

### Kinyarwanda Sibilant Harmony and Coronal Opacity

Sibilant harmony in Kinyarwanda is an often cited example in the literature on consonant harmony systems (e.g. Shaw 1991, Gafos 1998, Hansson 2001, Rose & Walker 2004). Previous descriptions of the pattern are based principally on Kimenyi (1979). In this paper we report new data from Kinyarwanda that reveal three previously undiscovered properties of its harmony system. First, our research with native speakers reveals that the regressive assimilating property is retroflexion rather than the alveo-palatal sibilant articulation as previously described. This is illustrated in (1); /-iṛ-e/ marks perfective, /-iiṣ-/ marks causative. In the perfective suffix, /ṛ/ spirantizes or deletes, depending on the context (Mpiranya 1998). Kinyarwanda's coronal and palatal consonant inventory consists of [t d ts tʃ s z ʃ ẓ n ɲ ɽ j].

- (1) a. -sas- 'to make the bed' /sas-iṛ-e/ → saʃe → [ʃaʃe]  
 b. -mes- 'to wash clothes' /mes-iiṣ-/ → [meʃ-iiṣ-]  
 c. cf. no progressive harmony: [-ʃize] 'had ceased'

Second, the retroflex harmony is obligatory in adjacent syllables (as seen in 1), but it is optional in non-adjacent syllables, as shown in (2).

- (2) a. -sákuz- 'to shout' /sákuz-iṛ-e/ → sákuẓe → [ʃákuẓe] ~ [sákuẓe]  
 b. -zímagiz- 'to mislead' /zímagiz-iṛ-e/ → zímagiẓe → [zímagiẓe] ~ [zímagiẓe]

Third, the harmony shows blocking by coronal and palatal consonants except [ɽ], as seen in (3). The optional application of harmony in non-adjacent syllables applies across the retroflex coronal liquid [ɽ], but this segment does not itself trigger harmony, as shown in (4).

- (3) a. -zituz- 'to cause someone to detach' /zituz-iṛ-e/ → [zituẓe] \*[ẓituẓe]  
 b. -súnuuk- 'to give a peek' /sunuuk-iṛ-e/ → [sunuukiẓe] \*[ʃunuukiẓe]  
 c. -zígaj- 'to economize' /zígaj-iṛ-e/ → [zígajiẓe] \*[ẓígajiẓe]  
 (4) a. -séseɽez- 'to offend' /séseɽez-iṛ-e/ → [ʃéseɽeẓe] ~ [séseɽeẓe]  
 b. /-soṛ-/ 'to pay tax' → [soṛ-], \*[ʃoṛ-]

The affricate [ts] does not undergo harmony, e.g. [-ṭsimbaraẓ-] 'to cause to be obstinate'. We attribute this to its stop component. The affricate [tʃ] is absent in triggering contexts.

From a theoretical viewpoint, the opacity in (3) is significant because it bears on a recent debate involving the analysis of "coronal" harmony systems. One approach analyzes coronal harmonies as the result of feature spreading (or gestural extension) that carries among articulatorily adjacent segments. Under this view, the spreading feature actually continues through all segments that intervene between the trigger and target, but its production is inaudible on transparent consonants and vowels (Flemming 1995, Ní Chiosáin & Padgett 1997, Gafos 1998). This is illustrated in (5a). (Ní Chiosáin & Padgett allow the possibility that although feature spreading is strictly local in the phonological representation, learners might not articulate the gesture on segments for which it is inaudible.) A second approach treats coronal harmonies in terms of feature matching in similar segments that stand in correspondence (Hansson 2001, Rose & Walker 2004, note also Clements 2001). That analysis posits that the assimilating feature is absent on intervening segments, as illustrated in (5b). An issue on which the two approaches depart is as follows: feature spreading predicts that certain intervening segments may block coronal harmony, while feature agreement predicts intervening segments will not block. Kinyarwanda's opacity effects diagnose it as a spreading based harmony rather than one involving agreement at a distance. Nevertheless, Kinyarwanda brings novel properties not seen before in coronal harmony patterns.

- (5) a. Feature Spreading Approach                      b. Feature Agreement Approach  
       ʃ a ʃ e                      Perceived: [ʃaʃe]  
       ↓                              ↓                              ↓  
       [retroflex]                      [retro.]                      [retro.]

Coronal harmonies rarely show opacity. Sanskrit retroflex harmony is the only other case of which we are aware. Sanskrit's progressive retroflex harmony affects /n/ across intervening vowels and consonants, but coronals are opaque: e.g. [kʃubh-aṇa] 'quake',

[kʂved-ana] ‘hum’ (Whitney 1889). Many analysts agree that Sanskrit involves local spreading (e.g. Flemming 1995, Ní Chiosáin & Padgett 1997, Gafos 1998, Hansson 2001, Rose & Walker 2004). Nevertheless, Kinyarwanda shows some key differences from Sanskrit. It is noteworthy that retroflexion is contrastive for the opaque coronals in Sanskrit, but not in Kinyarwanda. Also, Sanskrit’s harmony operates from continuants [ʂ, r] to [n], while Kinyarwanda’s harmony only audibly affects fricatives. Kinyarwanda thus contributes two facts of typological importance: (i) it reveals that a coronal harmony which produces audible effects only in sibilants can show opacity (cf. Hansson 2001, Rose & Walker 2004), and (ii) such harmony may be blocked by coronals not contrasting for [retroflex].

