Context Matters: Effects of Repetition and Lexical Neighborhood on Vowel Production

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Past work has shown that phonological neighborhood size—the number of lexical items differing from a word by a single segment—can affect vowel production (Munson, 2007; Munson & Solomon, 2004; Wright, 2004). Vowels in words with many phonological neighbors are produced with increased phonetic differentiation between vowel categories (i.e., expanded F1-F2 vowel spaces) relative to vowels in words with fewer phonological neighbors. Heller, Lehnert-LeHouillier, & Goldrick (2010) found that this interacts with phonetic variation due to word repetition. Repetition is associated with increased lexical activation and less extreme phonetic productions (Fowler & Housum, 1987). Results showed that effects of neighborhood density on vowel space size indeed decreased as word repetition increased. Words that had many phonological neighbors started out with a relatively expanded vowel space, which became smaller across repetitions. Words with relatively few phonological neighbors maintained a smaller vowel space across repetitions.

In the current work we examine contrasting accounts of this dynamic variation in the phonetic properties of vowels. Previous research has attributed (wholly or in part) the effect of density on vowel articulation to properties of the speaker's processing system (e.g., listener modeling: Wright, 2004; exemplar storage: Pierrehumbert, 2002; competition between similar phonological representations: Baese-Berk & Goldrick, 2009). Similarly, with respect to effects of repetition, vowel spaces may become smaller due to decreasing activation of repeatedly accessed representations within the speaker.

Alternatively, because high- and low-density words are typically presented in an intermixed fashion, both effects may be due to the context in which words are produced. Neighborhood effects might reflect speakers enhancing differences between contrasting lexical items within the list. Moreover, what appear to be repetition effects may instead be a reflection of the distance between mentions of neighbors in the list presentation. Because this distance is longer for later word repetitions, competition due to previous mentions would be more decayed for later word repetitions.

We investigated these hypotheses utilizing the experimental items from Heller et al. (2010). High and low-density words were paired; members of the pair were neighbors. A new set of participants produced these items in blocks, such that high- and low-density words were not intermixed within a block. We find no difference in vowel space size for high- and low-density words when they are separated from each other. Second, we performed a linear mixed effects regression reanalysis of the data from Heller et al., including distance since last mention of the word's paired item as an additional fixed effect. Outcomes indicate a robust role of word repetition, but not of distance from the last mention of the paired item. Although repetition number and distance were moderately correlated ($R = 0.78$), the addition of residualized distance to the model did not significantly improve its fit ($\chi^2 = 3.69$, df = 2, $p = 0.16$), whereas the addition of repetition to a model including distance did significantly improve model fit ($\chi^2 = 12.28$, df = 2, $p < 0.01$).

These results suggest that list context modulates neighborhood density effects. Presence of a paired, neighboring word in context is required for lexical competition to be high enough that a difference in vowel production can be detected. However, the lack of distance effects suggests that decay of neighbor activation is not sufficient to account for repetition effects.

References

Baese-Berk, M., & Goldrick, M. (2009). Mechanisms of interaction in speech production. *Language & Cognitive Processes, 24,* 527-554.

Fowler, C. A., & Housum, J. (1987). Talkers' signaling of "new" and "old" words in speech and listeners' perception and use of the distinction. *Journal of Memory & Language, 26,* 489-504.

Heller, J., Lehnert-LeHouillier, H., & Goldrick, M. (2010, September). The dynamics of lexical neighborhood effects on phonetic processing. Poster presented at the *6th International Workshop on Language Production*. Edinburgh, UK.

Munson, B. (2007). Lexical access, lexical representation, and vowel articulation. In J. Cole & J. Hualde (Eds.), *Laboratory Phonology 9* (p. 201-228) New York: Mouton de Gruyter.

Munson, B., & Solomon, N. P. (2004). The effect of phonological neighborhood density on vowel articulation. *Speech, Language, and Hearing Research, 47,* 1048-1058.

Pierrehumbert, J. B. (2002). Word-specific phonetics. In C. Gussenhoven & N. Warner (Eds.), *Laboratory phonology* (pp. 101-139). Berlin: Mouton de Gruyter.

Wright, R. (2004). Factors of lexical competition in vowel articulation. In J. Local, R. Ogden, & R. Temple (Eds.), *Papers in Laboratory Phonology VI* (pp. 26-50). Cambridge: Cambridge University Press.