Broken Harmony:

Correspondence and Dissimilation in Zulu

Wm. G. Bennett
Rutgers University

1. The Question: a thought experiment about dissimilation

(1) isiZulu[1] has a process of 'palatalization' that affects labial stops and nasals. It's induced by the passive suffix /w/, as shown by the pair in (2).

(2)

uku-ha[^{m}**b**]-is-a	uku-ha[^{n}**d͡ʒ**]-is-[**w**]-a[2]
inf-leave-Caus-ind	inf-leave-Caus-Pass-ind
'to remove'	'to be removed'

(3) I will treat this as a labial dissimilation process, and propose an analysis based on **surface correspondence** (Rose & Walker 2004, Hansson 2001)

Summary of proposal

(4) A constraint **CORR-B↔W** forces all labials in a stem to be in correspondence

(5) Correspondence across morpheme boundaries is penalized by a constraint '**NoCrossing**' (= ***[X$_j$]+[X$_j$]**)

(6) Unfaithfully mapping labials (to non-labials) can satisfy these constraints by violating **IDENT-[labial]** instead

(7) This is produced by a ranking: **CORR-B↔W, NoCrossing » IDENT-[labial]**

My three goals for this workshop

(8) Present a possible explanation of labial palatalization in Zulu

(9) Show how that analysis can capture dissimilation using constraints on surface correspondence

(10) Ask some big questions: Do we need the OCP? Can we derive its effects?

---

* I would like to thank Jeremy Perkins, Paula Houghton, Mike O'Keefe, Patrick Houghton, Aaron Braver, Jimmy Bruno, Carlo Linares, Crystal Akers, and Paul de Lacy for their numerous helpful suggestions on this topic.

1isiZulu = Zulu (Bantu < S.40 < Nguni, South Africa). Other Nguni languages (e.g. isiXhosa, siSwati) have similar palatalization processes. It's likely that this account will hold for some of those cases as well, but I make no promises.

2Examples are given in Zulu orthography, except for segments involved in the alternation we're looking at. I'll use superscript nasals for pre-nasalized stops (e.g. [^{m}b]). It's possible that these might actually be clusters, or partial geminates. Since they all behave the same way with regard to this process, I'm going to treat them as single segments.

2. The Phenomenon: long-distance labial palatalization

(11) Labials in Zulu roots become (alveo-)palatal (i.e. non-labial) in passivized stems (as in (2) above). The alternations involved are listed in (12):

(12) Inputs and outputs of labial palatalization:[3] ([IPA][4], 'orthography')

[pʼ]	'p'	→	[tʃ]	'tsh'
[pʰ]	'ph'	→	[ʃ]	'sh'
[ᵐpʼ]	'mp'	→	[ⁿtʃʼ]	'ntsh'
[m]	'm'	→	[ɲ]	'ny'
[ɓ]	'b'	→	[tʃʼ]	'tsh'
[b]	'bh'	→	[dʒ]	'j'
[ᵐb]	'mb'	→	[ⁿdʒ]	'nj'

(13) The palatalization effect triggered by the passive [w] can cross over a wide range of intervening material, as in (14-16):

	Active form	Passive form	Remarks
(14)	uku-se[**ɓ**]enz-a inf-work-ind 'to work'	i-ya-se[**tʃʼ**]enz-[**w**]-a 3.sg-Pres-work-Pass-ind 'it is being worked'	(intervening syllable)
(15)	uku-lu[**m**]-isis-a inf-bite-Emph-ind 'to bite hard'	uku-lu[**ɲ**]-isis-[**w**]-a inf-bite-Emph-Pass-ind 'to be bitten hard'	(intervening affix)
(16)	uku-[**pʰ**]a[**pʰ**]a[**m**]-a inf-wake.up-ind 'to wake up'	uku-[**pʰ**]a[**ʃ**]a[**ɲ**]-is-[**w**]-a inf-wake.up-Caus-Pass-ind 'to be woken up'[5]	(intervening undergoer)

3The Zulu consonant inventory consists of: [p], [t], and [k] with voiced, ejective, aspirated, and pre-nasalized variants of them; [m], [n], [ɲ], and [ŋ]; [f], [v], [s], [z], [ʃ], [ɬ], [ɮ], [h], [ɦ]; [t͡ʃ], [d͡ʒ], [k͡ɬʼ]; [j], [w]; and also a set of clicks that aren't relevant here. In the body of the handout, affricates are transcribed without the tie-bar diacritic.

