Effects of allophonic vowel nasalization on NC clusters: a contrast-based analysis

Overview. Meinhof's Law (or the Ganda Law) is a phenomenon familiar from the Bantu literature, in which a nasal-stop sequence (NC) is realized as a plain nasal (N) when followed by another NC. Data from Ngaju Dayak (Blust 2012: 372) illustrate it in (1); addition of the verbalizing prefix /maN-/ triggers the change. A related process, where NC is realized as a plain stop (C) when preceded by another NC, is illustrated in (2); this is commonly known as the Kwanyama Law (data from Herbert 1976: 344).

(1) Meinhof's Law in Ngaju Dayak
- a. /ma**N-b**a**nd**o/ → /ma-**m**a**nd**o/ 'turn against'
- b. /ma**N-d**i**nd**iŋ/ → /ma-**n**i**nd**iŋ/ 'wall up'

(2) The Kwanyama Law in Kwanyama
- a. o**ŋg**a**d**u (cf. Herero o**ŋg**a**nd**u)
- b. o**mb**a**b**i (cf. Herero o**mb**a**mb**i)

(1), (2), and other similar patterns (= *NC effects*) reveal a cross-linguistic dispreference for sequences of nasal clusters (*NC$_1$VNC$_2$). This paper seeks to identify the source of this dispreference: what is the nature of the markedness constraint that penalizes NC$_1$VNC$_2$? Many researchers (e.g. Meinhof 1932, McConvell 1988, Blust 2012) claim that (1), (2), and others are examples of *dissimilation*, driven by an OCP constraint that bans two successive NCs (*NC$_1$VNC$_2$). Others (e.g. Herbert 1986, Jones 2001) argue that these alternations are driven by phonetic considerations: the sequence NC$_1$VNC$_2$ is perceptually dispreferred.

This paper provides new arguments for Herbert and Jones's position that the repairs in (1-2) are responses to a constraint penalizing *insufficiently distinct contrasts*. I argue that NC$_1$VNC$_2$ is dispreferred because anticipatory nasalization stemming from NC$_2$ ([NC$_1\tilde{\text{V}}$NC$_2$]), necessary for NC$_2$ to remain distinct from C, renders the N–NC$_1$ contrast confusable (see Beddor & Onsuwan 2003). Arguments for the contrast-based analysis come from the larger typology of NC effects. I show that the analysis accurately predicts (i) constraints on possible types of repairs, (ii) implicational generalizations regarding the types of NC$_1$VNC$_2$ sequences repaired, and (iii) a universal restriction on the locality of repairs. By comparison, the alternative OCP analysis can neither predict nor explain any of these generalizations, let alone all of them together.

Repairs. A comprehensive survey of 63 languages, drawn from various sources, found four different types of NC effects. These are schematized below. I analyze the difference between the nasalization and oralization outcomes as a function of the ranking between Max[+nas] and Max[-nas]: when Max[+nas] >> Max[-nas], nasalization is the preferred outcome; when Max[-nas] >> Max[+nas], oralization is preferred. Differences in directionality (i.e. whether NC$_1$ or NC$_2$ is modified) can, with several exceptions, be linked to independent morphological facts (see also Jones 2001). If NC$_1$ is created by a prefix-stem boundary, NC$_1$ is modified; if NC$_2$ is created by a stem-suffix boundary, NC$_2$ is modified. In other words, preservation of stem-internal material is prioritized over preservation of affixal material (Beckman 1998).

Outcome	***Description***	***Attested?***
NC$_1$ Nasalization	/NC V NC/ → [**N** V NC]	Ngaju Dayak (Blust 2012) + 48 others
NC$_2$ Nasalization	/NC V NC/ → [NC V **N**]	Gurindji, western dialects (McConvell 1988)
NC$_1$ Oralization	/NC V NC/ → [**C** V NC]	Timugon Murut (Blust 2012) + 1 other
NC$_2$ Oralization	/NC V NC/ → [NC V **C**]	Bilinara (McConvell 1988) + 10 others

The typology of repairs is consistent with the predictions of both a contrast-based and an OCP-motivated analysis. All repairs alleviate in some way the perceptual problem posed by NC$_1$VNC$_2$, and all satisfy the OCP constraint. But while the OCP analysis has no reason to predict that a given repair should be preferable to any other, the contrast-based analysis does. In particular, the contrast-based approach predicts that NC$_2$ nasalization should be a *disfavored repair*: as the intervening vowel in NC$_1$VN is still nasalized ([NC$\tilde{\text{V}}$N]), mapping NC$_1$VNC$_2$ to NC$_1$VN$_2$ does not fully solve the problem posed by NC$_1$VNC$_2$. The contrast-based analysis thus predicts that NC$_2$ nasalization should only be possible in languages that nasalize more pre-NC than pre-N. In western dialects of Gurindji, where NC$_2$ nasalization is attested, the predicted asymmetry in nasal coarticulation appears to hold (though the evidence is indirect; see McConvell 1988).