In accordance with the feature spreading approach in (5a), we propose that harmony is driven by the constraint in (6). We follow Ní Chiosáin & Padgett (1997) in assuming a feature [retroflex], and the formulation of our spreading constraint builds on their account of Sanskrit. (The choice of SPREAD rather than alternatives such as ALIGN does not figure here.)

(6) SPREAD-L-(retroflex): Any [retroflex] feature contained in a [-sonorant] segment  $S_j$  must also be associated to any segment  $S_i$  that precedes  $S_j$  in the word.

Recall that retroflex sibilants trigger harmony but not [ɽ]. This motivates the restriction to [-sonorant] triggers. We hypothesize that retroflex obstruents alone trigger harmony because of their weaker auditory cues to retroflexion (see, e.g., Kaun 1995 on harmonies triggered by segments with weak auditory cues). In addition to having greater amplitude, the approximant [ɽ] provides auditory cues in its formant structure which are lacking in the turbulent production of a continuant obstruent. In this regard, Kinyarwanda again contrasts with Sanskrit, which is suggested to select triggers in which retroflexion is comparatively salient, namely, in continuants as opposed to stops (Ní Chiosáin & Padgett 1997, Gafos 1998).

Retroflex harmony is mandatory in adjacent syllables but optional in non-adjacent ones. We attribute this to separately ranked spreading constraints referencing different domains. A constraint requiring that [retroflex] spread left in adjacent syllables, SPREAD-L-ADJØ-(retro), consistently dominates IDENT-OI(retro), which penalizes segments that acquire a [retroflex] specification (Pater 1999). This produces obligatory harmony in adjacent syllables. We note that processes limited to adjacent syllables have been observed elsewhere in Bantu (e.g. Rose & Walker 2004). Optional harmony in non-adjacent syllables is achieved by the constraint, SPREAD-L-WD-(retro), which requires that [retroflex] spread left in the word, standing unranked with respect to IDENT-OI(retro) (after Ringen & Heinämäki 1999, among others).

We propose that the opacity of coronals besides [ɽ] is the effect of the constraints, \*Retro-CORSTOP and \*Retro-PAL, which prohibit association of [retroflex] with coronal stops (oral/nasal) and palatals. These constraints dominate the spreading constraints. The incompatibility of retroflexion with palatals is well-established (Gafos 1998, Clements 2001). \*Retro-CORSTOP is motivated by the perceptible effect of retroflexion on coronal stops. Although Kinyarwanda’s alveolar stops do not contrast with a retroflex series, they would be audibly altered if produced as retroflex—an option that Kinyarwanda does not permit. Optional spreading across nonadjacent syllables is illustrated in (7a), and blocking by a coronal stop in (7b). For simplicity, only a single “\*” is shown here in cells for which a constraint is violated.

		*Retro-CORSTOP	SPREAD-L-WD-(retro)	IDENT-OI(retro)
7a. /sákuz-ĩɽ-e/	i. šákuze			*
	ii. sákuze		*	
7b. /zituz-ĩɽ-e/	i. zítuze		*	
	ii. zítuze	*!		*

In sum, Kinyarwanda’s sibilant harmony stands outside classic scenarios. The coronal opacity is noteworthy, because it indicates that blocking by coronals cannot be attributed to contrast alone. In addition, weak retroflex sibilants alone trigger harmony. Consonant harmony may thus be triggered by weak segments, in parallel to certain vowel harmonies.

## References

- Clements, G. N. 2001. Representational economy in constraint-based phonology. In T. A. Hall, ed., *Distinctive Feature Theory*, pp. 71-146. Phonology and Phonetics 2. Berlin: Mouton de Gruyter.
- Flemming, Edward. 1995. Vowels undergo consonant harmony. Paper presented at the Trilateral Phonology Weekend 5, University of California, Berkeley.
- Gafos, Adamantios. 1998. *The Articulatory Basis of Locality in Phonology*. New York: Garland.
- Hansson, Gunnar. 2001. *Theoretical and Typological Issues in Consonant Harmony*. PhD dissertation, University of California, Berkeley.
- Kaun, Abigail. 1995. *The Typology of Rounding Harmony: An Optimality Theoretic Approach*. PhD dissertation, UCLA.
- Kimenyi, Alexandre. 1979. *Studies in Kinyarwanda and Bantu Phonology*. Edmonton, Alberta: Linguistics Research Inc.
- Mpiranya, Fidèle. 1998. *Perspective fonctionnelle en linguistique comparée des langues bantu*. Paris: Klincksieck.
- Ní Chiosáin, Máire & Jaye Padgett. 1997. Markedness, segment realization, and locality in spreading. Report no. LRC-97-01. Linguistics Research Center, University of California, Santa Cruz.
- Pater, Joe. 1999. Austronesian nasal substitution and other NC̥ effects. In R. Kager, H. van der Hulst & W. Zonneveld, eds., *The Prosody-Morphology Interface*, pp. 310-343. Cambridge: Cambridge University Press.
- Ringen, Catherine & Orvokki Heinämäki. 1999. Variation in Finnish vowel harmony: An OT account. *Natural Language and Linguistic Theory* 17, 303-337.
- Rose, Sharon & Rachel Walker. 2004. A typology of consonant agreement as correspondence. *Language* 80, 475-531.
- Shaw, Patricia. 1991. Consonant harmony systems: The special status of coronal harmony. In C. Paradis & J.-F. Prunet, eds., *Phonetics and Phonology, Volume 2, The Special Status of Coronals: Internal and External Evidence*, pp. 125-157. San Diego: Academic Press.
- Whitney, William. 1889. *Sanskrit Grammar*. London: Oxford University Press.