4The IPA values here are based on Poulos & Msimang (1998). There may be some inaccuracies regarding laryngeal features; sources frequently disagree on them. Khumalo (1987) claims that Zulu phonology only distinguishes [±aspirated] and [±depressed]; under that model, there is no featural distinction between voiceless unaspirated stops ([p]) and voiceless ejectives ([pʼ]). These issues are outside the scope of this talk.

5 The example in (16) comes from Poulos & Msimang (1998). Beckman (1993) reports a different pattern, which

(17) Labials that are root-initial are never palatalized, however (as in (18-20)):

(18)	uku-[ɓ]o[pʰ]-a inf-tie-ind 'to tie'	uku-[ɓ]o[ʃ]-[w]-a inf-tie-Pass-ind 'to be tied'	(cf. *uku-tʃoʃwa)
(19)	uku-[pʰ]a[pʰ]a[m]-a inf-wake.up-ind 'to wake up'	uku-[pʰ]a[ʃ]a[ɲ]-is-[w]-a inf-wake.up-Caus-Pass-ind 'to be woken up' (same as (16))	(cf. *uku-ʃaʃaɲiswa)
(20)	uku-[ᵐb]-a inf-dig-ind 'to dig'	uku-[ᵐb]-i[w]-a inf-dig-Pass-ind 'to be dug'	(cf. *uku-ⁿdʒiwa)

(21) This generalization can easily be captured using a positional faithfulness constraint (cf. Beckman 1998), such as:

(22) **IDENT-Root Initial-[labial]**: 'assign one violation for each root-initial labial in the input whose output is not labial'

(23) Labial continuants are also never palatalized: the passive suffix always surfaces as [w] (never [j]), and labio-dental fricatives surface faithfully:[6]

(24)	xo[v]-a imp-knead-ind 'knead!'	i-ya-xo[v]-[w]-a 3.sg-Pres-knead-Pass-ind 'it is being kneaded'	(cf. *iya-xoʒwa)

(25) We could capture this using (e.g.) a manner-specific faithfulness constraint:

(26) **IDENT-continuant-[labial]**: 'assign one violation for each labial continuant in the input whose output is not labial'

---

suggests there may be cross-speaker or cross-dialect variation, as there is in Ndebele (Sibanda 2004)

[6] The example in (24) comes from Beckman (1993:4). Roots with non-initial /w/ are rare in Zulu (if they exist), so we can't tell if they are similarly exceptional.

(27) Ranking the specialized faithfulness constraints above the constraints responsible for palatalization predicts the exceptional patterning observed.

Section Summary

(28) **The main generalization**: the Zulu passive suffix /-w-/ causes all non-initial, non-continuant labials in a root to surface unfaithfully (as palatals)

(29) This process applies non-locally, and is not sensitive to any material that may separate the passive [w] and other labials (13)

(30) But, palatalization *is* subject to specialized faithfulness (cf. (17), (23))

3. The Analysis: correspondence + blocking = dissimilation

(31) Surface correspondence has been used recently to explain consonant harmony (Rose & Walker 2004, Hansson 2001, McCarthy 2006), since it effectively captures ***non-locality***, ***similarity*** between triggers and undergoers and ***insensitivity*** to interveners.

(32) Cases of long-distance [place] dissimilation frequently share those properties (Hansson 2001). **Zulu palatalization shares those properties too**.

How does correspondence handle consonant harmony?

