The Hitchhiker’s Guide to Harmony Interactions
Alëna Aksënova

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Overview In this paper, I am considering harmony systems with multiple feature spreadings as a litmus test for the possible configurations of items involved in certain long-distance dependencies within the same language. The question that is being asked is what are the relations between the sets of items that take part in these spreadings. The logically possible configurations are the following ones: same set, when both spreadings operate over the same elements, distinct sets, when the sets of items involved in the harmonies are completely different, set and its subset, when one harmony operates over the subset of items involved in another harmony, and incomparable sets, when the sets of items involved in the two harmonies only partially overlap. I start by investigating typology, and show that the fourth option – the overlapping sets – is the only one that appears to be unattested. While this could be surprising, further I discuss formal reasons that explain such restriction. Going forward, considering such overlapping sets would produce the blow-up of options of the possible harmonic sets configurations.

Typology In this subsecton, I present typological data showing each of the configurations listed above, except the last one – the one that, to the best of my knowledge, is unattested. Here and further, by items involved in a harmony I mean items that are not transparent for the harmonic process, i.e. they are either blockers, or undergoers.

Same set Many harmonies with several feature spreadings operate over the same set of elements. This does not mean that undergoers and blockers are the same for both harmonies, it only means that none of the items taking part in one harmony is irrelevant for the other one. As an example of such language consider Yakut (TURKIC), (Sasa 2009). In this language, the harmonizing features are [front] and [round]. All vowels must agree in fronting (1-4). However, labial harmony spreads from low vowels onto both low and high ones (1,2), from high vowels to high ones (3), but it cannot spread from high vowels to low ones (4).

(1) oyo-lor ‘child-PL’ (3) murum-u ‘nose-ACC’
(2) oyo-nu ‘child-ACC’ (4) tümük-ler ‘window-PL’

Distinct sets In some cases, harmonies operate over completely different sets of elements. For example, in Kikongo (BANTU), vowel harmony co-exists with consonant assimilation, (Ao 1991, Hyman 1998). Vowels must agree in their [height] specification within a word (5-8). Suffixal consonants that are /d/ or /l/ underlyingly (5,6) are realized as /n/ if they are preceded by /n/ in the stem (7,8).

(5) -suk-idi- ‘wash-PERF.ACT’ (7) -meng-ene- ‘hate-PERF.ACT’
(6) -suk-ulu- ‘wash-PERF.PASS’ (8) -meng-ono- ‘hate-PERF.PASS’

Set and its subset The only remaining possibility among the attested ones is the case when one harmony operates over the subset of items involved in another harmony. In Imdlawn Tashlhiyt (BERBER), prefixal sibilants harmonize with the stem ones in voicing and anteriority, (Hansson 2010, McMullin 2016). Whereas nothing blocks the anteriority harmony (9-12), the voicing assimilation is blocked by any intervening voiceless obstruents (11,12).

(9) s-as:twaw ‘CAUS-settle’ (11) s-:ukz ‘CAUS-recognize’
(10) j-m:zdawl ‘CAUS-stumble’ (12) j-quzi: ‘CAUS-be.dislocated’

To the best of my knowledge, there are no languages that have multiple spreadings that operate...
over only partially overlapping sets of elements.

**Partitioning**  Here, I discuss the problem of configurations of harmonic sets from a formal point of view. Namely, I will show that if we consider all possible partitioning of a set into two subsets, then the vast majority of the resulting sets are the partially overlapping ones, and it is exactly the configuration that seems to be absent from natural languages. Eliminating the option of partially overlapping sets helps to simplify the variety of choices for natural language harmonic systems configurations. Including this option causes a blow-up of the possible harmonic systems: see below for the concrete numbers and formulas. This result highlights the importance of restricting the system in a way that natural languages restrict themselves.

