# Segments and segmental properties in cross-language perception: Korean perception of English obstruents in two prosodic locations.

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This work was supported by grants from NSF and NIH:
NSF-#BCS-9910701 &
NIH-NIDCD R03 DC04095

# Two approaches to multilingual perception

- Experimental Approaches
  - Phones tend to be treated as basic units (e.g., ‘new’ vs. ‘similar’ phonetic category formation (SLM): Flege, 1987; discrimination of non-native phones (PAM): Best & Strange, 1992; Best et al., 1988)
- Linguistic Approaches
  - Cross-category properties are basic (e.g., features, prosodic location, constraints: Lombardi, 2000; Eckman & Iverson, 1994)

# Bridging the Gap

- Theoretical links to generalization
  - Later descriptions of PAM consider cross-category (i.e., gestural) properties of consonants (Best et al., 2001); SLM relies on phonetic features (Flege, 1987; 1988); Other work explicitly compares segmental to non-segmental factors (Polka, 1992; 1991).
- Methodological links to generalization
  - Sample from a large proportion of L1/L2 phonological systems to test generalization across categories (Strange et al., 1998; 2001)

# Case Study: Korean perception of English Consonants

- From experimental (i.e., segmental) approaches
  - For Korean L1 speakers, English stops ‘p,’ ‘b,’ ‘t,’ and ‘d’ are ‘similar’ (or ‘old’) phones; English non-sibilant fricatives ‘f,’ ‘v,’ ‘th,’ and ‘dh’ are ‘new’ phones.
- From linguistic (i.e., cross-category) approaches
  - Sampling and testing across a large number of categories allows tests of generalization across segments.

# Methods: Subjects, Stimuli, Procedure

- Subjects
  - 20 adult L1 speakers of Korean (mean time in US: 5 months)
  - 9 native speakers of English (controls; performed near ceiling)
- Stimuli
  - 3 repetitions of voiced and voiceless labial and coronal stops and fricatives in onset and coda position in nonsense syllables (e.g., [ba], [ab], [pa], [ap], [va], [av],...) produced by a male L1 English speaker: 3 * 2 * 2 * 2 * 2 = 48
- Procedure
  - (pseudo) closed set consonant identification task:

t d θ ð f v s z p b m h other__

# Analysis: Accurate vs. Inaccurate ID

## Example graphs

Figure 1:
Near perfect identification

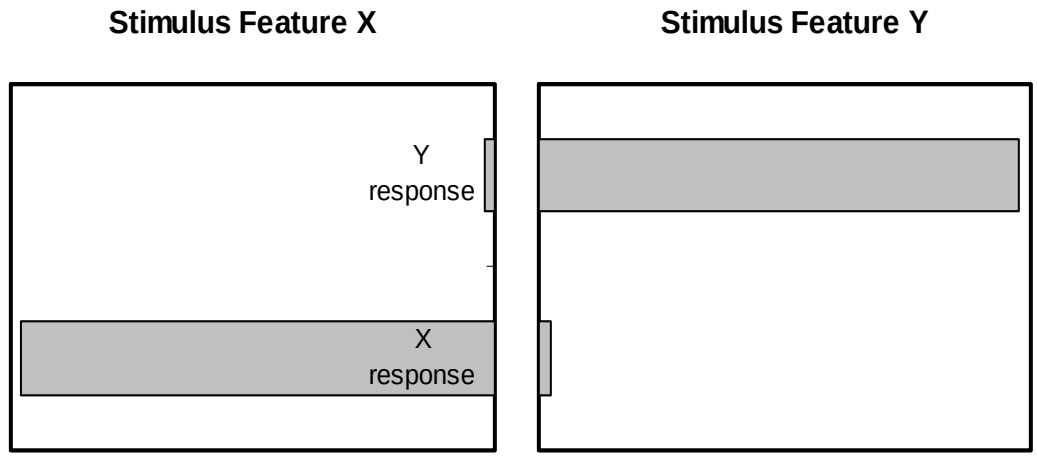
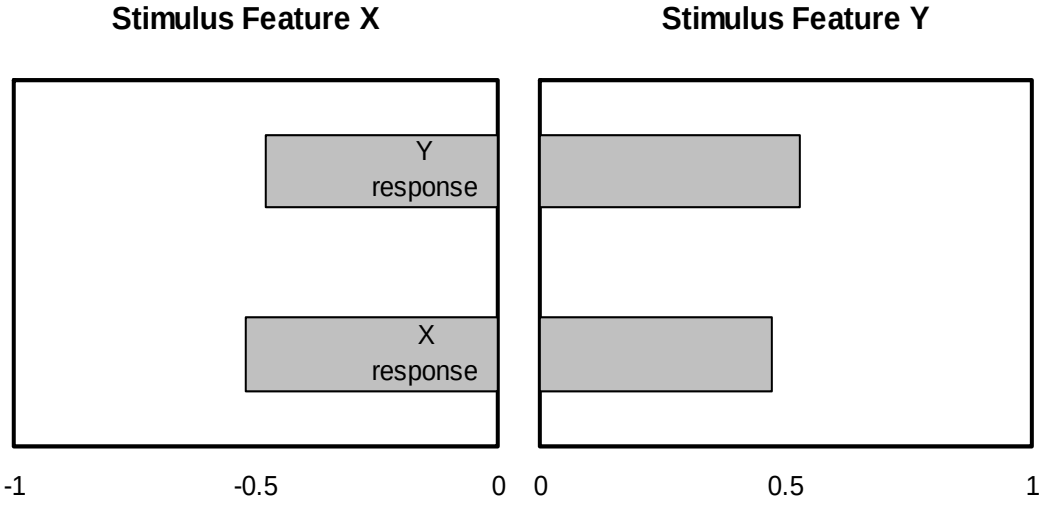



