NC voicing dissimilation in Tonko Limba

Amber Galvano[1], Daniel Ibrahim Kamara[1]
[1]*University of California, Berkeley*

Languages tend to avoid or repair nasal + voiceless stop sequences [1] (see [2] on nasal leakage). One formal way of accounting for this is a *NT constraint (e.g., [3]). However, some languages allow, or even create, [NT] from /ND/ (where D is a voiced oral obstruent), leading some to question *NT's universal relevance and propose a coexisting *ND ([4], cf. [5]). Bantu languages such as Tswana [6] and Shekgalagari [7] that avoid ND via post-nasal devoicing (PND) are typologically rare but problematize the idea of universal and phonetically underpinned constraints. The Tonko dialect of Limba (Niger-Congo; Kambia district of Sierra Leone), in which [ND] is avoided only at velar place, presents a new challenge: [ŋk] surfaces for /ŋɡ/ within morphemes, and /ɡ/ devoices after nasals across morphemes and words. [ŋk] surfaces within stems, between prefix and stem (with /N-/ homorganic with stem onset), and across the word boundary ([ŋ] is the sole word-final consonant). Limba's place-restricted dissimilation insinuates a mechanism by which *ND is strongest for velars. Note that despite using voicing dissimilation to "repair" [ŋɡ], Tonko is the main documented Limba variety where *k and *ɡ have not merged to /k/ (cf. [8]), as [ɡ] is preserved intervocalically and prefix-initially (but not stem-initially).

Phonetic data comes from the speech of the second author. Of 100 nouns containing NC, impressionistic counts for unique items with each [NC] type are given in Table 1. For acoustic analysis, each known word or phrase with a singleton or post-nasal stop was recorded four times: once in isolation, twice in the frame *Yàn dómé __ bà yì,* 'I said __ for you,' and again in isolation. The middle two productions were analyzed; cases of pause between the verb and target were excluded. Oral closure voicing was identified in Praat via energy striations at the lowest frequencies, pulses, and an uninterrupted voicing tracker. Preliminary results suggest post-nasal C voicing varies by place and morphological context [9], particularly for velars. 65% of /Nɡ/ were realized with ≥50% voicing ("voiced", per [6]), while /Nd, Nb/ were categorically voiced. Of 4 /Nɡ͡b/ tokens, all were unvoiced. 44% of /Nk/, 16% of /Nt/, and 28% of /Np/ were voiced; 63% of /nt^h/ were also voiced. Table 2 shows raw voicing results by word type: only 29% of /Nk/ in nouns were voiced; 71% in verbs were voiced, but when across a verb and noun, half of tokens were voiced and half unvoiced. In an LMER for PERCENT_VOICING by SEGMENT * CONTEXT with random effect WORD (reference: /Nk/, NOUN), /Nk/ differed only from /Nb/ and /Nd/; VERB#NOUN and VERB contexts differed from NOUN; /Nd/ * VERB and /Np/ * VERB interactions were also significant. Finally, Table 3 shows data examples for /Nk/ and /Nɡ/.

To account for this data with an OT framework, I propose the following: AGREE[PLACE] [10], as all outputs show place assimilation; *WEAK[INITIAL], to penalize "weak" (here, voiced) stem-initial consonants; *ND[NOUN], penalizing [ND] contained within a noun; *NT [3]; *ɡ *d, and *b [4]. I use MaxEnt weights to reflect the variable outputs; see Table 4 for schematic tableaux.

These data appear to refute a strictly articulatory explanation for PND and evidence the /k/-/ɡ/ merger in Limba. [ND] has been deemed perceptually non-optimizing, due to its closeness to N (e.g., [4] on Dayak; Scots), but perhaps preferable over [NT] in terms of articulatory ease; Limba thus exhibits the tension between articulatory "naturalness" (per *NT) and perceptual distinctness (per *ND), indicating a need to untangle two types of phonetic influence on phonological constraints. This issue also plays out in other languages that treat N + velar stop sequences uniquely, such as Tiene, where [ŋɡ] occurs only between prefix and stem, and Shona, where [ŋk] *only* occurs in this context [11]. Such languages further bring into question the formal differences between feature-specific constraints (e.g., *ɡ) and broader, phonetically transparent ones (e.g., *NT) – that is, can both be universal?