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**Set and its subset**  For a set of \( n \) elements, the amount of its subset is equal to choosing \( k \) elements from a set of \( n \), or \( \binom{n}{k} \). Two subsets need to be excluded: \( k = 0 \), where one of the sets is empty, and \( k = n \), where the two sets are equivalent (the ‘same set’ case). The amount of all other proper subsets is given by \( \sum_{k=1}^{n-1} \binom{n}{k} = 2^n - 2 \).

**Distinct sets**  The general case of partitioning a set of \( n \) elements into \( k \) disjoint subsets is given by Stirling Numbers of the Second Kind or \( S(n,k) \), see (Knuth 1968). For the partitioning into 2 sets, the following formula can be used: \( S(n,2) = \frac{1}{2} \sum_{j=0}^{2} (-1)^{2-j} \binom{2}{j} j^n \).

**Overlapping sets**  In this case we want to partition a set of \( n \) elements into two sets with a non-empty intersection. This problem can be divided into two sub-problems: partitioning the set of \( n \) elements into 3 disjoint sets using \( S(n,3) \); and ordering the partitions to generate all possible intersections. The solution can be obtained by the following formula: \( 3 \cdot S(n,3) = \frac{1}{2} \sum_{j=0}^{3} (-1)^{3-j} \binom{3}{j} j^n \).

The picture above illustrates growth of these functions. For example, for 10 elements, there are 511 ways to arrange them in two distinct sets, 1022 ways to obtain a set and its subset, and 27990 ways to create two overlapping sets.

**Discussion**  I showed that there are no attested cases when multiple harmonies within the same language operate over only partially overlapping sets of elements – moreover, this typologically unattested case would lead to a blow-up of possible configurations of harmonic systems.

This is just preliminary research about the typology of long-distance processes and the math behind it, and, of course, a lot is still remained unexplored. However, this result can be interesting from several different perspectives. First, it reveals new typological generalizations about harmonic systems and natural languages in general. Secondly, it might shed light on the issues related to the learnability of long-distance processes. And, lastly, it brings a desired naturalness to the models of natural languages.

It is regularly asserted in surveys of vowel harmony systems that vowel harmony ‘canonically’ applies within the (P)Word. That is, the domain is roughly the word but can be smaller than the word due to phonological or morphological conditions on harmony. The ‘word’ is usually taken to refer to the phonological word, not the grammatical word, since compounds are commonly disharmonic. Indeed, vowel harmony is said to rarely cross lexical word boundaries, either within compounds or within phrases. (See surveys such as: Archangeli & Pulleyblank 2007, Hyman 2002, Kaisse 2016, Krämer 2003, Rose & Walker 2011, van der Hulst & van der Weijer 1995.)

However, if one focuses on African languages, one gets a different perspective on how closely the domain for vowel harmony matches the (P)Word. As a reminder, approximately 2000/6000 (roughly 1/3) of the world’s languages are spoken in Africa, and three types of vowel harmony are found in African languages: ATR harmony; Bantu vowel height harmony; and raising harmony (in Sotho-Tswana). As Clements & Rialland (2008) point out, while the first two types of harmony are quite frequently found in languages spoken across the continent, they are not attested (or rarely attested) outside of Africa.

This talk will undertake a preliminary survey of vowel harmony domains from an Africanist perspective and present case studies from a variety of languages showing that it is relatively common for vowel harmony to apply in a domain that is either larger or smaller than the PWord. The talk will focus on harmony systems – almost all characterized as ATR harmony systems – that take a phrasal domain and demonstrate that it is perhaps not as rare for vowel harmony to apply across word boundaries as has been asserted in the previous literature on this topic. The talk will end by raising the question of why, in most of the known cases of cross-word harmony, ATR or some other laryngeal vowel quality is the harmonizing feature. And if phonologists had investigated ATR harmony systems first, would we have made the generalization that vowel harmony in general is a PWord phenomenon?
The aim of this talk is to propose an original and theory-derived interpretation of Vowel Harmony. I suggest that Vowel harmony does not result from spreading or copy, but from a reorganization of phonological space.

