Directionality in Nkore-Kiga sibilant harmony: arbitrary or emergent?

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1. Introduction

1.1. Overview and the question

(1) The focus of this talk is sibilant harmony in Nkore-Kiga (henceforth just ‘Kiga’), a Bantu language spoken primarily in Uganda.

(2) Previous work on Kiga reports three generalizations (Hyman 2003, Hansson 2001/2010).

**Kiga generalizations:**

(3) **Gnztn #1:** Anteriority in sibilants is normally *allophonic*, conditioned by the following vowel

a. [+anterior] { s z } before [i]

b. [–anterior] {ʃ ʒ } elsewhere

(4) **Gnztn #2:** *Harmony* within the stem makes sibilants deviate from the normal allophonic pattern (*{ʃ ʒ }...{s z}, and *{s z}...{ʃ ʒ }*)

(5) **Gnztn #3:** Harmony operates strictly *right-to-left*
The rightmost sibilant in the stem is conditioned in the normal way, and other, preceding, sibilants assimilate to match it.

(6) Taken together, these generalizations yield a pattern of consonant harmony that defies explanation in Agreement By Correspondence (Walker 2000a, 2000b; 2001, Hansson 2001/2010; Rose & Walker 2004).

a. Sibilant allophony determines the result of agreement

b. But, agreement otherwise overrides allophonic conditioning

(7) **The Question:** if sibilants are allophonic in the first place, how can harmony always prefer a strictly Right-to-Left directionality?

*Acknowledgements: We want to thank Dr. Connie Tukwasibwe, Blake Allen, and Gunnar Hansson for assistance in obtaining and processing Kiga data, and organisers and participants at the 3rd African Linguistics School in Ibadan, where the problem addressed in this talk came to our attention.*
1.2. Context: Directionality in ABC

(8) Previous approaches to directionality of harmony in ABC:
   a. Build directionality into the Correspondence Relation and/or the CORR constraints (Hansson 2001/2010; Walker 2000b, 2001)
   b. Build directionality into the CC·IDENT constraints that drive agreement (Rose & Walker 2004)
   c. Appeal to other factors, like positional faithfulness (Bennett 2013; see also Hansson 2010)

(9) None of these turn out to handle the Kiɡa pattern correctly.
   a. The core issue is the direction of assimilation
   b. Building directionality into the basic ABC mechanism can’t control the direction of assimilation - it only restricts when harmony is enforced
   c. Positional faithfulness doesn’t work if the sibilant controlling harmony isn’t faithful (i.e. is allophonically determined)

1.3. Goals and structure of this talk

Aims of this talk:

(10) Explicate the problem Kiɡa poses for an ABC theory that doesn’t take directionality as primitive and parametrically determinable

(11) Demonstrate that the problem actually isn’t well supported by the facts
   a. Distribution of \{ s z \} ~ \{ʃʒ \} is not straightforwardly allophonic
   b. But it is heavily affected by morphology

(12) Proposal: the directionality isn’t arbitrary; it follows at least in part from morphologically-introduced asymmetries

(13) Broader conclusion: this is an interesting problem, but one we don’t yet need to adjust the core of the theory to solve

Road map:

(14) §2 explores the problem in more detail, and shows how it isn’t explained by extant proposals

(15) §3 explores the data in more depth, and shows that sibilants aren’t really allophonic. This puts a much different spin on the problem.

(16) §4 considers the effects of morphology, which handle one crucial case

(17) §5 summarizes and points out the broader consequence: the Kiɡa case doesn’t require an ABC theory to refer to directionality specifically
2. The Kiga Puzzle

2.1. Kiga in a little more detail

(18) Nkore-Kiga is actually a family of closely related dialects spoken primarily in Uganda, classified as E.13-14, in the Inter-lacustrine group.

(19) We follow Taylor’s (1985) convention of referring to Runankore and Rukiga together as Nkore-Kiga, and the generalisations & data reported in previous work generally aren’t attributed more specifically within this group.

(20) The phonemic consonant inventory of Kiga (after Taylor 1985):¹

<table>
<thead>
<tr>
<th>Labial</th>
<th>Dental</th>
<th>Post-alveolar</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>p b t d tj dʒ k ɡ</td>
<td>f v s z j ʒ k</td>
<td>m n n j</td>
<td>w j ɹ</td>
<td>h</td>
</tr>
</tbody>
</table>

(21) Sibilants don’t occur before consonants; the only possible consonant clusters are NC[w,j] in form. [w] and [j] seem to pattern like [u] and [i], respectively.²

(22) Previous work (Hyman 2003, Hansson 2001/2010) reports that the anteriority of sibilants is conditioned by the following vowel, in a “backwards” fashion:

a. [+anterior] sibilants [s z] occur before [i]

b. [-anterior] sibilants occur before all other vowels

(23) Allophonic sibilant distribution

\[
\begin{align*}
\text{si zi} & \quad \text{fu ʒu} \\
\text{ʃe ʒe} & \quad \text{ʃo ʒo} \\
\text{ʃa ʒa} &
\end{align*}
\]

(24) This distribution is unusual (cf. Japanese, Nupe, Kikongo, etc.; /s/ → [ʃ]/_i). That isn’t relevant for the directionality issue in harmony, though.

