segment **mappings** between novel sounds and native language sounds, which are determined according to the sounds' acoustic or articulatory **similarity**.

Example:



❖ However, it is often unclear how to assess relative similarity between sounds; thus, no strong predictions for cases where it's unclear how mappings between sounds would work.

Example:



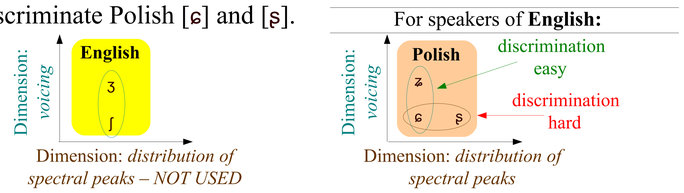
Proposal

Nonnative speech perception is a problem of (implicitly) **predicting** which acoustic-phonetic dimensions one should attend to when listening to a novel language.

❖ How do listeners make these predictions?

❖ **Specific hypothesis**: Listeners **generalize** from the languages they already speak. If a given acoustic-phonetic dimension is used to distinguish between phonetic categories in one of the known languages, then listeners will attend to this dimension in the novel language.

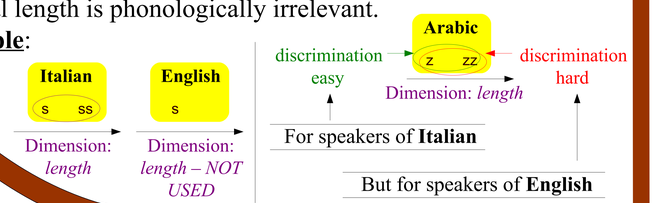
❖ **Example**: Native speakers of English
- attend to *voicing*, and can thus discriminate Polish [ʑ] and [ɕ];
- don't attend to the *distribution of spectral peaks*, and thus can't easily discriminate Polish [ɕ] and [ʂ].



❖ In this study, we tested the proposed hypothesis for length contrasts (e.g., [z]-[zz]).

❖ **Predictions**: speakers of a language where the length dimension is used should perform better than speakers of a language where segmental length is phonologically irrelevant.

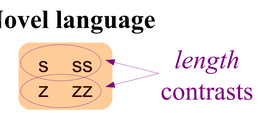
Example:



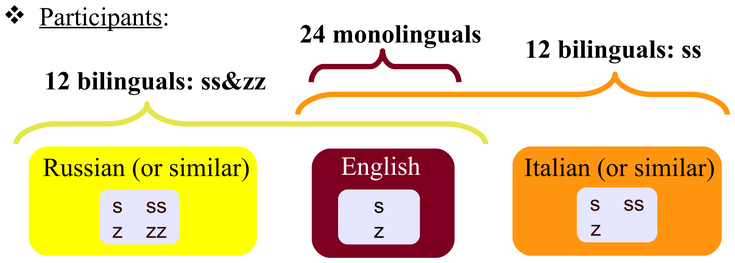
Experiment 1

Bilinguals vs. monolinguals

❖ Task: AX discrimination of length contrasts [s]-[ss] and [z]-[zz] (embedded in words).

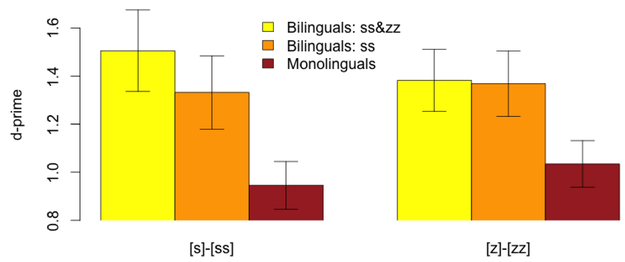


❖ Participants:



Predictions
- Both bilingual groups should generalize the relevance of *length*.
- Thus, all bilinguals should be better than monolinguals on both [s]-[ss] and [z]-[zz] contrasts.

❖ Results: All bilinguals better than monolinguals on both contrasts.