I base my analysis on the idea that Vowel Harmonies are conditioned by prominence (see Garde 1968, Majors 1998, Klein 2000, Walker 2011, etc): assimilation targets the prominent syllable (e.g. Old Norse, 1a) or the non prominent syllables (e.g. Finnish, 1b).

(1) a. Metaphony b. Proper Vowel Harmony

My claim is that the processes in (1) can be predicted from the representation of prominence. Following Garde (1968:47), the distinction between strong and weak positions is quantitative. The strong position is nothing but a weak position plus “something” (2a). This proposition is logically equivalent to the proposition in (2b): the weak position is nothing but a strong position minus “something”.

(2) a. $S = W+x$

b. $\Leftrightarrow W = S-x$ \hspace{1cm} (S = strong, W = weak)

Based on lengthening effects, studies in Government Phonology argue that the “something” that distinguishes strong and weak syllables is a chunk of phonological space (e.g. Chierchia 1986, Larsen 1998, Scheer 2000, Enguehard 2016, etc). Additionally, studies on Virtual Length (Carvalho 1994, Bendjaballah 1999, Ségéral & Scheer 2001, Barillot 2002, etc) put forward that space can be interpreted vertically or horizontally (3), i.e. as a tier or as a slot.

(3) $\begin{array}{c}
\text{x} \\
\text{X}
\end{array}$ $\Leftrightarrow$ $\begin{array}{c}
\text{x} \\
\text{x}
\end{array}$

Now, three possible mechanisms can derive the equation in (2): i. addition (4), ii. deletion (5), or iii. redistribution of space (6). I show that these correspond to phonological processes.

In (4), prominence is manifested by addition of space to the strong syllable (represented by □). The horizontal addition (4a) accounts for phenomena such as Tonic Vowel lengthening (Chierchia 1986, Larsen 1998). The vertical addition (4b) corresponds to metaphonies resulting in a greater vowel inventory in strong syllables (see Old Norse in 1a).

(4) Addition

a. \[
\begin{array}{c}
S \\
W
\end{array} \rightarrow \begin{array}{c}
S \\
\square \\
W
\end{array}
\]

b. \[
\begin{array}{c}
S \\
W
\end{array} \rightarrow \begin{array}{c}
\square \\
S \\
W
\end{array}
\]

In (5), prominence is manifested by a removed space in weak syllables (represented by $\Rightarrow$). The horizontal deletion (5a) corresponds to Unstressed Vowel Shortening (e.g. Norman French diphthong [ˈkɔw] ‘hot’ monophtongized in [koˈfe] ‘to hot’). The vertical deletion (5b) corresponds to Vowel Reductions resulting in a smaller vowel inventory in weak syllables (e.g. mid vowels are never observed in Russian unstressed syllables).

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1 Prominence does not necessarily correspond to phonetic stress. In Turkish, the prominent syllable is the initial one, but the phonetically stressed syllable is the final one (Garde 1968).
(5) Deletion

a.  
\[ \text{S} \quad \text{W} \rightarrow \text{S} \quad \text{W} \]

b.  
\[ \text{□} \quad \text{S} \quad \text{W} \rightarrow \text{S} \quad \text{W} \]

Vowel Harmony is structurally similar to Vowel Reduction: it implies a loss of contrast in unstressed vowels (Garde 1968). The only difference is that the realization of Vowel Harmony depends on the quality of the strong nucleus. Such a dependence corresponds to the third possible manifestation of prominence (6). In this last case, prominence is achieved by redistribution of space from the weak syllables to the strong syllable. Horizontal redistribution (6a) corresponds to compensatory tonic lengthenings (e.g. *kala* > Livonian *kปลา* ‘fish-part.sg’). As for vertical redistribution (6b), it corresponds to Proper Vowel Harmony (see 1b).

(6) Redistribution

a.  
\[ \text{S} \quad \text{W} \rightarrow \text{S} \quad \text{W} \]

b.  
\[ \text{S} \quad \text{W} \rightarrow \text{S} \quad \text{W} \]

In Figure (7), the features of the strong vowel do not spread or copy. However, a whole tier is reassigned to the strong vowel in order to match (2). This vowel cannot be [F] and not-[F] at the same time. Thus, its own value is imposed on the tier to the whole word. Hence harmony.