¹ Taylor analyzes [tʃ] and [dʒ] as palatalization of /k ɡ/ before high vowels, and [d] as an allophone of /r/ after /n/. Taylor doesn’t give /ts/ as a segment in his inventory, nor does Poletto (1998), but it’s attested in examples given by both.

² Taylor (1985:205, 210) mentions that vowel reduction in normal speech can yield ‘quasigeminated’ [ʃ], and [ʃt] clusters, but we don’t consider these here.
(25) Representative examples:

\[ s \sim \ddash \]

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>kù-sìn-à</td>
<td>‘scold’</td>
<td>[i]</td>
</tr>
<tr>
<td>b.</td>
<td>kù-jëk-à</td>
<td>‘laugh’</td>
<td>[e]</td>
</tr>
<tr>
<td>c.</td>
<td>kù-fàmb-à</td>
<td>‘kick’</td>
<td>[a]</td>
</tr>
<tr>
<td>d.</td>
<td>kù-jòm-à</td>
<td>‘read’</td>
<td>[o]</td>
</tr>
<tr>
<td>e.</td>
<td>kù-fùng-à</td>
<td>‘flatter’</td>
<td>[u]</td>
</tr>
</tbody>
</table>

(26) Within the stem (root + suffixes), sibilants agree in anteriority.³

a. In some cases this harmony is trivial, since agreement is expected from the allophony anyway pattern (27).

b. In others, sibilant harmony overrides the expected allophony (28).

(27) Simple distributional harmony examples:

\[ [ s, z ] \]

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>òbù-sìsì</td>
<td>‘sin(s), evil’</td>
<td>ètʃi-zìzì</td>
</tr>
<tr>
<td>b.</td>
<td>ñe-ʃë</td>
<td>‘dysentery’</td>
<td>kù-zëŋg-àkì</td>
</tr>
<tr>
<td>c.</td>
<td>òmù-fà</td>
<td>‘(African) long hair’</td>
<td>kù-záàb-à</td>
</tr>
<tr>
<td>d.</td>
<td>kù-fòjòr-à</td>
<td>‘pull out’</td>
<td>èn-zòʒò</td>
</tr>
<tr>
<td>e.</td>
<td>kù-fùf-à</td>
<td>‘seem, look’</td>
<td>èbì-zùʒ</td>
</tr>
</tbody>
</table>

(28) Sibilant harmony overrides allophonic distribution

<table>
<thead>
<tr>
<th>Expected by allophony</th>
<th>Attested (R-L harm.)</th>
<th>Unattested (L-R harm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. *-sìja</td>
<td>-jìjà</td>
<td>*-_sisa</td>
</tr>
<tr>
<td>b. *-síja</td>
<td>-jìjà</td>
<td>*-_siisa</td>
</tr>
<tr>
<td>c. *-_siìja</td>
<td>-jìrizà</td>
<td>*-_siiza</td>
</tr>
<tr>
<td>d. *-_síswa</td>
<td>-jìzwà</td>
<td>*-_síswa</td>
</tr>
<tr>
<td>e. *-_jaasire</td>
<td>-sààsirë</td>
<td>*-_jaasire</td>
</tr>
<tr>
<td>f. *-_jasi</td>
<td>-sàsì</td>
<td>*-_jási</td>
</tr>
<tr>
<td>g. *-_jasi</td>
<td>-sási</td>
<td>*-_jázi</td>
</tr>
<tr>
<td>h. *-_jaazi</td>
<td>-sàażì</td>
<td>*-_jaażi</td>
</tr>
</tbody>
</table>

³ Harmony doesn’t extend across the stem boundary into prefixes: [z-a-(ʃà)] ‘they (cl.10) have arrived’ (Taylor 1985:122; tones not given). This bounding parallels sibilant harmony in other Bantu languages, such as Kinyarwanda (Kiményi 1979, Mpiranya & Walker 2005, Bennett 2013), and can be handled in the same way.
(29) On the basis of the allophony pattern, we would expect forms in (28) to have disagreeing sibilants - but they don’t.

(30) Harmony in these cases is crucially resolved in a Right-to-Left way:
   a. The rightmost sibilant follows the allophony - its quality is predictable from the following vowel
   b. Preceding sibilants deviate from the allophony in order to agree with the rightmost one - they aren’t predictable from the following vowel

(31) **Point:** The rightmost sibilant seems to be controlling the agreement, irrespective of its quality (which is determined based on the following V).

