Lexical Effects on Phonetic Variation
Independent of Phonotactic Probability
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Introduction

• Can word level properties affect phonetic properties?
• Modular feed-forward models: No
• Interactive models (e.g., cascading interaction): Yes

Existing evidence for interactive models
• Vowels in high-density neighborhoods are hyperarticulated and more coarticulated (Wright, 2004; Munson, in press; Scarborough 2003).
• Potential confound: Neighborhood density is strongly correlated with phonotactic probability, a sublexical property (Bailey and Hahn, 2001) which influences production independent of neighborhood density (Vitevitch et al., 2004).

Focus of the current study
We examined phonetic properties of words contrasting in consonants. Lexical properties independently affect phonetic properties of words. Words were presented visually for self-paced reading. pairs of words varying in whether or not they had a minimal pair neighbor were matched for a number of word level and phonetic properties. We contrasted voice onset time (VOT) of initial voiceless stops in words varying in whether or not they had a minimal pair neighbor. Critical words embedded in a list with monosyllabic fillers. None began with the target consonant for that list. None rhymed with target words. Minimal pair competitors (e.g., <god> for <god>) were not presented within a session. Fillers beginning with stops did not have minimal pair competitors.

Summary of results
Lexical properties independently affect phonetic properties of consonants.
• This effect is constant across place of articulation.

Methods and Materials
Participants
23 Native English speakers
• /p/-initial condition: n=13
• /t/- and /k/-initial conditions: n=10

Speech Materials
Pairs of words varying in whether or not they had a minimal pair neighbor were matched for a number of word level and phonetic properties.
• Lexical frequency (all low-frequency words, <20/million).
• Monosyllabic.
• Beginning with the same initial stop and vowel (e.g. /ka/).
• Phoneme length.
• Phonotactic probability (sum segmental and biglphone probability).
• 16 /p/-initial pairs, 19 /t/-initial pairs, and 12 /k/-initial pairs.

Sample pair: <cod> (competitor <god>) vs. <cop> (no competitor <god>)

Critical words embedded in a list with monosyllabic fillers.
• None began with the target consonant for that list.
• None rhymed with target words.
• Minimal pair competitors (e.g., <god> for <god>) were not presented within a session.
• Fillers beginning with stops did not have minimal pair competitors.

Procedure
Words were presented visually for self-paced reading.
• Three random orders within a session.
• One group produced only /p/-critical words.
• The other group produced both /t/- and /k/- lists, with list order counterbalanced.
• Mispronunciations were excluded from analysis (1.5% of tokens in the /p/- condition, 2.1% in /t/-condition and 1% in /k/-condition).

Results

Word level properties independently condition VOT variation.
• Words that form a minimal pair have significantly longer VOTs than words that do not.

<table>
<thead>
<tr>
<th>Initial Consonant</th>
<th>Voice Onset Time (msec)</th>
<th>Wilcoxon Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimal Pair</td>
<td>No Minimal Pair</td>
</tr>
<tr>
<td>/p/</td>
<td>68.9</td>
<td>65.7</td>
</tr>
<tr>
<td>/t/</td>
<td>84.3</td>
<td>80.3</td>
</tr>
<tr>
<td>/k/</td>
<td>95.5</td>
<td>90.6</td>
</tr>
</tbody>
</table>

This effect is constant across place of articulation.

Discussion

Word level properties affect phonetic properties of initial consonants.
• Participants produce words with a minimal pair neighbor with a longer VOT than words that do not have a minimal pair neighbor.
• This extends previous work by demonstrating that:
  • These effects are independent of phonotactic probability
  • They affect production of consonants
  • This effect is consistent with other results showing non-significant (but trending) hyperarticulation in voicing contrasts (van Alphen & Smits, 2004).

This effect is constant across place of articulation.
• This is consistent with the fact that these effects are lexically and not phonetically driven.

Future directions
Examining the source of this variation.
• Is this effect produced online or offline?
• Is it driven by production or perception systems?

References