Figure 2:
Poor identification with no bias



# Analysis: Unbiased vs. Biased ID

## Example graphs

Figure 2:
Poor identification with no bias

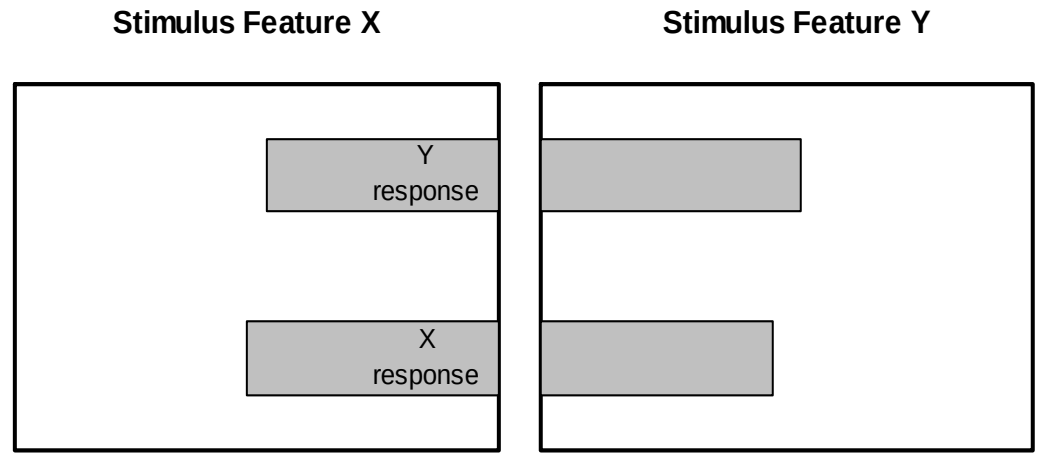
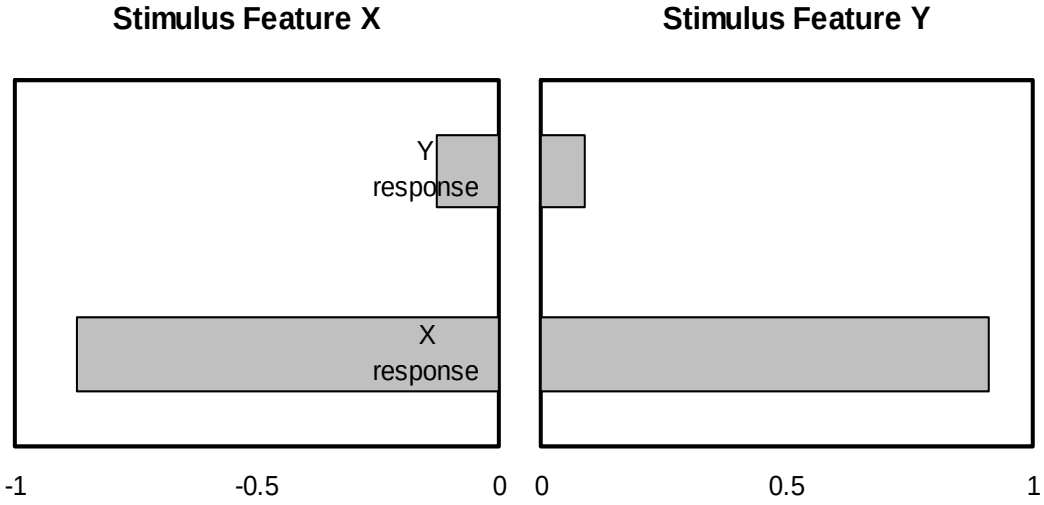