**2.2. The problem, illustrated**

(32) The combination of allophonic conditioning and strict directionality makes the Kiga pattern problematic for theories like ABC, where harmony is driven by an imperative to have agreement.⁴

<table>
<thead>
<tr>
<th>Key Constraints</th>
<th>(Definitions adapted from Bennett 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CORR·[+sibilant]:</strong> ‘Sibilants correspond with each other’</td>
<td></td>
</tr>
<tr>
<td>For each distinct pair of output consonants X and Y, assign a violation if:</td>
<td></td>
</tr>
<tr>
<td>i. X and Y are both [+sibilant]</td>
<td></td>
</tr>
<tr>
<td>ii. X and Y are not in the same surface correspondence class</td>
<td></td>
</tr>
<tr>
<td><strong>CC· IDENT-[anterior]:</strong> ‘Correspondents agree for anteriority’</td>
<td></td>
</tr>
<tr>
<td>For each distinct pair of output consonants X and Y, assign a violation if:</td>
<td></td>
</tr>
<tr>
<td>i. X and Y are in the same surface correspondence class</td>
<td></td>
</tr>
<tr>
<td>ii. X is [+anterior]</td>
<td></td>
</tr>
<tr>
<td>iii. Y is [-anterior]</td>
<td></td>
</tr>
<tr>
<td><strong>ʃi:</strong> ‘no [ʃi] or [ʒi] sequences’</td>
<td></td>
</tr>
<tr>
<td>One violation for each [-anterior] sibilant followed by [i] in the output.</td>
<td></td>
</tr>
<tr>
<td><strong>s:</strong> ‘no [s] or [z]’</td>
<td></td>
</tr>
<tr>
<td>One violation for each [+anterior] sibilant in the output.⁵</td>
<td></td>
</tr>
</tbody>
</table>

(37) The basic allophonic distribution requires ʃi to dominate *s (and both must dominate faithfulness for anteriority too)

<table>
<thead>
<tr>
<th></th>
<th>ʃi</th>
<th>s</th>
<th>IDENT-[ant]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>/ʃi/ → si ~ ʃi</td>
<td>W (0~1)</td>
<td>L (1~0)</td>
</tr>
<tr>
<td>b.</td>
<td>/sa/ → ʃa ~ sa</td>
<td>W (0~1)</td>
<td>L (1~0)</td>
</tr>
</tbody>
</table>

⁴ This issue generalizes to other agreement-based harmony theories besides ABC (Pulleyblank 2002, e.g.), but we will consider only ABC here.

⁵ These specific definitions of the allophony constraints are not essential to the problem. For example, instead of ʃi →*s, we could have *sa,se,so,su → ʃ, and the puzzle arises in the same way.
(38) In order for harmony to force sibilants to deviate from the usual allophonic pattern, the Corr and CC·Ident constraints that drive harmony must dominate (some of) the constraints responsible for the allophony.

(39) But, ranking Corr·[+sibilant] and CC·Ident·[anterior] over *ʃi and *s can’t produce strictly directional harmony.

(40) *ʃi favors right-to-left harmony in inputs ending in /...Si/:*

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. s₁as₁i</td>
<td>SCorr.R: {s s}</td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(2)</td>
<td>R-to-L harm</td>
</tr>
<tr>
<td>b. j₁a₁i</td>
<td>SCorr.R: {ʃʃ}</td>
<td>W (0~1!)</td>
<td>L (2~0)</td>
<td>corr, no harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. j₁as₁i</td>
<td>SCorr.R: {ʃ s}</td>
<td>W (0~1!)</td>
<td>L (2~1)</td>
<td>no corr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. j₁as₁i</td>
<td>SCorr.R: {ʃ}</td>
<td>W (0~1!)</td>
<td>L (2~1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(41) But *ʃi doesn’t* favor right-to-left harmony in inputs ending in /...Sa/:*

<table>
<thead>
<tr>
<th>Input: /-ʃ[a]/</th>
<th>Exp: [-ʃ[a]]</th>
<th>Corr·[+sibilant]</th>
<th>CC·Ident·[anterior]</th>
<th>*ʃi</th>
<th>*s</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. s₁s₁a</td>
<td>SCorr.R: {s s}</td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(2)</td>
<td>L-to-R harm</td>
</tr>
<tr>
<td>b. j₁ʃ[a]</td>
<td>SCorr.R: {ʃʃ}</td>
<td>W (0~1!)</td>
<td>L (2~0)</td>
<td>R-to-L harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. s₁ʃ[a]</td>
<td>SCorr.R: {ʃ}</td>
<td>W (0~1!)</td>
<td>L (2~1)</td>
<td>corr, no harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. s₁ʃ[a]</td>
<td>SCorr.R: {ʃ}</td>
<td>W (0~1!)</td>
<td>L (2~1)</td>
<td>no corr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(42) What’s going on here:

a. **Candidates (c) & (d) are disharmonic:** they either don’t have correspondence between sibilants (d), or have correspondents that disagree (c); they’re ruled out by the harmony constraints.

b. **Candidates (a) & (b) do harmony:** the sibilants correspond and agree. The difference between (a) and (b) is the result of agreement: either [s...s], or [ʃ...ʃ].