Table 1: [NC] lexical noun counts

	prefix-stem	stem	cross-word	total
[mp]	1	5	0	**6**
[mb]	3	7	0	10
[nt]	4	12	0	**32**
[ntʰ]	1	5	0	
[nd]	1	16	0	17
[ŋk]	4	24	17	**45**
[ŋg]	0	0	0	0
[ŋg͡b]	1	1	0	2

Table 2: Voicing in velar NC by word type

	type	≥50% voiced	<50% voiced	fully voiced	total
/Nk/	noun	16	40	5	56
		28.6%	**71.4%**	8.9%	
	verb	20	8	15	28
		71.4%	28.6%	53.5%	
	vb#n	11	11	7	22
		50.0%	**50.0%**	31.8%	
/Ng/	noun	1	6	0	7
		14.3%	**85.7%**	0.0%	
	verb	0	0	0	0
		0.0%	0.0%	0.0%	
	vb#n	41	16	31	57
		71.9%	28.1%	54.3%	

Table 3: /Nk/ and /Ng/ in nouns (n) and verbs (vb)

	Transcription	Gloss
/Nk/ (noun)	bi-jɛ**ŋk**i	CL-Kamara.clan
/Nk/ (verb)	du**ŋk**uŋ	give
/Nk/ (vb#n)	ha**ŋ** **k**u-thala goŋ	hit CL-branch DET
/Ng/ (noun)	/gu-to**ŋ** **g**oŋ/ [gu-toŋ koŋ]	CL-rice.flour DET
/Ng/ (verb)	n/a	n/a
/Ng/ (vb#n)	/ha**ŋ** **g**u-thagi goŋ/ [haŋ ku-thagi goŋ]	hit CL-foot DET

Table 4: Selected schematic tableaux for /ND/

/Ng/ (noun)	AGR [PL] 13.69	*NT 1.93	*ND [N] 1.03	*g .99	*d .64	WK [INIT] .23	*b 0	**H**
☞[ŋk]		1						1.93
[ŋg]			1	1				2.02
[nk]	1	1						15.62
/Ng/ (vb#n)								
☞[ŋg]				1		1		1.22
[ŋk]		1						1.93
[nk]	1	1						15.62
/Nd/(n)								
☞[nd]			1		1			1.67
[nt]		1						1.93
[ŋd]	1				1			14.33
/Nb/(n)								
[mp]		1						1.93
☞[mb]			1				1	1.03
[ŋb]	1						1	13.69

References

[1] Pater, J. (1996). *NC. In *Proceedings of the 26th NELS* (pp. 227-239).

[2] Hayes, B, & Stivers, T. (2000). *Postnasal Voicing*. Unpublished manuscript.

[3] Pater, Joe (1999) Austronesian nasal substitution and other NC effects. In R. Kager, H. van der Hulst, & W. Zonneveld (Eds.), *The Prosody-Morphology Interface* (pp. 310-343). Cambridge University Press.

[4] Hyman, L. M. (2001). The limits of phonetic determinism in phonology: *NC revisited. In E. Hume & K. Johnson, *The role of speech perception in Phonology* (pp. 141-185).

[5] Zsiga, E., & Gouskova, M. (2006). On the Status of Voiced stops in Tswana: Against ND. In *Proceedings of The 36th NELS.*

[6] Coetzee, A. W., Lin, S., & Pretorius, R. (2007). Post-nasal devoicing in Tswana. In *Proceedings of the 16th ICPhS* (pp. 861-864).

[7] Solé, M. J., Hyman, L. M., & Monaka, K. C. (2010). More on post-nasal devoicing: The case of Shekgalagari. *Journal of Phonetics*, *38*(4), 604-606.

[8] Clarke, M. L. (1922). *A Limba-English dictionary / Tampen ta ka talun ta ka hulimba in huinkilisi ha.* Houghton.

[9] Smith, J. L. (2011). Category-specific effects. In M. J. Ball & M. R. Perkins (Eds.), *The Blackwell Companion to Phonology* (pp. 1-25). Wiley-Blackwell.

[10] Lombardi, L. (1999). Positional faithfulness and voicing assimilation in Optimality Theory. *NLLT*, 17, 267-302.

[11] Hyman, L. M. (2003). Segmental Phonology. In N. Derek & G. Philippson (Eds.), *The Bantu languages* (pp. 128-149). Routledge.