Phonetically Complete Neutralization in Mankiyali
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INTRODUCTION. Under usage-based models of speech production, lexical representations consist of a complex network of interconnected and phonetically detailed exemplar memories of words and phrases a language user has encountered.[1][2][3] The strength of the relationship between these stored exemplars increases with greater phonetic and semantic similarity between forms, and such links are used to explain a vast array of phenomena, including the emergence of phonemic categories, morphological paradigm uniformity, and the productive generalization of common phonological patterns to novel forms. In other words, rather than positing the existence of an abstract and symbolic grammar through which lexical items are filtered to generate phonological patterns in a language, usage-based models contend that the grammatical properties of language *emerge* from the repetition of such patterns over a large number of lexical types and tokens. An important prediction argued to arise from the interconnectedness of exemplar memories is that the contextual neutralization of phonological contrasts results in phonetically incomplete neutralization, as the relational links between stored exemplars preserve traces of the original contrast. In defense of formal generative grammar, this paper presents oral-nasal air pressure data from vowels in Mankiyali to argue that, at some point, URs must be filtered through an abstract grammar separate from lexical representations that is capable of transforming sounds with distinct phonological targets into sounds with identical phonological targets.[4] Specifically, the oral-nasal vowel contrast in Mankiyali is neutralized before nasal consonant suffixes, and this neutralization *is* phonetically complete. Exemplar-theoretic models are capable of modeling phonetically incomplete neutralization, but they have difficulty modeling phonetically complete neutralization simultaneously. Conversely, the complete phonetic merger of two distinct sounds is unsurprising given an abstract symbolic grammar common in generative frameworks[5].

MANKIYALI PHONOLOGY. Mankiyali is an Indo-Aryan language spoken by 500 people in two remote villages in the Khyber Pakhtunkhwa Province of Northern Pakistan. Long vowels contrast in nasality in the language (e.g., [ɖɪː] 'giant' vs. [ɖĩː] 'firewood'). Before a nasal suffix, however, this contrast is neutralized, with both vowel types described impressionistically by native speakers as nasalized: [ɖĩː-ŋ] 'of the giant, of the firewood'. Crucially, it is unclear if this neutralization is phonetically complete or not.

PHONETICALLY COMPLETE AND INCOMPLETE NEUTRALIZATION. Due to their modular, feedforward nature, generative frameworks predict that the lexical identity of a morpheme (i.e., its UR) should not affect its phonetic realization. This is because the input to the phonetic component of the grammar is the output of the phonological component (i.e., the SR). Thus, the makeup of a morpheme's UR is not available during the phonetic implementation of the SR, so neutralized contrasts are predicted to map to identical phonetic targets. Nevertheless, a large body of recent work has demonstrated that phonological neutralization is not always phonetically complete, and differences in lexical frequency often result in word-specific phonetics.[3] For example, voiced obstruents are devoiced word-finally in German (e.g., both /ʁaːd/ 'wheel' and /ʁaːt/ 'council' are pronounced [ʁaːt]). However, Port & O'Dell (1985) found that this devoicing is phonetically incomplete, detecting a small but reliable acoustic difference in the length of preceding vowels depending on the underlying voicing of the obstruent: the vowel in [ʁaːt] 'wheel' is reliably longer than the vowel in [ʁaːt] 'council'.[6] Generative theories incorrectly predict, then, that both /ʁaːd/ and /ʁaːt/ should exhibit identical phonetic realizations and have no easy explanation for the effect of lexical identity on phonetic realization (PR). For usage-based models, these phonetically distinct productions arise from the strong relational connection of phonetically and semantically similar items. Specifically, [ʁɛːdɐ] 'wheels' is produced with a voiced stop intervocalically, thereby phonetically lengthening the preceding vowel, and stored exemplars of this plural form influence the realization of the singular form, [ʁaːt] 'wheel'. Conversely, the pre-stop vowel in [ʁaːt] 'council', which is always realized with a voiceless stop throughout its paradigm, has no such influence. However, while connections between semantically and phonetically similar forms in usage-based models explain phonetically incomplete neutralization like that in German word-final devoicing, these same connections make the possibility of observing *complete* neutralization difficult to explain. Specifically, if a sound contrast exists in one paradigmatic form, that contrast should influence the realization of all other forms in the paradigm, thereby preventing complete neutralization.