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* The tableauxs here, and most others later, use a hybrid comparative format. Winning candidates are given in row (a), and other rows represent comparisons between that winner and an alternative, losing, candidate. Integers in parentheses show the constraint violations incurred by the winner, and how they compare to violations incurred by the losing alternative. Losers that match the data are marked with ‘☹’. ‘W’, ‘L’, and ‘e’ indicate a constraint’s preference for the Winner or the Loser, or neither (Prince 2002). To reduce visual clutter, e values are suppressed when both candidates have zero violations; blank cells indicate ‘e (0~0)’.
c. The harmony constraints are satisfied equally well by both ways of doing agreement; they only rule out (c) & (d)7

d. If the choice between [s...s] and [ʃ...] gets passed down to *ʃi, it favors the harmonic candidate with fewer [ʃi] sequences (which is (a), [s...s])

(43) This is value-dominant harmony, not directional harmony:

   a. The choice between the agreeing candidates is being made based on the anteriority value of the output
   b. As long as there’s a [+anterior] sibilant, agreement will converge on it

(44) **Point:** if *ʃi is what makes the decision, then the directionality of harmony will change to suit the preferred form of agreement (to avoid [ʃi]) – and that isn’t the right generalization.

## 2.3. There’s no simple fix

(45) We know of no straightforward way to get a strictly directional pattern to fall out from this kind of system without radical changes to the constraints

(46) **Option 1:** Hansson (2001/2010) uses targeted constraints (Wilson 2001)

   a. ~CC·IDENT-[anterior] favors agreement only if it’s attained by changing the segment on the left to match the one on the right in anteriority
   b. Targeted constraints like this necessarily do not assign countable violations
   c. This analysis also requires other markedness constraints that interact with harmony (i.e. *ʃi) to be targeted constraints as well

(47) **Option 2a:** Rose & Walker (2004) build directionality into CC·IDENT:

   a. Left-to-Right CᵢCᵢ·IDENT-[+F] penalizes [+F...–F]
   b. Right-to-Left CᵢCᵢ·IDENT-[+F] penalizes [–F...+F]

(48) **Option 2b:** Other work (Walker 2000b, 2001; Hansson 2001/2010) builds directionality into the correspondence relation instead, and has it percolate through to the agreement constraints, but the result seems to be the same.8

(49) These directional constraints can restrict where harmony applies, but they can’t impart directional control of the sort we seem to need for Kiga

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7 We aren’t the first to point this kind of indeterminacy out; see Hansson (2001:341).
8 NB: in order to make a meaningful directionality distinction, these agreement constraints need to be value-specific. Rose & Walker did this using a privative feature rather than a binary one like I’m doing, but this is just a notational variance.
A directional reformulation of CC\textsuperscript{IDENT-[anterior]}:
\textbf{CR\textsubscript{L}C\textsubscript{R}C\textsubscript{L}\textsuperscript{IDENT-[+anterior]}:} ‘Preceding correspondents agree for [+anterior]’
For each distinct pair of output consonants X and Y, assign a violation if:
\begin{enumerate}
\item X and Y are in the same surface correspondence class
\item Y precedes X
\item X is [+anterior]
\item Y is [-anterior]
\end{enumerate}

Replacing CC\textsuperscript{IDENT-[anterior]} with designatedly Right-to-Left CR\textsubscript{R}CR\textsubscript{L}\textsuperscript{IDENT constraints doesn’t solve the problem.

\textbf{CR\textsubscript{R}CR\textsubscript{L}\textsuperscript{IDENT constraints are still satisfied by both agreement candidates:}

<table>
<thead>
<tr>
<th>Input: /-si\textsubscript{ʃ}a/</th>
<th>Exp: [-ʃiʃa]</th>
<th>Corr: \textsuperscript{[+sib]}</th>
<th>CR\textsubscript{R}CR\textsubscript{L}\textsuperscript{IDENT-[–ant]}</th>
<th>CR\textsubscript{R}CR\textsubscript{L}\textsuperscript{IDENT-[+ant]}</th>
<th>*ʃi</th>
<th>*s</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. s\textsubscript{1}is\textsubscript{1}a</td>
<td>SCorr\textsuperscript{R}:{s s}</td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(2)</td>
<td>L-to-R harm</td>
<td></td>
</tr>
<tr>
<td>b. j\textsubscript{1}ʃ\textsubscript{1}a</td>
<td>SCorr\textsuperscript{R}:{ʃʃ}</td>
<td></td>
<td></td>
<td></td>
<td>W</td>
<td>(0~1!)</td>
<td>L</td>
</tr>
<tr>
<td>c. j\textsubscript{1}is\textsubscript{1}a</td>
<td>SCorr\textsuperscript{R}:{ʃs}</td>
<td></td>
<td>W</td>
<td>(0~1! - [+ant])</td>
<td>W</td>
<td>(0~1)</td>
<td>L</td>
</tr>
<tr>
<td>d. j\textsubscript{1}is\textsubscript{2}a</td>
<td>SCorr\textsuperscript{R}:{ʃs}</td>
<td></td>
<td>W</td>
<td>(0~1!)</td>
<td>W</td>
<td>(0~1)</td>
<td>L</td>
</tr>
</tbody>
</table>

\textbf{Option 3:} Bennett (2013) proposes a positional faithfulness constraint, CC\textsuperscript{ANCHOR-R}, that protects the rightmost correspondent in a class.