(33) There is a family of constraints, CORR-X↔Y, which requires correspondence between segments with some common feature(s).

e.g.: **CORR-l↔ɬ**: 'all [+lateral] segments must be in correspondence'

(34) A second family of constraints, CC-IDENT-[±F], requires that segments in a correspondence relationship have the same specification for some feature

e.g.: **CC-IDENT-[±voice]**: 'every pair of Cs in a correspondence relationship must have the same [±voice] specification'

(35) Ranking these CC-IDENT and CORR constraints above IDENT results in assimilatory harmony: the winning candidate may sacrifice IDENT violations in order to create the desired correspondence relationship (illustrated in (36)).

(36) Hypothetical example: **CORR-l↔ɬ, CC-IDENT-[voice]** » **IDENT-[voice]**

/ ɬahala /[7]	CORR-l↔ɬ	CC-IDENT-[voice]	IDENT-[voice]
a. ☞ ɮ$_1$ahal$_1$a			*
b. ɬ$_1$ahal$_1$a		W *!	L
c. ɬ$_1$ahal$_2$a	W *!	W *	L

(37) **Recap**: assimilatory harmony results from general faithfulness (IDENT) being violated to satisfy a constraint that requires correspondence (CORR-X↔Y), and a constraint that restricts the shape of valid correspondences (CC-IDENT)

Adapting correspondence to Zulu labials

(38) The CORR-X↔Y constraint relevant to this data would be one that requires correspondence between [labial] consonants. So, we need:

(39) **CORR-B↔W**: 'assign 1 violation for each pair of distinct consonants that are both [labial] and are not in correspondence

(40) We don't observe effects of a constraint **CC-IDENT-[labial]**.

(41) This is consistent with the claim that there is no such constraint, as well as the observation that assimilatory consonant harmony for [place] does not exist (Rose & Walker 2004, Hansson 2001).

(42) If CORR-B↔W » IDENT-[labial], then IDENT-[labial] will be freely violated when doing so reduces CORR-B↔W violations; effectively, segments will change their [labial] specifications when it allows a better correspondence relationship.

(43) Based on that effect, we can make the dissimilatory pattern in Zulu follow from non-correspondence: if labials are required to correspond, and correspondence is restricted in some context, then labials in that context will become non-labial to escape the correspondence requirement.

[7] Identical subscripts are used to indicate correspondence

(44) The data in Zulu shows dissimilation being triggered only across a morpheme boundary. To represent this, I propose the following constraint:

(45) **NoCrossing**: 'assign 1 violation for each pair of distinct segments that are in correspondence, and are separated by a morphological boundary'

(46) This constraint is not unprecedented: Ito & Mester's (1994) CrispEdge constraints similarly penalize relationships across edges.

(47) The primary difference is that CrispEdge is violated by **autosegmental association** across edges, while NoCrossing is instead violated by **surface correspondence** across edges.

(48) **Recap**: we can handle Zulu's dissimilation with 3 constraints, ranked thusly:
CORR-B↔W, NoCrossing » IDENT-[labial]

Applying the correspondence analysis

(49) The ranking in (48) makes labials in passives dissimilate to avoid a bad type of correspondence:

/ lum-w-a /	CORR-B↔W	NoCrossing	IDENT-[lab]
a. ☞ luɲ-w$_1$-a			*
b. lum$_1$-w$_1$-a		*! W	L
c. lum-w-a	*! W		L

(50) Labials in non-passives are unaffected, since no cross-morpheme labial correspondence arises:

/ ɓop^h-a /	CORR-B↔W	NoCrossing	IDENT-[lab]
a. ☞ ɓ$_1$op$^h{}_1$-a			
b. ɓoʃ-a			*! W
c. ɓop^h-a	*! W		

(51) This ranking makes labials dissimilate regardless of any intervening phonological material:

/ haᵐb-is-w-a /	CORR-B↔W	NoCrossing	IDENT-[lab]
a. ☞ haⁿdʒ-is-w-a			*
b. haᵐb₁-is-w₁-a		*! W	L
c. haᵐb-is-w-a	*! W		L

(52) If the specialized faithfulness constraints in (22) & (26) are ranked above the constraints on dissimilation, then root-initial labials and /w/ map faithfully:

/ ɓopʰ-w-a /	IDENT-init, IDENT-cont	CORR-B↔W	NoCrossing	IDENT-[lab]
a. ☞ ɓ₁oʃ-w₁-a			*	*
b. ɓ₁opʰ₁-w₁-a			**! W	L
c. ɓ₁opʰ-w₁-a		**! W	*	L
d. tʃ'oʃ-w-a	*! (init) W		L	** W
e. ɓ₁opʰ₁-j-a	*! (cont) W		L	*

Section Summary

(53) The combination of CORR-B↔W and NoCrossing militates against labial consonants, but only in the context of a labial suffix.

