Initial velar nasal deletion in Wubuy is sensitive to morphological information as well as prosodic phrasing

Background. Many current models of intervocalic stop lenition assume that lenition derives from speech speed: faster utterances produce greater approximation, or target undershoot, which leads to lenition, and potentially deletion (Ennever et al. 2017; Cohen Priva & Gleason 2020; Katz 2021). Lenition and deletion of *initial* stop segments has affected numerous indigenous Australian languages historically, but is poorly understood (Blevins 2001, Dixon 2002:593). One relevant factor in this type of lenition appears to be position in utterance: utterance-initial segments are more likely to be deleted than utterance-medial segments (Hercus 1979, Blevins 2001, Marley 2020), though the reasons remain unclear. Here, we examine a synchronic initial deletion phenomenon in the Australian language Wubuy (Heath 1984) in which the initial velar nasals of inflectional prefixes on verbs are targeted, as in Bininj Gun-wok (Evans, 2003; Marley, 2020), though not velar nasals elsewhere.

Method. We elicited 72 utterances consisting of an initial agreement prefix, followed by one of 12 incorporated nouns, followed by one of 6 inflected verb forms, see (1) and (2). We recorded a total of 10 repetitions of each utterance (five utterances in 'slow speech', five in 'fast speech') produced by three speakers of Wubuy = 2160 utterances (72x10x3). The recordings were segmented by hand in *Praat* (Boersma & Weenink, 2018), and the presence or absence of initial nasal was identified auditorily and by visual inspection of the spectrogram and waveform. We also coded each utterance for presence or absence of a pre-utterance 'pause' (>150 ms). We extracted measures of duration of all supplied initial /ŋ/s and the duration of vowels /a/ or /aa/ in the prefixes.

Results. The distribution of supplied /ŋ/ is presented in Table 1. We first fit a binary logistic regression to the data, and a chi-square test returned a significant intercept ($p < .0001$; see Figure 1). The results further indicate that /ŋ/ deletion is more frequent in polysyllabic prefixes than monosyllabic ($p < .0001$), and that speakers are more likely to delete the initial nasal following a pause ($p < .0001$). Speed is *not* statistically significant ($p = .997$). Secondly, we ran GLMMs (fixed effects Prefix type [mono vs polysyllabic], Environment [pause vs no pause] and Speed [fast vs slow]) on the duration of supplied /ŋ/s and the prefix vowels (there was no duration difference between /a/ and /aa/ so we collapsed the categories). The /ŋ/ duration analysis indicated that /ŋ/s are on average 19 ms longer in polysyllabic prefixes, that slow speech increases duration by 6 ms, and that pre-pausing reduces duration by 8 ms. The vowel duration analysis indicated slow speech increases vowel duration by 16ms. There was no effect of Prefix type or Environment.

Discussion. The results of the present study of velar nasal deletion in Wubuy suggest, in contrast to what has been proposed in the literature (discussed above), that not all processes of lenition or deletion reflect bottom-up phonetic changes due to a fast speaking rate, though fast speech has the expected effects on segmental durations (/ŋ/ and /a ~ aa/). The results also indicate that prefix-initial velar nasals are not all subject to deletion at the same rate, though consistent with (Hercus 1979, Marley 2020), nasals following a pause are targeted for deletion much more than those not preceded by a pause. Taking these observations together, and under the assumption that the initial segment of words is crucial to successful lexical retrieval (Norris & McQueen 2008), we suggest that speakers and listeners are sensitive to the number of segments left in the prefix after deletion. In particular, the difference between the monosyllabic prefix ŋa- '1sg' and the polysyllabic prefixes ŋaampu- '1INCL.PL/3ANIM.IRR', ŋaaŋku- '1INCL.PL/3NEUT.IRR' appears to be best explained in terms of this ratio of information loss (number of segments left compared to segments lost), rather than any phonological factors.

1. ŋa-jinak-alaati
1sg-head-bad
'my head is bad'

2. ŋaampu-jinak-ka[a[ii
1INCL.PL/3ANIM.IRR-head-scratch.FUT
'We (incl.) will scratch their heads'

ID	Fast		Slow		Pause		No-Pause	
	Total *N*	Deleted	Total *N*	Deleted	Total *N*	Deleted	Total *N*	Deleted
W1	257	42%	248	43%	181	79%	319	21%
W2	316	49%	336	55%	616	53%	36	33%
W3	375	25%	400	38%	258	80%	514	7%

Table 1. Summary of /ŋ/ occurrence in slow vs fast and pause vs no-pause conditions.

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