Figure 3:
Poor identification with strong bias



# Results: Voicing Identification in Onset Coronals

Do voicing identification patterns for ‘old’ phones (i.e., coronal stops) generalize to ‘new’ phones (i.e., coronal fricatives)?

Figure 4: Voicing ID in coronal stops (‘old’ phones) in onset position

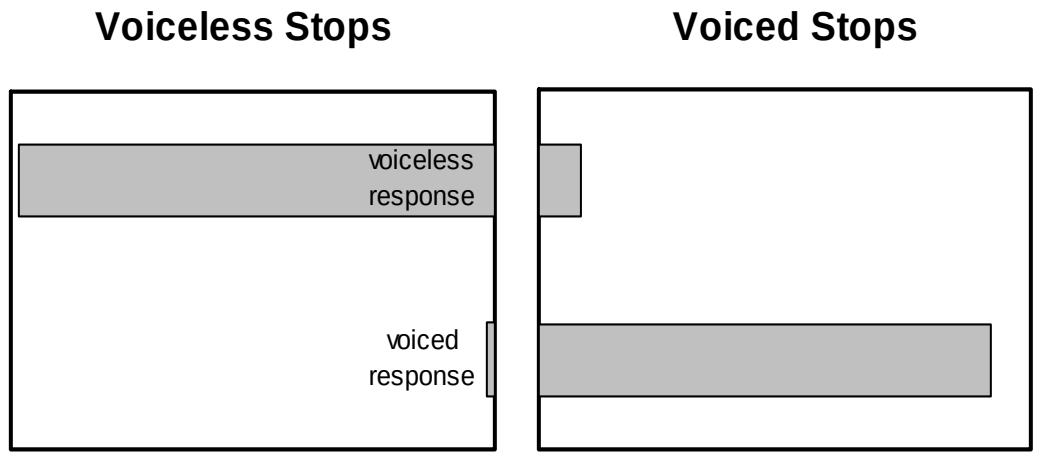
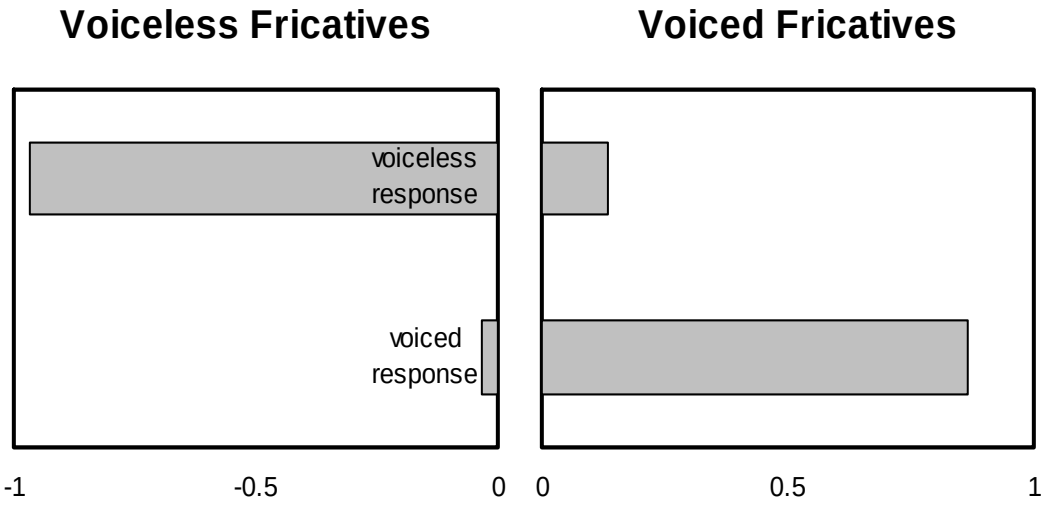



