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Optionality in sibilant harmony: Experimental evidence from Kirundi

Cross-linguistic surveys of patterns of consonant harmony have revealed a high incidence of optionality in language-particular systems (Hansson 2001). For example, the application of sibilant harmony can be obligatory across a vowel and optional at a longer distance (e.g. Sarcee), obligatory within roots and optional across root-affix boundaries or in compounds (e.g. Zayse), or obligatory in some lexical items/morphemes and optional in others (e.g. Slave). This high rate of optionality reflects a greater instability of consonant harmony systems, as opposed to other long-distance interactions, such as vowel harmony and dissimilation. It also points to a different mechanism for the former – *agreement by correspondence* (*ABC*: Hansson 2001; Rose & Walker 2004), functionally grounded in the error-prone processing of highly similar phonological categories. The different kinds of optionality pose a problem for formal analyses of consonant harmony systems, regardless of the approach taken (agreement or spreading). Yet hardly any studies have directly investigated optionality in language-particular consonant harmony systems.

In this paper we examine Kirundi (Bantu), a language with a highly restricted and optional sibilant harmony. The process is described as being triggered by stem-final [ʃ] and [ʤ] ([+ant]; outputs of s+j and z+j palatalization) and regressively targeting stem-initial/medial /s/ and /z/ ([-ant]) (1a). Sources disagree on whether the process is limited to adjacent syllables (Rodegem 1970; Mpiranya & Walker 2006), or applies at a greater distance (Ntihirageza 1993) (1b). Most are also inexplicit about optionality of the process (but see Meeussen 1959). All researchers, however, note that harmony fails to be triggered by non-derived [ʃ] of the causative suffix /-iiʃ/ (1c), in contrast to the closely related language Kinyarwanda (Mpiranya & Walker 2006).

To investigate the extent of optionality and the factors that influence it, we conducted 2 experiments with 8 native speakers of Kirundi. In the production experiment (I), participants produced a derived verb form from an infinitive (e.g. *gusaaje/gushaaje* 'he is old' given *gusaaza* 'to get old'). In the identification experiment (II), they selected the form they would normally use given the choice of 2 (e.g. *gusaaje* or *gushaaje*), and were asked to comment on the use of the other form. Responses were used to calculate within- and across-speaker rates of harmony (based on experiments I & II, max 1.00) and 'non-harmony' (experiment II only, min -1.00).

The results revealed a wide range of optionality in both tasks and for all the speakers. However, this optionality was distributed unevenly across lexical items and phonological or morphological contexts (2). Specifically, in the production test some items were consistently harmonized (a rate of 1.00); others consistently resisted harmony (0.00); yet the others showed intermediate, speaker-specific behavior. Harmony tended to apply (often categorically) in adjacent syllables and tended to fail at longer distances. The sporadic harmony application in the latter case involved intervening consonants, including coronals. Unexpectedly, there were cases of harmony triggered by the causative suffix. The results of the identification test confirmed and provided further evidence for optionality of harmony. Sibilant place differences ([±ant]) were further verified by measurements of spectral center of gravity (COG, Hz).

In sum, the results demonstrate that sibilant harmony in Kirundi is to a large degree optional, but strongly influenced by phonological proximity, lexical specificity, and morphological complexity. This suggests that variable rankings of constraints (as adopted to account for Kinyarwanda harmony: Mpiranya & Walker 2006) are not sufficient to capture the optionality in the current data, and have to be supplemented with lexically-indexed constraints – both IO faithfulness (cf. Coetzee & Pater, 2006) and C↔C Correspondence.

(1)	a.	/ku-saaz-a /	[gusaaza]	‘to get old’
		/a-a-ra-**s**aa**z**-**j**e/	[jara**s**aa**ʤ**e] → [jara**ʃ**aa**ʤ**e]	‘s/he is old’
			[+ant]…[-ant] → [-ant]…[-ant]	
	b.	/ku-suhuz-a/	[gusuhuza]	‘to visit a patient’
		/a-a-ra-**s**uhu**z**-**j**e/	[jara**s**uhu**ʤ**e] or [jara**ʃ**uhu**ʤ**e]?	‘s/he visited a patient’
	c.	/ku-sas-a/	[gusasa]	‘to make bed’
		/a-a-ra-sa**s**-ii**ʃ**-je/	[jarasa**s**ii**ʃ**i**ʤ**e] (*[jarasa**ʃ**ii**ʃ**i**ʤ**e])	‘s/he had bed made’

(2) Selected results for production and identification rates, 8 speakers (males M1-M4 and females F1-F4); 1 = harmony, 0 = no harmony; vowel length and tone are omitted.

Type	**Change**	**Production**									**Ident. rate**	
		M1	**M2**	**M3**	**F1**	**M4**	**F2**	**F3**	**F4**	**Mean**	**H.**	**Non-H.**
C_1VC_2	saʤ → ʃaʤ	1	1	1	1	1	1	1	1	*1.00*	*1.00*	*-0.07*
	soʤ → ʃoʤ	1	1	1	1	1	1	1	1	*1.00*	*1.00*	*-0.13*
	uzuʤ → uʤuʤ	1	1	1	1	1	1	1	1	*1.00*	*0.88*	*-0.13*
	saʃ → ʃaʃ	1	1	1	1	1	1	1	0	*0.88*	*0.88*	*-0.13*
	seʃ → ʃeʃ	1	1	0	1	0	1	1	0	*0.63*	*0.94*	*-0.25*
	siʤ → ʃiʤ	1	0	0	0	0	0	0	0	*0.13*	*0.50*	*-0.56*
C_1VCVC_2	uzuriʤ → uʤuriʤ	1	1	1	1	1	1	0	1	*0.88*	*0.63*	*-0.75*
	sakaʤ → ʃakaʤ	0	1	0	0	0	0	1	0	*0.25*	*0.33*	*-0.86*
	samuʤ → ʃamuʤ	0	0	1	0	1	0	0	0	*0.25*	*0.00*	*-1.00*
	sokoʤ → ʃokoʤ	0	0	0	1	0	0	0	0	*0.13*	*0.25*	*-0.94*
	sotoʤ → ʃotoʤ	0	0	0	0	0	0	0	0	*0.00*	*0.25*	*-1.00*
	suhuʤ → ʃuhuʤ	0	0	0	0	0	0	0	0	*0.00*	*0.13*	*-0.94*
CVC_1-VC_2	son-iʃ → ʃoneʃ	0	1	1	0	1	1	1	0	*0.63*	*0.81*	*-0.50*
	ses-iʃ → seʃeʃ	1	0	0	0	0	0	0	0	*0.13*	*0.44*	*-0.75*
	sas-iʃ → saʃiʃ	0	0	0	0	0	0	0	0	*0.00*	*0.43*	*-0.63*
	som-iʃ → ʃomeʃ	0	0	0	0	0	0	0	0	*0.00*	*0.00*	*-1.00*

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