\textbf{CC\textsuperscript{ANCHOR-R-[anterior]}:} ‘if a C is rightmost among its SCorr class, it is faithful for anteriority’
For each distinct pair of output consonants X and Y, assign a violation if:
\begin{enumerate}
\item X and Y are in the same surface correspondence class
\item X precedes Y
\item There is no other Z that corresponds with Y and is preceded by Y
\item The [+anterior] value of Y differs from the [+anterior] value of its input correspondent Y
\end{enumerate}
In contexts where the rightmost sibilant is unfaithful, and still controls harmony, this explanation simply doesn’t get the desired result:

<table>
<thead>
<tr>
<th>Input: /-sisa/ Exp: [ʃiʃa]</th>
<th>CC·ANCHOR-R</th>
<th>CORR· [+sib]</th>
<th>CC·IDENT-[ant]</th>
<th>*ʃ</th>
<th>*s</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. s₁is₁a SCorr R:{s s}</td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(2)</td>
<td>L-to-R harm</td>
</tr>
<tr>
<td>b. j₁ʃ₁a SCorr R:{ʃʃ}</td>
<td>W</td>
<td></td>
<td></td>
<td>W</td>
<td>L</td>
<td>R-to-L harm</td>
</tr>
<tr>
<td>c. s₁ʃ₁a SCorr R:{ʃʃ}</td>
<td>W</td>
<td></td>
<td></td>
<td>W</td>
<td>L</td>
<td>corr, no harm</td>
</tr>
<tr>
<td>d. s₁ʃ₂a SCorr R:{ʃʃ}</td>
<td>W</td>
<td></td>
<td></td>
<td>W</td>
<td>L</td>
<td>no corr</td>
</tr>
</tbody>
</table>

2.4. Section recap

The harmony pattern reported in Kiga has a strict directionality that seems to be totally arbitrary.

a. The rightmost sibilant needs to be allophonically conditioned, yet still control harmony

b. This doesn’t emerge from a basic ABC analysis: the two agreement possibilities [s...s] and [ʃ...ʃ] tie on the harmony constraints

c. Using direction-specific harmony constraints doesn’t break the tie (in order to disambiguate, the harmony constraints would need to penalize agreement)

d. Letting general markedness constraints break the tie leads to value-dominant harmony, with flexible (not fixed) directionality

e. Having faithfulness break the tie doesn’t work in all cases, because sometimes we need the controlling sibilant to be unfaithful

How do we solve this problem? Two possibilities:

a. The agreement-based approach of ABC is fundamentally wrong, and we should abandon it for a more process-based theory (cf. Nevins 2004)

or:

b. The facts of Kiga are wrong. (We’re going to argue it’s this one.)
3. Re-evaluating the data: a problem that isn’t

3.1. The empirical basis for allophony

(58) Earlier descriptions of the Nkore-Kiga sibilant patterns come from Hyman (2003) and Hansson (2001), and the original source data comes from a dictionary and grammar by Taylor (1959, 1985)\(^9\)

(59) A search of Taylor’s grammar turns up numerous examples that undermine the notion that sibilants in Nkore-Kiga have an allophonic distribution.

(60) Some minimal and near-minimal pairs: (Taylor 1959, 1985)

a. kw-àsà ‘chop’
b. kw-àfà ‘strike (of lightning)’
c. kw-ízà ‘ease, darken’
d. kw-íʒà ‘come’
e. kù-ʃǐjà ‘spoil, do wrong, sin’
f. kù-sísà ‘ask for meat’
g. kù-sòmà ‘do a stamping dance’
h. kù-fɔmà ‘read, attend church’
i. òmù-ziŋà ‘swarm, bee-hive’
j. òmù-zǐnjà ‘ambition’
k. kù-zɛŋgà ‘wander, be dying’
l. kù-zɛŋgà ‘become sodden’
m. òrù-sà ‘permission’
n. (ò)bù-fà ‘in vain’
o. òrú-sjà ‘new’

(61) While some examples do show [s]~[ʃ] alternations, there are a number of other morphemes which systematically fail to do so:

a. -gàʃ-à ~ -gàs-ìrè ‘useful’/‘useful (perf.)’
b. -báàs-à ~ -báàs-ìk-à ‘able to’/‘possible’
   (-gaj- ~ -gas-, but not *-baaj- ~ -baas-)

---

\(^9\) Poletto’s (1998) Ph.D. dissertation explores the phonology of Runyankore in detail, but makes no mention of sibilant harmony or the allophony.
c. (è)zàndʒè  ‘its (cl.10, poss. cl.9)’

d. èzò  ‘that (cl.10)’

e. èzì  ‘this (cl.10)’

(class 10 prefix invariably has [z], never *[ʒ])

f. -r-ìs-à  ‘pasture; cause to eat’

g. -r-iis-ibw-a  ‘cause to be eaten’

(‘long’ causative suffix invariably has [s])

(62) Both Hyman (2003) and Hansson (2010) note that [s] may occur before vowels other than [i] as the result of a covert ‘short’ causative suffix -j-

a. The [sa] from /s-j-a/ analysis is possible – if unintuitive – for some forms, like [òrù-sà] ‘permission’ (maybe from /-jà/ ‘in vain’?).

