

NASAL COARTICULATION IN LEXICAL PERCEPTION: TESTING THE ROLE OF NEIGHBORHOOD-CONDITIONED VARIATION

Vowels adjacent to nasal consonants (either preceding or following) are at least partially nasalized in English. While this coarticulatory nasality is consistently present (thus predictable based on the presence of a nasal C), the degree of nasality varies across tokens. Some of this variation has been shown to be systematically predictable in words depending on the number of phonological neighbors: words with many neighbors (Hi ND) are produced with a greater degree of vowel nasality than words with fewer phonological neighbors (Lo ND) (Scarborough 2004).

This study examines the effect of this systematic low-level variation on lexical perception by presenting natural real and nonsense words from high and low density neighborhoods with manipulated degrees of nasality to subjects in two tasks: lexical decision and forced choice preference. Based on the responses from these tasks, we can both see the effect that fine-grained detail in coarticulatory nasality has on lexical perception and assess the degree to which neighborhood-conditioned adjustments in production influence perception.

Degree of vowel nasality was manipulated by combining the waveform of a nasal or oral “donor” vowel with the waveform of the target “recipient” token in varying ratios by formula using Praat. “Original” and “nasality-modified” stimuli pairs were selected, representing the natural neighborhood-conditioned degree and an increased or decreased degree of nasality (measured acoustically by A1-P0 (Chen 1997)). The amounts of change in nasality between the original and modified versions were determined on the basis of the previously measured nasality differences for low versus high neighborhood density NV and VN words produced by 9 native English speakers (Scarborough submitted). Effectively, neighborhood-conditioned differences were neutralized in the modified tokens: Hi ND words were modified to have the degree of nasality typical of Lo ND words (i.e., nasality was decreased), and Lo ND words were modified to have the degree of nasality typical of Hi ND words (i.e., nasality was increased).

The findings of this study indicate that listeners are indeed sensitive to this systematic low-level phonetic variation in some contexts and that it has an influence on lexical perception. Listeners both found it easier to identify and preferred more nasal Hi ND words and nonwords [$F(1,17) = 5.54, p < .05$ on lexical decision]. However, there were no significant differences for listeners in ease of identifying or preference of more or less nasal Lo ND words and nonwords. (Figure 1 shows lexical decision results; Figure 2 shows forced-choice preference results.)

For Hi ND words, we take these results as demonstrating that perception mirrors production: speakers produce Hi ND words with more nasality, and listeners both respond faster and systematically prefer tokens that conform to these patterns. The lack of significant differences among the Lo ND words, however, invites speculative hypotheses about the respective roles of vowel nasality as a predictive cue and stimulus naturalness (or closeness to produced norms) in lexical perception. One possibility is that increased nasality (as in Lo ND modified tokens) and naturalness (as in Lo ND original tokens) are similarly weighted perceptual cues. Alternately, listeners may be less reliant on (and sensitive to) such detailed cues in easier Lo ND words. Evaluation of these hypotheses awaits results from further experimentation now in progress.

Whether or not neighborhood-conditioned effects are produced explicitly *for* listeners (Scarborough 2004, Wright 2004), our results show that listeners are sensitive to and make use of systematic neighborhood-conditioned variation in the speech signal, showing better perception when the effects of such variation are present – at least for Hi ND words – and critically, when they are present as they are in natural production.

Figure 1: Lexical Decision Task: Average log Response Times by neighborhood density (Hi ND, Lo ND) and nasality (more nasal, less nasal).

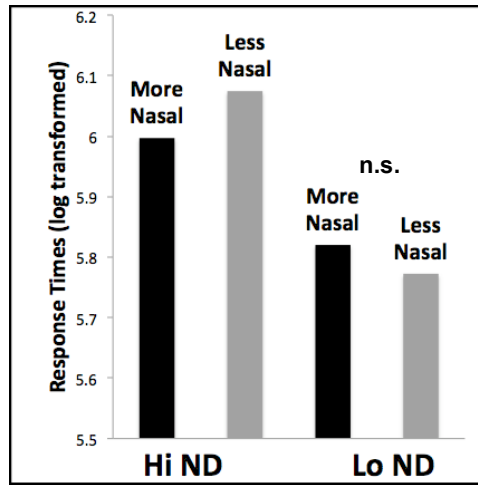
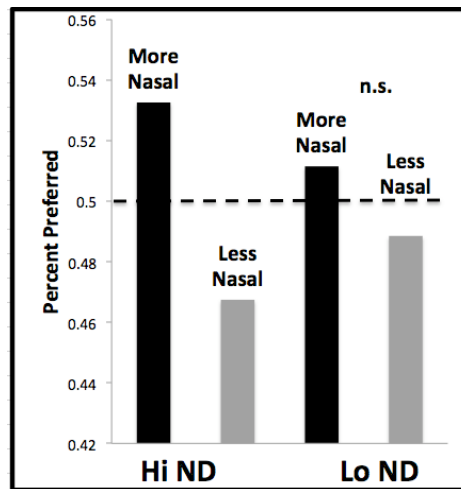


Figure 2: Percentage of preferred responses to original-changed nasality real word pairs, by ND.



References:

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