Types of NC_1VNC_2 sequences repaired. There is substantial, cross-linguistic evidence that some nasals induce more nasalization than others. For example, it has been well-documented that *coda* nasals induce more nasalization than *onset* nasals (e.g. Schourup 1973, Herbert 1977, Krakow 1993, Jeong 2012). Under a contrast-based analysis of NC effects, we expect for this phonetic asymmetry to lead to a typological one. If a language repairs the sequence NC_1VN_2V, where N–NC_1 is *less* endangered by the lesser degree of nasalization from N_2, then this should imply that it also repairs NC_1VNC_2, where N–NC_1 is *more* endangered by the greater degree of nasalization from N_2. With one exception (Bolia; Mamet 1960), this prediction is borne out (3): repair of NC_1VN_2V *asymmetrically implies* repair of NC_1VNC_2. This generalization would be particularly difficult to account for under an OCP-motivated analysis: it is unclear why repair of NC_1VN_2V (which does not violate the OCP) should imply repair of NC_1VNC_2 (which does).

(3) $*NC_1VN_2$ implies $*NC_1VNC_2$

	$*NC_1VN_2$	✓NC_1VN_2
$*NC_1VNC_2$	34	27
✓NC_1VNC_2	1	*n.a.*

An additional phonetic asymmetry has to do with the role of NC voicing: Beddor (2009) shows that, in many languages, vowels are *more* nasalized before voiceless NCs (NTs) than they are before voiced NCs (NDs). In languages with this asymmetry, the N–NC_1 contrast will be more endangered when preceding NT (where the intervening vowel is *more* nasalized) than when preceding ND (where the intervening vowel is *less* nasalized). Under the contrast-based analysis, this asymmetry leads to a typological prediction: if a language repairs NC_1VND_2, where N–NC_1 is more distinct, it should also repair NC_1VNT_2, where N–NC_1 is less so. While in most languages NC effects occur in both contexts, in Mori Bawah (Blust 2012:367ff) we find an asymmetry in the expected direction: NC_1VNT_2, but not NC_1VND_2, is repaired.

Various implicational generalizations regarding the identity of NC_1 are also predicted. For example, it is universally true that repair of NT_1VNC_2 implies repair of ND_1VNC_2. I argue that this is because internal cues to N–NT are more robust than are internal cues to N–ND (see Kaplan 2008): NT's longer oral closure and louder burst is sufficient to differentiate it from N, even given the presence of a following nasalized vowel. Further evidence that the application of NC effects is inversely correlated with the strength of N–NC's internal cues comes from Ngaju Dayak (Blust 2012: 372ff). While NC_1 nasalization consistently applies when NC_1 is bilabial /mb/ (63/65 possible targets) and alveolar /nd/ (2/2), it applies less consistently when NC_1 is velar /ŋg/ (16/25), and rarely applies when NC_1 is palatal /ndʒ/ (2/13). Velar stops generally have longer VOTs than bilabials and alveolars (Cho & Ladefoged 1999), with affricates having longer VOTs still. Assuming that the longer a stop's VOT, the more distinct it is from N, what Ngaju Dayak shows us is that repair of NC_1VNC_2 becomes more probable as the internal cues to N–NC_1 becomes less robust.

Locality. A contrast-based analysis also makes testable predictions regarding the *locality* of repairs. Under the contrast-based analysis, NC effects are compelled by NC_1's local vocalic context. If something were to intervene between NC_1 and NC_2 to *block* the spread of nasality (i.e. C, in [$NC_1VC\tilde{V}NC_2$]), we would not expect to find NC effects in that context, because they would not be motivated. Thus the contrast-based approach predicts that, if non-local NC effects exist, the set of possible interveners should be the set of segments that nasality can spread through. In most languages, NC effects are *only* transvocalic, so this prediction is vacuously true. In Gurindji (McConvell 1988), however, NC_2 oralization can apply non-locally, but only when the intervening consonants are approximants or glides (e.g. [pa**rnk**u-wu**j**a] 'with another thief'; cf. [ngaji-wu**nyj**a] 'with father'). Building on insights from the typology of nasal spreading (e.g. Walker 2000), I argue that the Gurindji pattern should be seen as a local effect: in hypothetical *[pa**rnk**ũ-w̃ũ**nj**a], nasality would spread through all of the intervening material, and render N–NC_1 insufficiently distinct. Under this interpretation, the NC effects in Gurindji, like in all other cases, are *exclusively local*. An OCP-motivated analysis could not predict this locality generalization: it would have to stipulate it instead.

Summary. This paper shows that a contrast-based analysis of NC effects naturally predicts (i) constraints on possible repairs, (ii) generalizations regarding the types of sequences repaired, and (iii) restrictions on the locality of repairs. The true strength of the analysis is that it provides a unified explanation for a seemingly unrelated set of typological generalizations – a result that existing alternatives do not match.