b. But a covert causative /-j-/ analysis doesn’t work in most cases:

i. Non-root-final [s], as in [kù-sòòmà] ‘do a stamping dance’

ii. Invariable class 10 [z] in [èzò] and [èzì], which are demonstratives

iii. The ‘long’ causative /-iis-/ would need to be treated as a double causative in all cases

(63) Observed/Expected ratios calculated from Taylor’s (1959) dictionary

a. 11 654 stems (non-lemmatized), digitized by CBOLD

b. An O/E value of 1.0 means a combination occurs as often as expected from the individual frequencies of each sound

c. O/E values less than 1 mean a combination is under-represented; greater than 1 means it’s over-represented

(64) O/E ratios for sibilant-vowel combinations in stems:

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>e</th>
<th>a</th>
<th>o</th>
<th>u</th>
<th>j</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>0.9</td>
<td>0.3</td>
<td>1.6</td>
<td>1.0</td>
<td>0.1</td>
<td>1.9</td>
</tr>
<tr>
<td>z</td>
<td>1.1</td>
<td>0.2</td>
<td>1.4</td>
<td>1.1</td>
<td>0.0</td>
<td>0.7</td>
</tr>
<tr>
<td>ŋ</td>
<td>0.1</td>
<td>1.6</td>
<td>1.5</td>
<td>1.8</td>
<td>3.4</td>
<td>0.0</td>
</tr>
<tr>
<td>ṭs</td>
<td>0.0</td>
<td>0.7</td>
<td>1.3</td>
<td>2.6</td>
<td>6.4</td>
<td>0.0</td>
</tr>
<tr>
<td>ŋ̕</td>
<td>0.0</td>
<td>0.7</td>
<td>1.3</td>
<td>2.6</td>
<td>6.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

≥1.5 and ≤0.5 in boldface; ≤0.5 also shaded

10 More on this in §4

11 It doesn’t explain why there seems to be a three-way [s]-[ʃ]-[ʃ] contrast, though.
(65) Key points from this data:
  a. [s] is attested before all the vowels, and so is [ʃ]
  b. {s z} are under-represented before [e] and [u], but not [a] or [o]
  c. {ʃ ʒ} are strongly under-represented before [i] (but [ʃi] sequences are still attested, and [ʒ] is also slightly under-represented before [e])

(66) This isn’t indicative of systematic and active allophony
  a. The ban on *ʃ and *ʒ before [i] (and [j]) seems clearly supported
  b. The ban on *s and *z before all other vowels isn’t supported
  c. This looks much more like neutralization of /ʃi/ to [si] rather than the full two-way neutralization of an allophonic pattern

3.2. Lack of allophony changes the problem

(67) If the basic distribution of [s]~[ʃ] and [z]~[ʒ] isn’t allophonic, then it doesn’t set up the arbitrary directionality problem in the same way.

(68) To illustrate this, consider an system like the one reported for Kiga, but with one-way neutralization instead of two-way allophony:
  a. /ʃi/ and /si/ neutralize to [si]
  b. /sa/ and /ʃa/ surface faithfully (no neutralization for /s z/)

(69) If there is neutralization of this sort, then some sub-cases of agreement can be explained without harmony being direction-specific

(70) Consider a hypothetical input /-səʃi/ (cf. -ʃààʃa/-sààsìrè ‘be in pain (perf.)’): here, right-to-left agreement falls out just from neutralization:

<table>
<thead>
<tr>
<th>Input: /-saʃi/</th>
<th>Output: [-sasi]</th>
<th>CORR[+sibilant]</th>
<th>*ʃi</th>
<th>IDENT[-[ant]]</th>
<th>*s</th>
</tr>
</thead>
<tbody>
<tr>
<td>rιa.</td>
<td>s,aʃ1,1</td>
<td>(0)</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>b.</td>
<td>ʃ1aʃ1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>s,aʃ1,1</td>
<td>W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>s,aʃ1,1</td>
<td>W</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

UC Berkeley Phonology Lab Annual Report: ABC↔Conference
(71) The same is true for inputs like /-ʃisa/: neutralization yields agreement, even if the harmony constraints don’t play a role

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Image of table" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(72) **Point:** if it’s neutralization instead of allophony, then some of the mappings required to have agreement fall out for free

(73) We can further restrict the problem by considering CC·ANCHOR-R: in cases where the rightmost sibilant is faithful, right-to-left harmony can be handled by this constraint

<table>
<thead>
<tr>
<th>Input: /-ʃ[i]a/</th>
<th>Output: [-ʃi]a</th>
<th>CORR-[+sibilant]</th>
<th>CC·ANCHOR-R</th>
<th>*ʃi</th>
<th>IDENT-[ant]</th>
<th>*s</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Image of table" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(74) There are **16 possibilities** for inputs with two sibilants, for all permutations of [-anterior] and [+anterior] on each, followed either by [i] (the neutralisation context) or [a] (representing non-neutralising contexts).