Figure 5: Voicing ID in coronal fricatives (‘new phones’) in onset position



# Results: Voicing Identification in Onset Labials

Do voicing identification patterns for ‘old’ phones (i.e., labial stops) generalize to ‘new’ phones (i.e., labial fricatives)?

Figure 6: Voicing ID in labial stops (‘old’ phones) in onset position

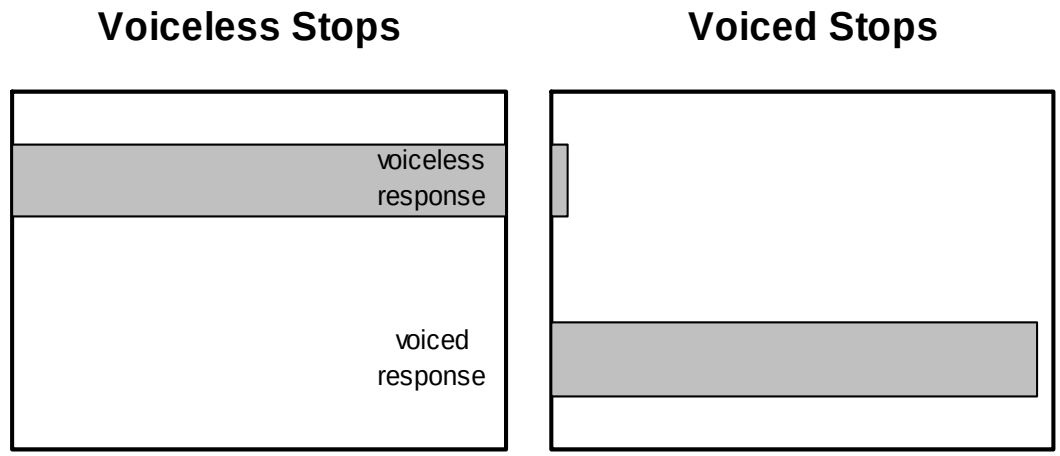
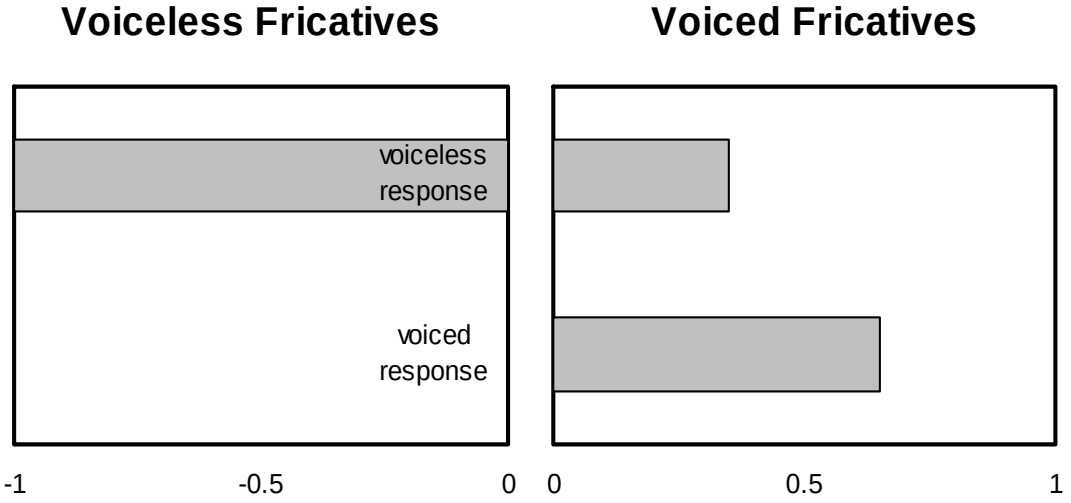