(54) This results in labial dissimilation triggered by /w/ in the passive suffix (49), independently of any intervening material (51).

(55) Labials are correctly predicted not to cause dissimilation root-internally (50).

(56) Root-initial labials are predicted to map faithfully (52).

(57) Zulu labial dissimilation is like a 'broken' form of consonant harmony – it uses the same key mechanism (surface correspondence), but the constraint that would use that to drive assimilation (CC-IDENT-[lab]) is missing.

4. The Alternative: dissimilation powered by the OCP

(58) Most other analyses of dissimilation are based on the Obligatory Contour Principle (=OCP), a prohibition on adjacent identical elements.

(59) This section presents two instantiations of this idea in OT, and highlights where they have problems dealing with the Zulu data we're considering.

Alternative #1: OCP as a family of constraints

(60) One fairly standard interpretation of the OCP in OT is that it comprises a family of constraints, i.e.: (cf. Fukazawa 1999, or McCarthy 2006, e.g.)

(61) **OCP-[F]**: assign one violation for each pair of adjacent instances of feature [F]

(62) These constraints are normally taken to apply at a featural level, rather than a segmental one – no violations are assigned for multiple segments associated with a single feature.

(63) If we take this approach, the constraint relevant to our Zulu data would be:

(64) **OCP-[labial]**: 'assign one violation for each pair of distinct [labial] features'

(65) To capture the long-distance component of Zulu palatalization, this constraint would need to be sensitive only to the occurrence of [labial] features

(66) If other Place features could block the OCP's effects, we would wrongly predict no dissimilation in (67), where a [Coronal] feature separates the [Labial]s:

(67)

uku-se[ɓ]enz-a	i-ya-se[tʃ']enz-[w]-a
inf-work-ind	3.sg-Pres-work-Pass-ind
'to work'	'it is being worked'

(68) **A problem**: if OCP-[labial] assigns violations only for distinct features (and is content with multiple segments linked to the same feature), it does not have the desired effect on roots with initial labials.

(69) The candidate in (71a) is the observed output, where the non-initial labial in the root (i.e. /p^h/) dissimilates.

(70) However, OCP-[Labial] does not distinguish a dissimilating candidate (71a) a candidate that de-links one [Labial] but spreads another (71b). If the distinction gets passed down to IDENT-[Labial] it makes the wrong choice.

(71) When labials in roots surface, OCP-[Labial] doesn't force dissimilation:[8]

[LAB] [LAB] [LAB] / ɓo p^h - w-a /	OCP-[Labial]	IDENT-[Labial]
a. [LAB] [LAB] ☹ ɓo ʃ - w-a	*	*!
b. [LAB] [LAB] ☠ ɓo p^h - w-a	*	
c. [LAB] [LAB] [LAB] ɓo p^h - w-a	**!	

(72) **Recap**: We need a constraint that penalizes root-internal labials, even when initial labials surface faithfully. OCP-[Labial] doesn't do that.

Alternative #2: Generalized OCP

(73) Suzuki's (1998) Generalized Obligatory Contour Principle interprets the OCP as a hierarchical constraint schema. The core components of the proposal are given in (74) and (75).

