Change over time in nasal coarticulation: Independent socio-dialectal and frequency effects

Introduction. English vowels can be contextually nasalized due to an overlapping velum gesture from an adjacent nasal consonant. Nasal coarticulation is traditionally viewed as a reflex of physiological constraints on phonetic implementation (Chomsky & Halle 1968). Recent work, however, demonstrates that nasality shows interspeaker convergence (Zellou et al. 2013), which suggests that nasal coarticulation is a perceptible and malleable phonetic property. This dovetails with observations that nasal coarticulation varies across dialects (vanReenen 1982, Plichta 2010). We present evidence for a change over time in degree of nasal coarticulation within a speech community, strengthening the view that nasality is not simply an articulatory universal but rather is under some degree of (subconscious) speaker control. We further show that this change over time is independent of the effect of lexical frequency on nasality and discuss the implications of these findings for theories of phonetics and phonology in sound change.

Methods. Our data come from the sociolinguistic interviews in the Philadelphia Neighborhood Corpus (Labov & Rosenfelder 2011). We selected 42 speakers balanced for sex and age over birthyears 1890 to 1991. From these speakers' sound files we extracted monosyllabic/morphemic content words containing exactly one nasal segment. We measured acoustic nasality as the difference in amplitude between first formant and nasal formant peaks (A1-P0: small=more nasal, Chen 1997) at vowel midpoint. We fit linear mixed models with fixed effects for speaker age, birthyear, and gender; log vowel duration; coarticulatory direction (anticipatory/carryover); log word frequency (SUBTLEX, Brysbaert & New 2009); phonotactic probability (Miller & Selfridge 1950); and frequency-weighted phonological neighborhood density (neighbors calculated from the Hoosier Mental Lexicon, Nusbaum et al. 1984), plus random intercepts for word and speaker and a random slope for direction by speaker. Age was residualized by birthyear and phonotactic probability by direction to eliminate collinearity. The final model's significant fixed effects after backward selection are presented in (1).

Discussion. We highlight four points of interest from the result in (1). First, the significant positive effect of birthyear signals a reduction in nasal coarticulation over time. This novel observation of a nasality change-in-progress in conversational speech suggests that nasal coarticulation can fall under the purview of socio-dialectal change within a community, thereby supporting the view that speakers can perceive and control nasality. Second, the effect of frequency, with more frequent words showing greater nasal coarticulation, suggests that nasal coarticulation can increase under lenition: high frequency words undergo greater segmental reduction, which causes greater gestural overlap (Lindblom 1990). Third, we find a significant interaction between frequency and direction wherein the difference between anticipatory and carryover nasality is greater in high frequency words; this may reflect a retiming of the velum gesture compensating for final segment weakening that does not occur for initial segments. Finally, there is no evidence for an interaction between birthyear and frequency. The change thus fails to accrue differentially to high frequency words as predicted by pure exemplar-based models. Rather we suggest that this result is consistent with models positing some level of abstraction, such as hybrid models (Pierrehumbert 2001).

(1) Fixed effects parameters (t > 2 = significant)

	Estimate	Std. Error	*t* value
Intercept	-81.69	33.87	-2.41
Log duration	2.61	0.39	6.71
Direction:anticipatory	-4.84 1.81	-2.67	
Log frequency	-1.12	0.38	-2.94
Birthyear	0.04	0.02	2.50
Direction:antic. * log freq.	0.99	0.46	2.165

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