Figure 7: Voicing ID in labial fricatives (‘new’ phones) in onset position



# Results: Voicing Identification in Coda Coronals

Does prosodic position modulate voicing identification patterns and generalization of such patterns from ‘old’ to ‘new’ phones?

Figure 8: Voicing ID in coronal stops (‘old’ phones) in coda position

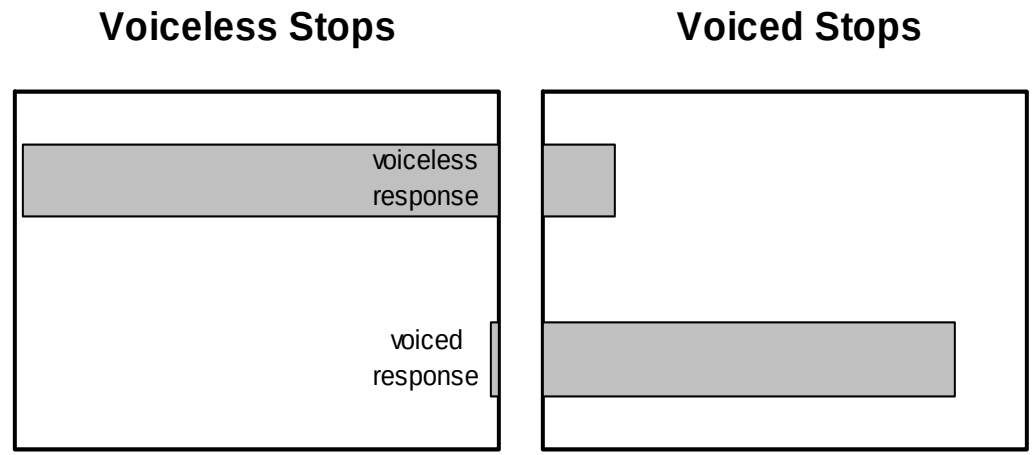
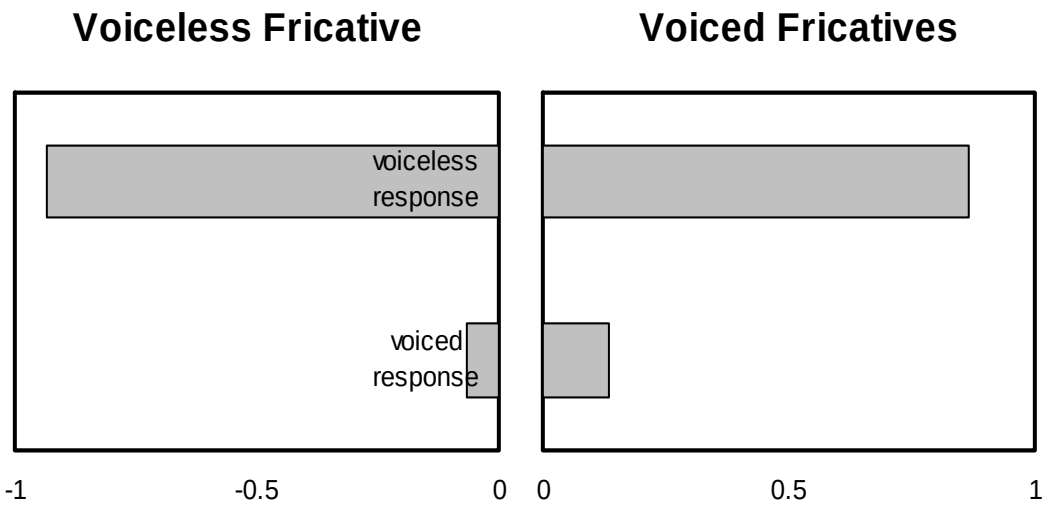



Figure 9: Voicing ID in coronal fricatives (‘new’ phones) in coda position



# Results: Voicing Identification in Coda Labials

Does prosodic position modulate voicing identification patterns and generalization of such patterns from ‘old’ to ‘new’ phones?