EXPERIMENT 1. We examined the phonetic nature of the neutralization of vowel nasality before nasal consonant suffixes in Mankiyali. Usage-based models predict that the vowel in [ɖĩːŋ] 'of the giant' should

be less nasalized (because of its morphological relationship with oral [ɖɪɪ] 'giant') than the vowel in [ɖĩɪ̃ŋ] 'of the firewood' (because of its morphological relationship with nasal [ɖĩɪ̃] 'firewood'). Twenty native Mankiyali speakers read 51 monosyllabic words four times each in isolation into a dual-chamber airflow mask that measures oral and nasal air pressure (N = 4,080 tokens). Tokens were sourced from four conditions: oral (CVV), nasal (CṼṼ), genitive oral (CVV=N), and genitive nasal (CṼṼ=N). Results (fig. 1) demonstrate that the neutralization of vowel nasality before a nasal consonant suffix is phonetically complete in Mankiyali, such that the nasalance, duration, and quality of vowels were not significantly different across the underlying oral and nasal vowel types.
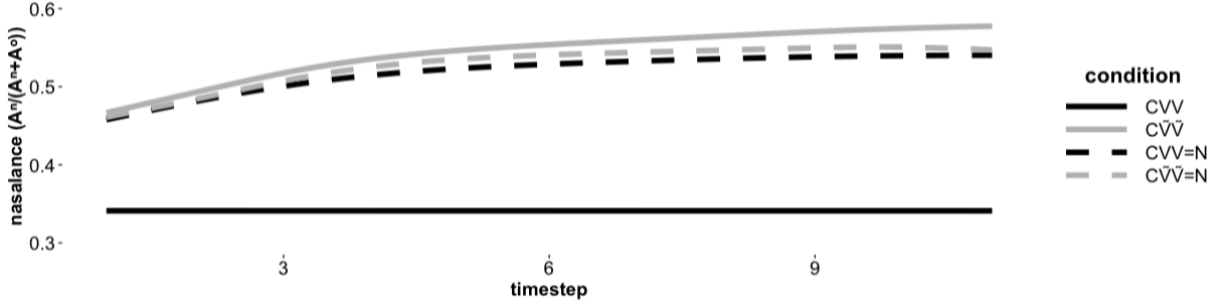

Figure 1: GAM curves showing mean vowel nasalance at 11 normalized timesteps for all exp. 1 tokens.

EXPERIMENT 2. It is possible that the phonetic differences between oral and nasal vowels do not arise on the vowels themselves but manifest on preceding segments, similar to how the phonetic distinction between obstruents in German is realized as a difference in duration on the preceding vowel. Experiment 2 investigated whether coarticulatory nasalization differed between the two vowel types. Sixteen additional native Mankiyali speakers read 38 di/trisyllabic words from four conditions, all with similar shapes for the final two syllables: VV.GVV (oral), VV.GṼṼ (nasal), VV.GVV=N (genitive oral), and VV.GṼṼ=N (genitive nasal). The same procedure and analysis from experiment 1 was followed. Preliminary results from ten speakers are given in Figure 2 (N = 1,520) and indicate that anticipatory coarticulation was not significantly different between oral and nasal vowels in the genitive form.
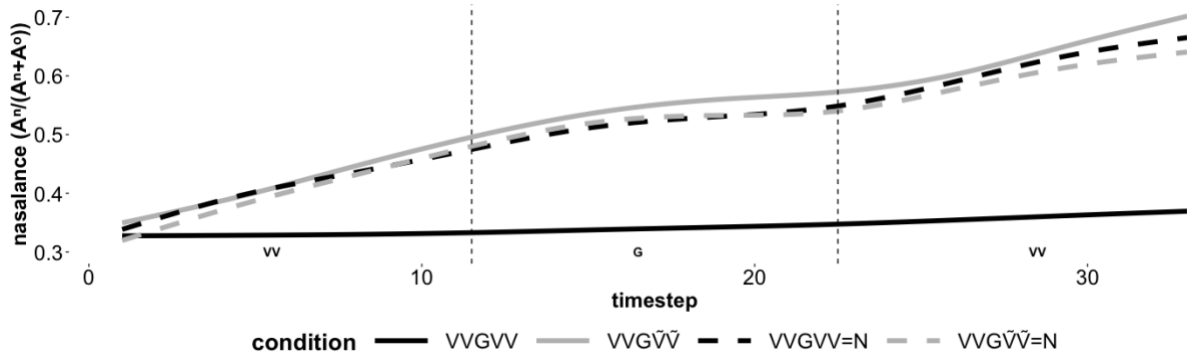

Figure 2: GAM curves showing mean nasalance at 33 normalized timesteps across the three segments of the VVGVV sequence from all experiment 2 tokens for ten speakers.

CONCLUSION. The phonetically complete neutralization of vowel nasality before nasal suffixes in Mankiyali presents difficulties for usage-based theories, which predict that underlying oral vowels should be less nasalized than underlying nasal vowels in this environment due to their phonetic and semantic similarity to completely oral forms. Regardless of how generative models of speech production need to change to account for cases of incomplete neutralization like that of German word-final devoicing, purely usage-based theories, due to the mechanisms needed to account for incomplete neutralization, cannot account for phonetically complete neutralization.

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