(74) **Generalized OCP**: '***X...X**: A sequence of two X's is prohibited.'
Where: **X** ∈ {PCat, GCat}
"**...**" is intervening material

(75) **GOCP + Proximity Hierarchy**:
*X...X = {*XX » *X-C-X » *X-μ-X » *X-$\mu\mu$-X » *X-σσ-X » ... » *X-∞-X}

[8] In the tableau in (71) the leftmost [Labial] feature is underlined, along with all segments associated with it. The desired winner is marked with ☹, and the actual (but unwanted) winnder is marked with ☠

(76) In Suzuki's proposal, any phonological or grammatical category can be plugged into the *X…X schema to form a hierarchy as in (75).

(77) If we take this approach, we would posit a hierarchy like in (78), with IDENT-[Labial] appropriately ranked to restrict the domain of dissimilation

(78) *LabLab » *Lab-C-Lab » *Lab-μ-Lab » *Lab-$\mu\mu$-Lab » *Lab-σσ-Lab »...» *Lab-∞-Lab

(79) **A problem**: using Suzuki's hierarchy results in a ranking inconsistency

(80) Labial dissimilation can happen across two syllables:

(81)

uku-lu[**m**]-isis-a	uku-lu[**ɲ**]-isis-[**w**]-a
inf-bite-Emph-ind	inf-bite-Emph-Pass-ind
'to bite hard'	'to be bitten hard'

(82) In order to predict this with Suzuki's GOCP, we would need the ranking *[lab]-σσ-[lab] » IDENT-[lab]

/ lum-isis-w-a /	*[lab]-σσ-[lab]	IDENT-[lab]
a. ☞ luɲ-isis-w-a		*
b. lum-isis-w-a	*! W	L

(83) However, this ranking wrongly predicts dissimilation in non-passives:

/ ɓop^h-a /	*[lab]-σσ-[lab]	IDENT-[lab]
a. ☹ ɓop^h-a	*!	
b. ☠ ɓoʃ-a	L	* W

(84) **Recap**: we need a constraint that favors labial dissimilation across large distances, but *only* when the passive [w] suffix is present. The GOCP can't handle that kind of morphological sensitivity.

Section summary

(85) Both of the instantiations of the OCP reviewed here fail to capture all of the Zulu data under consideration.

(86) To be fully tenable based on the data considered here, these approaches need to introduce new constraints or other complications which are not necessary under the correspondence-based dissimilation analysis.

5. Conclusion

(87) Zulu exhibits a pattern of long-distance labial dissimilation, which can be represented using constraints on surface correspondence (as in section 3)

The core of the surface correspondence account

(88) A constraint that requires correspondence (CORR-B↔W), and a constraint that penalizes correspondence in the appropriate contexts (NoCrossing) both dominate general Input-Output faithfulness (IDENT-[Labial]).

(89) Under this ranking, labials dissimilate to avoid penalized correspondence.

(90) Bonus: Khumalo (1987) reports place-sensitive laryngeal harmony in Zulu verb roots, which affirms the idea that correspondence occurs here.

Extensions of the same idea

(91) The basic interaction that produces dissimilation from correspondence could be applied to other cases as well: any ranking where CORR-X↔Y & some constraint against correspondence dominate IDENT can produce dissimilation.

(92) The constraints that favor dissimilation by penalizing correspondence might even be the same constraints used to produce assimilation.

(93) This is illustrated in (95), using the hypothetical example given previously (36).

(94) When the constraints that normally yield assimilatory harmony all dominate IDENT-[lateral], the candidate with lateral dissimilation (95d) wins (instead of the harmonizing candidate in (95a)).

(95) Hypothetical example : (based on 36)
CORR-l↔ɬ, CC-IDENT-[voice], IDENT-[voice] » IDENT-[lateral]

/ ɬahala /[9]	CORR-l↔ɬ	CC-IDENT-[voice]	IDENT-[voice]	IDENT-[lateral]
a. ɮ$_1$ahal$_1$a			W *!	L
b. ɬ$_1$ahal$_1$a		W *!		L
c. ɬ$_1$ahal$_2$a	W *!			L
d. ☞ ɬ$_1$ahar$_2$a				*

(96) Thus, dissimilatory effects might be derived from the same mechanism responsible for long distance assimilation.