(75) In **15** of these 16 cases, agreement that respects the rightmost sibilant’s behaviour falls out from basic faithfulness and neutralization, and/or from faithful protection of the rightmost correspondent.
Inputs and explanatory coverage:

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>Agreement follows from $/ʃ/ \rightarrow [s]$ neutralisation</th>
<th>R to L harmony follows from rightmost faithfulness (CC·ANCHOR-R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $ʃʃ$</td>
<td>sisi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>b. $ʃʃ$</td>
<td>$ʃʃ$</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>c. $ʃʃ$</td>
<td>sasi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>d. $ʃʃ$</td>
<td>$ʃʃ$</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>e. $ʃ$</td>
<td>sisi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>f. $ʃ$</td>
<td>sisa</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>g. $ʃ$</td>
<td>sasi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>h. $ʃ$</td>
<td>sasa</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>i. $ʃ$</td>
<td>sisi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>j. $ʃ$</td>
<td>$ʃ$</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>k. $ʃ$</td>
<td>sasi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>l. $ʃ$</td>
<td>$ʃ$</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>m. sisi</td>
<td>sisi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>n. sisa</td>
<td>sisa</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>o. sasi</td>
<td>sasi</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>p. sasa</td>
<td>sasa</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

(77) The arbitrary right-to-left directionality issue only arises in one input, $ʃʃ$.

(78) Why?

a. The rightmost sibilant must be unfaithful, otherwise directional harmony can be handled with CC·ANCHOR-R

b. The preceding sibilant must also be unfaithful; if it isn’t, it means harmony falls out just from neutralization of the rightmost one only, and no assimilation is crucially happening

c. The preceding sibilant must be in a context where we expect it to be faithful - we only see a crucial effect of harmony if it deviates from the normal mapping

d. Only $ʃ[a,e,o,u]ʃ$ inputs fit this profile

(79) Point: The only case that really needs explaining in order to handle the Kiga data are inputs like $ʃʃ$-i that surface as [-sas-i]

4. The role of morphology

The explanation we propose for the $ʃʃ$-i $\rightarrow$ [sasi]-type cases is that they are in part the result of morphological effects
4.1. Morphologically-conditioned mutations

(81) The examples that crucially show root-final /ʃʒ/ surfacing as [s z] come overwhelmingly from forms with three specific suffixes:
   a. Perfective /-ire/
   b. Agentive nominalizer /-i/
   c. Causative /-j-/  

(82) These affixes cause an assortment of consonant mutations in various eastern Bantu languages, e.g. Kinyarwanda, Kinande, Haya, Bemba, and others.¹²

(83) Kiga is no exception: these three affixes induce a host of consonant changes, including:
   a. Affrication of stops
   b. Assibilation of /r/ and /h/
   c. Fronting of /ʃʒ/ to [s z]

(84) Consonant mutations caused by certain suffixes with /i/:

<table>
<thead>
<tr>
<th>Suffix</th>
<th>Examples</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfective /-ire/</td>
<td>-fifà → -sisire ‘be fat’</td>
<td></td>
</tr>
<tr>
<td>Nominaliser /-i/</td>
<td>-jejì → òmù-sèèsi ‘pull down (house)’ / ‘puller-downer’</td>
<td></td>
</tr>
<tr>
<td>Causative /-j/</td>
<td>-rwàrà → -rwàzà ‘be ill’ / ‘make ill, nurse’</td>
<td></td>
</tr>
</tbody>
</table>

(85) Not all suffixes with /-i/ cause systematic mutations:¹³

<table>
<thead>
<tr>
<th>Suffix</th>
<th>Examples</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicative /-ir/</td>
<td>kù-gàf-à ‘be useful’</td>
<td>kù-gàf-ir-à ‘be of use to’</td>
</tr>
<tr>
<td>Stative /-ik/</td>
<td>-jata ‘spill’</td>
<td>-jat-ik-a ‘get spilt’</td>
</tr>
</tbody>
</table>

¹² For details on Kinyarwanda, see Kimenyi (1979), and Walker et al. (2008); for others, see Hyman (2003).
¹³ Some applicative forms do seem to have at least the [-anterior] to [+anterior] shift for sibilants, but it doesn't appear to be consistent. For instance, Taylor’s (1959) dictionary gives the form [-gàf-ir-à] as in (85), but in Taylor’s (1985) grammar, the form [-gàs-ir-à] can be found as well, along with a few other such examples (such as [-izà] ‘come for/to’, from [-i-à] ‘come’). Taken together with the non-mutated forms in (85), it appears that these are not systematic changes, and this is corroborated by the lack of mutation for other consonants. But even if applicatives did exhibit mutations, this could potentially be explained as analogical extension.
(86) The mutations caused by these suffixes have an important consequence for harmony: when the rightmost sibilant gets mutated from /ʃ/ to [s], the agreeing sibilants are not on equal footing.

(87) In a form like /[ʃaaf]-ire/ → [saas-ire] 'be in pain (perf.)', one sibilant has its form dictated by the perfective suffix. The other sibilant does not.

(88) In this situation, right-to-left directionality can be understood as harmony respecting the idiosyncratic phonology that goes with these morphemes.