Figure 10: Voicing ID in labial stops (‘old’ phones) in coda position

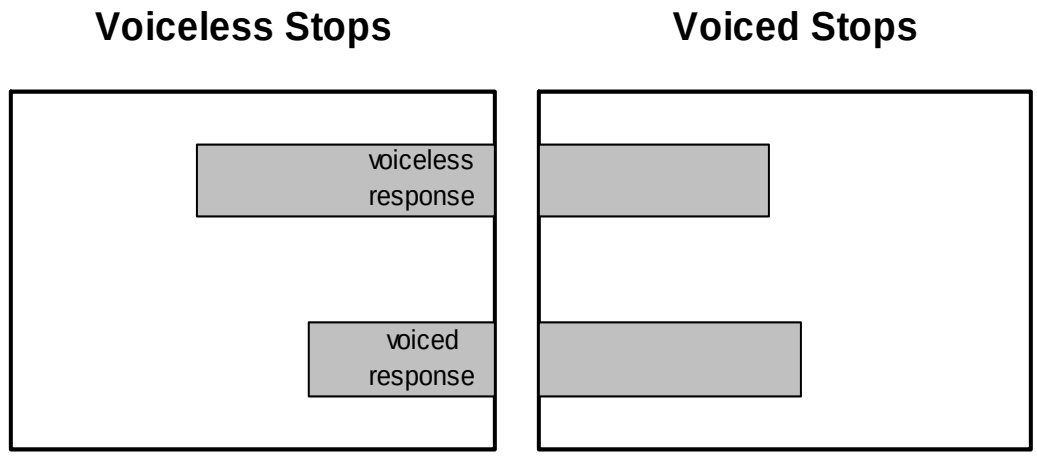
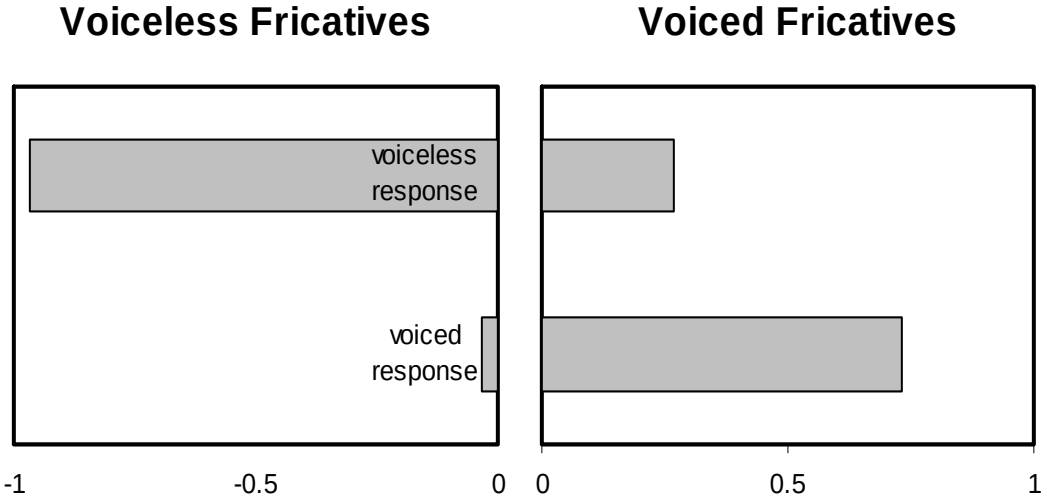



Figure 11: Voicing ID in labial fricatives (‘new’ phones) in coda position



# Results: Manner Identification in Coronals

It may be the case that voicing identification in coronal fricatives is accurate (when it is) because coronal fricatives are heard as stops...

