Competition affects voice onset time differently for voiced and voiceless stops

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Introduction

Competition correlates with *hyperarticulation*

- Experiments link lexical competition to phonetic enhancement [1, 2]
- Observational studies have found the same correlation [3, 4]

How should competition be *operationalized*?

- Lexical-phonological neighborhood density (ND)? [2 - 4]
- Phonetically specific minimal pair competition? [1, 4]
- Alternatives based on relative *position* or *type* of competition? [3, 5]

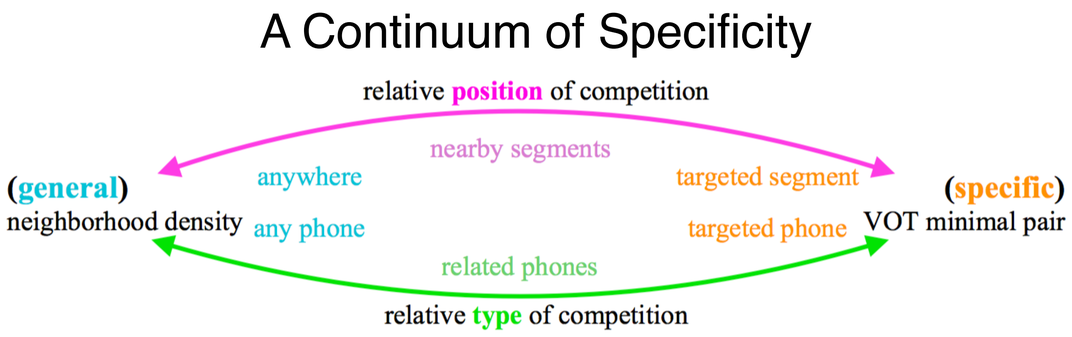

Fig. 1. Schematization of a continuum in lexical competition. Two dimensions of specificity are highlighted: the relative *position* and *type* of competition. On either dimension, a competitor can be more or less specifically defined.

Research Question

How phonetically specific does competition have to be to correlate with hyperarticulation of voice onset time (VOT) in conversational speech?

Method

Conversational speech data

Buckeye Corpus of Conversational Speech [6]

- 1-hour long interview conversations; our data from 24 of 40 speakers

Dependent measure: VOT-length ratio

- Content words of 1 or 2 syllables with initial stop consonant
- Proportion of stop duration consisting of VOT
- Provides localized control for speech rate
- More direct measure of targeted hyperarticulation

Measures of lexical competition ("NDs")

Common measures of lexical competition

- Overall ND = tally of words with single phoneme edit distance
- Phonetically specific minimal pair competition (initial VOT competitor)

Modified Neighborhood Densities (NDs)

Position-specific NDs

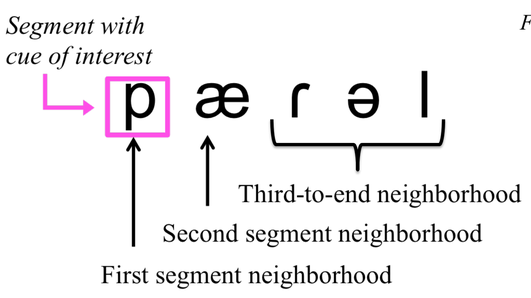

Fig. 2. Three NDs for position of competition relative to the segment of interest (initial segment).

Type-specific NDs

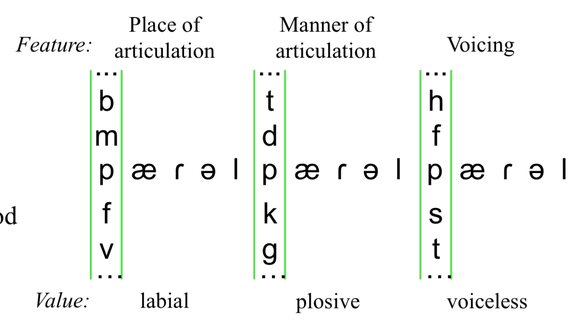

Fig. 3. Three types of relationship between target and competitor. For each, separate NDs were made for competitors with the same feature value and those with a different feature value.