(89) We can understand it as a morpheme-realization effect:
   a. If the mutations caused by the perfective, agentive nominal, and causative suffixes are an integral part of realizing these morphemes,
   b. Then failing to implement them would violate a constraint on morpheme realization - call it MORPHREAL

(90) MORPHREAL can break the directionality tie in exactly the same way as CC·ANCHOR does.

<table>
<thead>
<tr>
<th>Input: /-[ʃaaf]-ire/</th>
<th>Output: [-saas-ire]</th>
<th>MORPHREAL</th>
<th>CORR{[s]+sibilant}</th>
<th>CC·IDENT-[ant]</th>
<th>CC·ANCHOR</th>
<th>*ʃi</th>
<th>IDENT-[ant]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. s₁aas₁-ire</td>
<td></td>
<td>(0)</td>
<td>(0)</td>
<td>(1)</td>
<td>(0)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>sCorr: R:{s s}{r}</td>
<td></td>
<td>W</td>
<td>L</td>
<td>W</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. f₁aaf₁-ire</td>
<td></td>
<td>(0~1!)</td>
<td>L</td>
<td>W</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sCorr: R:{ʃʃ}{r}</td>
<td></td>
<td></td>
<td>(1~0)</td>
<td>W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. f₁aaf₁-ire</td>
<td></td>
<td></td>
<td></td>
<td>W</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sCorr: R:{ʃʃ}{r}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. f₁aas₁-ire</td>
<td></td>
<td></td>
<td></td>
<td>W</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sCorr: R:{ʃʃ}{s}{r}</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(91) This is a familiar control type of interaction.
   a. MORPHREAL nails down the rightmost (root-final) sibilant as [+anterior]
   b. By doing so, it forces other sibilants to assimilate to match the root-final one – leading to Right-to-Left harmony

---

14 We intend this in the same spirit as Kurisu’s (2001) REALIZEMORPHEME, but abstract away from formal details in implementation that are outside the scope of the Kiga harmony direction puzzle. The exact model we are currently exploring is one proposed in recent work by Archangeli & Pulleyblank (2012, in press, to appear a, to appear b). In that model, choosing between allomorphs is central to the theory, and the choice may be dictated by phonotactics in some cases and by morpheme-specific selectional requirements in others. The cases covered here by MORPHREAL would be the latter kind of pattern.
4.2. **Is there any principled basis for this morphological story?**

(92) For at least the short causative forms, the answer seems to be a definite yes.

(93) In most cases, the only surface evidence for the /-j-/ causative is the mutation it induces on a previous consonant:

a. -kora ‘work’
   -koza ‘make (X) work’

b. -funda ‘be narrow’
   -funza ‘restrict’

c. -taaha ‘enter’
   -taasja ‘take in’

(94) For this affix, failure to manifest the mutations means leaving the morpheme totally unexpressed - a canonical type of **REALIZE MORPHEME** violation

(95) For the other suffixes that cause mutations (perfective -ire and nominal -i), the situation is a little murkier.

(96) But, there still seems to be some basis for it:

a. The vowels in all three of these suffixes were historically super-high vowels in proto-Bantu (Hyman 2003): *- ɨd-e, *- ɨ, and *-ɨ-.

b. The high vs. super-high contrast would have been crucial for morphological disambiguation in proto-Bantu (e.g. applicative *-id- vs. perfective *-id-e)

c. As the high vs. super-high contrast was lost in Kiga, the functional load for these distinctions would have shifted from vowel height to the spirantizations induced by super-high vowels

d. On this interpretation, the mutations caused by suffixes like perfective /-ire/ would have been crucial for realizing these morphemes (even if it’s been rendered redundant by subsequent changes in Kiga)

(97) **The point:** in cases where harmony is right-to-left, but cannot be explained by rightmost-faithfulness, there is a demonstrably morphological source to the observed directionality.
5. Summary & conclusions

Key points we’ve showed in this talk:

(98) Kiga raises an interesting conundrum for how directionality needs to be handled in ABC
   a. It’s strictly right-to-left, with no apparent basis for being so
   b. Agreement for both values - not a one-direction agreement pattern like many other cases of directional harmony
   c. Not explainable as faithfulness-driven control, since it’s allophonic

(99) But actually, it only raises that problem in some other possible world
   a. Sibilants don’t really have an allophonic distribution in Kiga
   b. Morphological effects just make it look that way

(100) The pattern we actually do find in Kiga can be explained in ABC
   a. CC·ANCHOR-R handles cases where the rightmost sibilant is faithful
   b. MORPHREAL handles cases where it’s mutated by the morphology

Conclusions for the bigger picture:

(101) At least some kinds of directional asymmetries can be derived without having the basic mechanism of ABC (CORR, CC·IDENT constraints) refer to directionality (along the lines suggested in Bennett 2013)

(102) Kiga seems like one of the best cases to argue that the theory of Surface Correspondence needs to refer to directionality, but it doesn’t hold up as such.

(103) Maybe other cases of strict directionality can be handled in similar ways, without needing to adjust the theory.

References