Figure 12: Manner ID in coronal segments in onset position

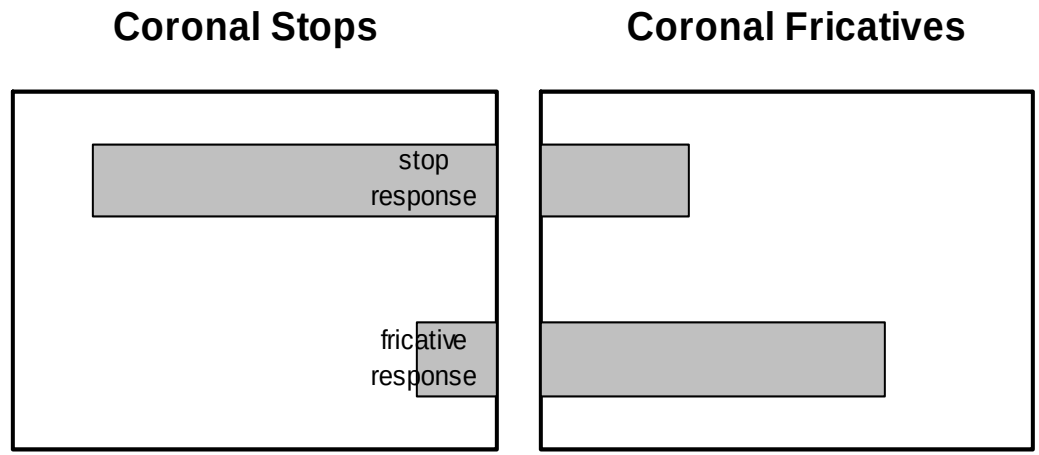
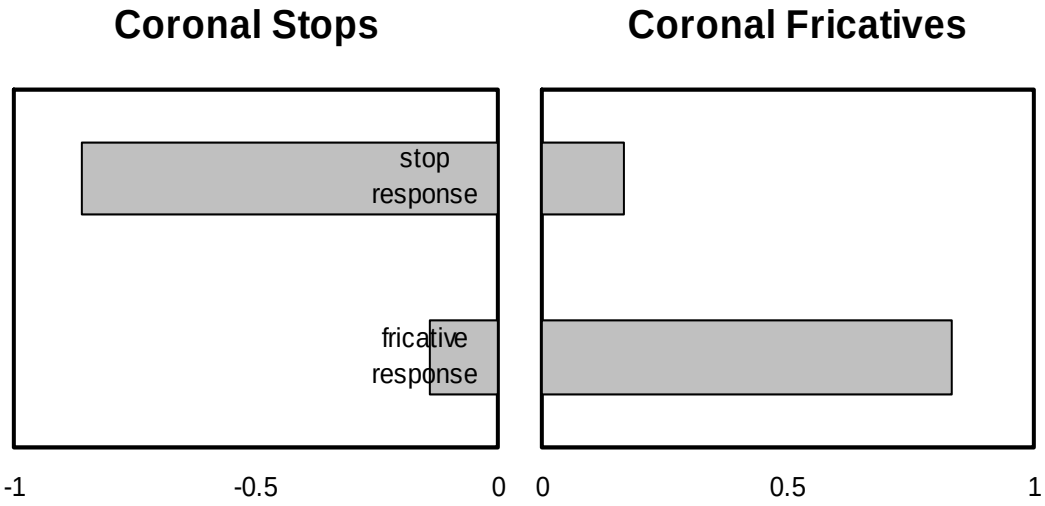



Figure 13: Manner ID in coronal segments in coda position



# Results: Manner Identification in Labials

It may be the case that voicing identification in labial fricatives is accurate (when it is) because labial fricatives are heard as stops...