Analysis

Linear Mixed Effects Regression models

- Separate models made for each ND, and one with no ND measure
- Separate models made for voiced and voiceless stops
- Collection of common control predictors assumed to affect VOT

Analysis cont'd

AIC_c comparison of models

- Models compared by corrected Akaike's Information Criterion (AIC_c)
- Ranks models based on likelihood
- Allows for evidence ratios, which indicate how much evidence there is in support of one model over another

Results

Voiced stops

Rank	Model	K	AIC_c	Δ AIC_c	AIC_cWt	Cum.Wt	LL
1	Minimal pair exist	27	-4138.00	0.00	0.93	0.93	2096.34
2	Second segment ND	27	-4131.86	6.14	0.04	0.97	2093.27
3	Base model	22	-4129.43	8.57	0.01	0.99	2086.94
4	Same place ND	27	-4128.38	9.62	0.01	0.99	2091.53
5	Overall ND	27	-4126.38	11.62	0.00	1.00	2090.53

Table 1. Top 5 models in AIC_c comparison for voiced stops. The remaining models did not contribute to the cumulative weight of the comparison table, suggesting that they are extremely unlikely models.

Phonetically specific competition produced the best model

- Existence of a minimal pair competitor for initial stop voicing correlates with *shorter VOT in initial voiced stops*
- 72 times more evidence in favor of this model over base model
- 21 times more evidence for this model over second-best model

Competition in the following segment also improved the model

- Increased competition in the following segment correlates with *shorter VOT in initial voiced stops*
- 3 times more evidence in favor of this model over base model

Voiceless stops

Rank	Model	K	AIC_c	Δ AIC_c	AIC_cWt	Cum.Wt	LL
1	Minimal pair exist	27	-6206.49	0.00	0.42	0.42	3130.45
2	Base model	22	-6204.86	1.64	0.18	0.60	3124.56
3	Same voice ND	27	-6204.26	2.23	0.14	0.74	3129.33
4	Overall ND	27	-6203.94	2.55	0.12	0.85	3129.18
5	Second segment ND	27	-6202.19	4.30	0.05	0.90	3128.30

Table 2. Top 5 models in AIC_c comparison for voiceless stops. The AIC_c weights are more distributed than the results for voiced stops, and second segment ND was ranked considerably lower.

Phonetically specific competition produced the best model

- Existence of a minimal pair competitor for initial stop voicing correlates with *longer VOT in initial voiceless stops*
- 2 times more evidence in favor of this model over base model
- No other form of competition improved the model

Effect of voicing minimal pair competition on VOT

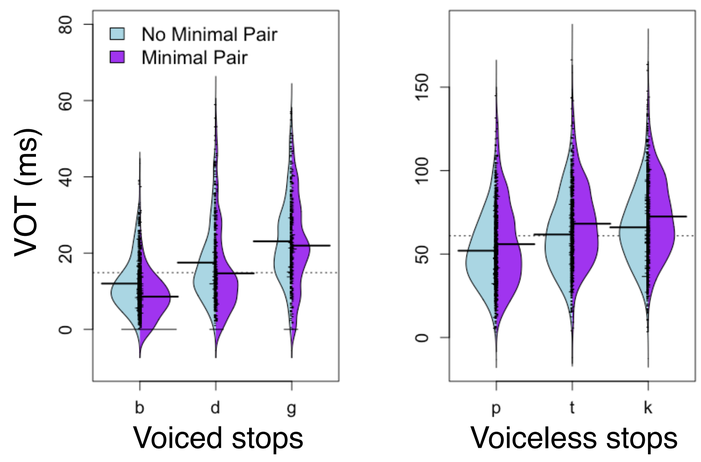

Fig. 4. Average VOTs for voiced and voiceless stops by place of articulation, comparing targets with a minimal pair competitor for initial voicing to those without one.

Conclusions

- Phonetically specific competition correlates with contrastive hyperarticulation in conversational English
- Effects are most robust for voiced stops, which have been under-studied relative to voiceless stops in the hyperarticulation literature

Future Research Questions

Do different types of competition yield different *kinds* of phonetic effects?

Do we find contrastive hyperarticulation for non-primary phonetic cues?

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