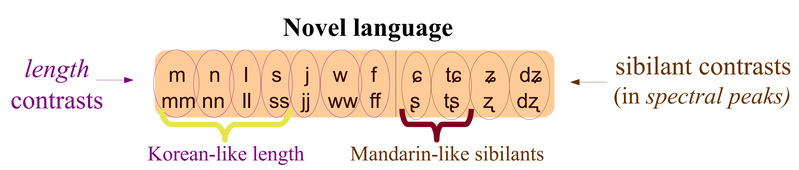


Experiment 2

Bilinguals familiar vs. unfamiliar with length contrasts

❖ Motivation: (1) Is it just a bilingual advantage?
(2) Would the same result hold for more novel segments?

❖ Task: AX discrimination of length & sibilant contrasts.



❖ Participants:

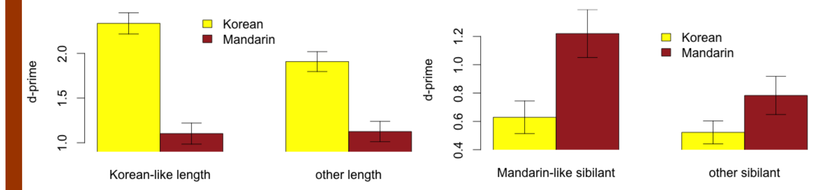
24 English-Korean bilinguals
Korean
m n l s j w (no f)
mm nn ll ss

24 English-Mandarin bilinguals
Mandarin
m n l s j w f ɕ tɕ
ʂ tʂ ʐ

Predictions
Interaction between *language* and *contrast*:
- Korean speakers better at *all* length contrasts;
- Mandarin speakers better at *all* sibilant contrasts.

❖ Results:
- Significant interaction: Korean speakers better at length, and Mandarin speakers better at sibilants.

Crucially:
- Korean speakers better at *all* length contrasts.
- Mandarin speakers better at *all* sibilant contrasts.



Experiment 3

Bilinguals: further generalization (from vowels to consonants)

❖ Motivation: Can listeners generalize across segments that are acoustically very distinct, such as vowels and consonants?

❖ Materials: same as experiment 2.

❖ Participants:

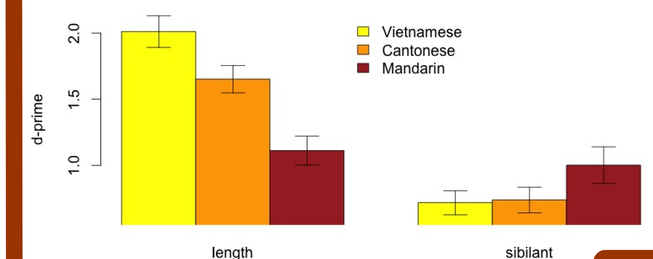
24 English-Vietnamese bilinguals
Vietnamese
m n l w j s f a e
aa ee

24 English-Cantonese bilinguals
Cantonese
m n l w j s f a e i o u
aa ee ii oo uu

❖ Compared to Mandarin speakers from experiment 2
- Mandarin has no vowel length contrasts;
- Vietnamese & Cantonese have no sibilant contrasts (of the relevant type).

Predictions
Interaction between *language* and *contrast*:
- Vietnamese & Cantonese speakers better at length contrasts;
- Mandarin speakers better at sibilant contrasts.

❖ Results:
- Significant interaction: Both Vietnamese & Cantonese speakers better at length, and Mandarin speakers better at sibilants.



Conclusion

❖ We proposed to redefine nonnative speech perception as a problem of predicting which acoustic-phonetic dimensions are relevant in a novel language.

❖ We hypothesized that listeners make these predictions by generalizing over phonological properties of languages they already speak.

❖ We tested this hypothesis by comparing discrimination of length contrasts by listeners with different language backgrounds.

❖ The results provided support for the hypothesis: speakers familiar with some length contrasts performed better than controls, even when the contrast was applied to entirely novel segments.

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