Figure 14: Manner ID in labial segments in onset position

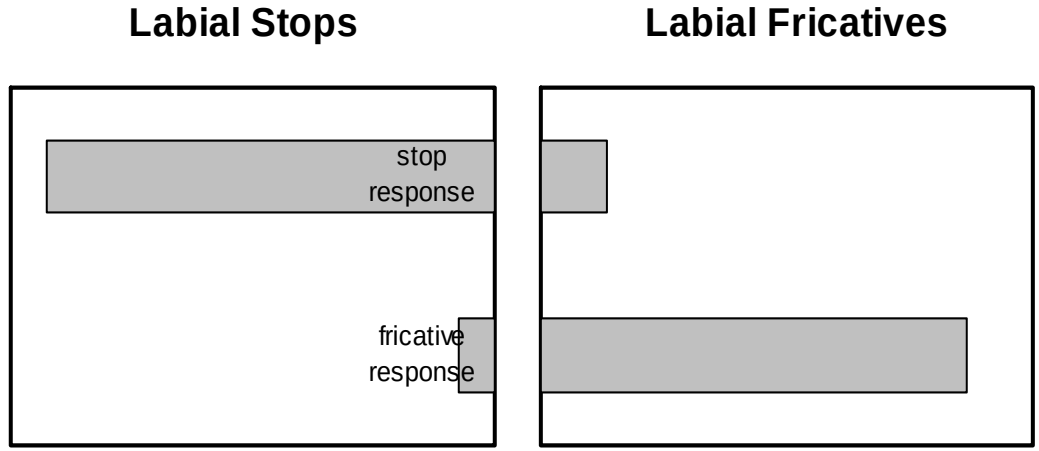
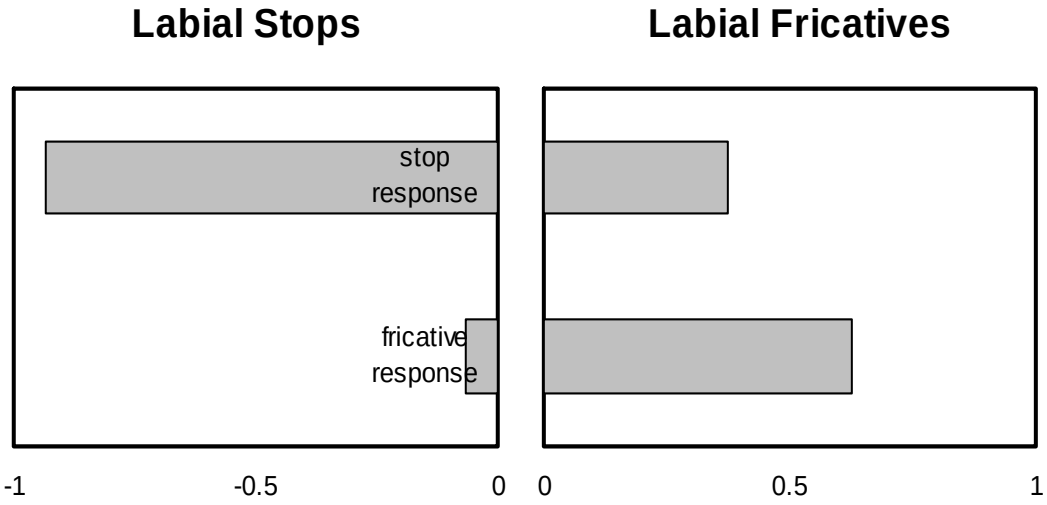



Figure 15: Manner ID in labial segments in coda position



# Results: Statistical Analysis

- Stepwise elimination of factors in a (four-way) multi-way frequency analysis resulted in a model with the following parameters:
  - voice * manner * prosodic location
  - manner * prosodic location
  - voice * prosodic location
  - manner * voice
  - prosodic location
  - manner
  - voice
- Likelihood ratio $G^2 = 10.8448$, df = 8, $p = 0.211$
  - High *p* reflects the fact that this simpler model is statistically indistinguishable from the saturated (full) model, which predicts cell frequencies exactly.

# Conclusions

- Features do (occasionally) generalize to ‘new’ phones
  - Voicing identification is very good for both coronal and labial stops in onset position; a small bias toward voiceless responses was observed.
  - Voicing identification is very good for coronal fricatives in onset position, good (though slightly worse) for labial fricatives in onset position; a slightly larger bias toward voiceless responses was observed.

- In certain cases, prosody, place and manner interact
  - Voicing identification is good for labial stops in onset position, poor in coda position, with a small bias toward voiceless responses.
  - Voicing identification is good for coronal fricatives in onset position, poor in coda position, with a large bias toward voiceless responses.

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