(97) Now, back to the big question: **how does this speak to the OCP?**

References

Beckman, Jill N. 1998. *Positional faithfulness*. Doctoral dissertation, University of Massachusetts, Amherst.

Beckman, Jill N. 1993. Feature Organization and the Strong Domain Hypothesis in Zulu [Labial] Phonology. University of Massachusetts Occasional Papers, vol. 16.

Buell, Leston C. 2005. Issues in Zulu Verbal Morphosyntax. Ph. D. thesis, University of California, Los Angeles.

Chen, Su-I & Gloria Malambe. 1998. Palatalization in SiSwati: An Optimality Theoretic Approach. In Ian Maddieson & Thomas J. Hinnebusch (eds), Language history and linguistic description in Africa, 137-146. Trenton, N.J.: Africa World Press, Inc.

Doke, C.M. 1984. Textbook of Zulu Grammar. Cape Town: Maskew Miller Longman.

Doke, Clement M. 1969. *The Phonetics of the Zulu Language*. Wiesbaden: Kraus-Thomson Organization Limited.

Fukazawa, Haruka. 1999. Theoretical Implications of OCP Effects on Features in Optimality Theory. Ph.D dissertation, University of Maryland. [ROA-307]

Hansson, Gunnar Ólafur. 2001. Theoretical and Typological Issues in Consonant Harmony. Doctoral dissertation, University of California, Berkeley, CA.

Hyman, Larry, Sharon Inkelas & Galen Sibanda. 1998. Morphosyntactic Correspondence in Bantu Reduplication. ROA-437.

Ito, Junko, and Armin Mester. 1994. Reflections on CodaCond and Alignment. In Phonology at Santa Cruz, eds. Jason Merchant, Jaye Padgett and Rachel Walker, 27-46. Santa Cruz: Linguistics Research Center, UC Santa Cruz. [Available on Rutgers Optimality Archive, ROA-141.]

Jokweni, M.W. 1999. 'Deviating from identity: syntagmatic constraints in Xhosa nasal assimilation and

[9] Identical subscripts are used to indicate correspondence

palatalisation.' In South African Journal of African Languages, 2002, volume 19, No. 3: 149-154

Khumalo, James Steven Mzilikazi. 1987. *An autosegmental account of Zulu phonology*. Ph.D dissertation, University of Witwatersrand.

Kitto, Catherine, and Paul de Lacy. 1999. Correspondence and epenthetic quality. In Proceedings of AFLA VI: The Sixth Meeting of the Austronesian Formal Linguistics Association (Toronto Working Papers in Linguistics), eds. Catherine Kitto and Carolyn Smallwood, 181-200. Toronto: Department of Linguistics, University of Toronto. [Available on Rutgers Optimality Archive, ROA-337.]

Krämer, Martin. 1999. On the role of prosodic and morphological categories in vowel harmony and disharmony: a correspondence approach. In Tina Cambier-Langeveld et al. (eds.) ConSOLE-7 Proceedings. Leiden: SOLE 1999, pp. 183-199.

McCarthy, John J. 2006. Consonant Harmony via Correspondence: Evidence from Chumash. ROA-879.

Naidoo, S. 2002. The palatalisation process in isiZulu revisited. In South African Journal of African Languages, 1:59-69

Poulos, G and Msimang, C. T. 1998. A linguistic analysis of Zulu. Cape Town: Via Afrika.

Prince, Alan, and Paul Smolensky. 2004. Optimality Theory: Constraint Interaction in Generative Grammar. [ROA-537.]

Rose, Sharon, and Rachel Walker. 2004. A typology of consonant agreement as correspondence. Language 80:475-531. [Available on Rutgers Optimality Archive, ROA-458.]

Sibanda, Galen. 2004. Verbal Phonology and Morphology of Ndebele. Ph.D dissertation, UC Berkeley.

Suzuki, Keiichiro. 1998. A typological investigation of dissimilation. Ph.D dissertation, University of Arizona.

Wm. G. Bennett
bennettw@rutgers.edu

Rutgers University
Linguistics Department
18 Seminary Place
New Brunswick, NJ 08901