(7) a.  
\[ 'k \text{U} \text{l} \text{A} \text{s} \text{s} \text{A} \rightarrow 'k \text{U} \text{l} \text{A} \text{s} \text{s} \text{A} \]

b.  
\[ 's \text{A} \text{U} \text{n} \text{A} \text{s} \text{s} \text{A} \rightarrow 's \text{A} \text{U} \text{n} \text{A} \text{s} \text{s} \text{A} \]

Following this interpretation, Vowel harmony is not initiated by the “trigger” or the “target”. It is initiated by a reorganization of the phonological space conditioned by prominence. In other terms, the vowels of the word harmonize in [F] because the tier of [F] is entirely captured by the prominent vowel in order to match the equation in (2).

Non-local vowel harmony in Nganasan?

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Vowel harmony is usually viewed as a feature agreement between the vowels of neighboring syllables. Vowels next to each other form a harmonic domain. Neutral vowels, which do not undergo alternation due to vowel harmony, may be transparent or obscure. Transparent neutral vowels do not interrupt harmonic domains. Obscure neutral vowels start a new harmonic domain according to their phonetic value. E.g. in a language with front/back vowel harmony, a (phonetically) back neutral vowel following front vowels can start a new harmonic domain of back vowels. However, despite its neutrality, the same (phonetically) back neutral vowel cannot start a new domain of front vowels when it follows back vowels. (C.f. e.g. Kiparsky – Pajusalu 2003.)

Nganasan, a moribund Samoyedic language spoken on the Taymir peninsula seems to contradict these principles. Nganasan is the only living Samoyedic language with vowel harmony. It has a rich morphophonology with plenty of alternations, including alternations caused by vowel harmony.

According to the literature on Nganasan phonology (Helimski 1997, Várnai 2002), earlier Nganasan had front/back (palatovelar) vowel harmony, but as a result of changes of vowel quality the original process was obscured. Today the harmony class of stems is lexicalized: based on the phonological composition of stems it is unpredictable which harmony class they belong to. However, my recent research based on the lexicon of the morphological analyzer of Nganasan (http://www.morphologic.hu/urali/index.php?lang=english) shows that the harmonic class of a stem is quite reliably predictable based in the vowels of the stem. Stems containing labial vowels, the diphthong ûa and a (marked blue in the chart bellow) usually belong to one class (U stems), stems containing illabial vowels (including the diphthong ia but except for illabial velar mid vowel ə, (marked red in the chart bellow) belong to the other class (I stems). If we analyze a as a phonologically labial vowel (although phonetically illabial), we can speak about roundness harmony in Nganasan. (In addition, Nganasan has also palatovelar harmony, playing a peripherial role, not discussed here.)

<table>
<thead>
<tr>
<th>Front</th>
<th>Back</th>
</tr>
</thead>
<tbody>
<tr>
<td>labial</td>
<td>illabial</td>
</tr>
<tr>
<td>high</td>
<td>ü</td>
</tr>
<tr>
<td>mid</td>
<td>e</td>
</tr>
<tr>
<td>low</td>
<td>a</td>
</tr>
<tr>
<td>diphthongs</td>
<td>iå</td>
</tr>
</tbody>
</table>

Harmony classes of vowels in Nganasan

Stems containing exclusively ə may belong either of the classes, just as stems containing vowels of both harmony classes. In these cases roughly half of the stems belongs to the U class and half of them to the I class, and it seems to be impossible to predict to which class a given stem belongs to.

Although vowel harmony in Nganasan is not without exceptions, 95% of the internally harmonic stems (namely those which contain vowels exclusively belonging to one or the other harmonic class) are also externally harmonic (that is they must be followed by that allomorph of a suffix alternating due to vowel harmony which contains a vowel belonging to the same harmonic class as the vowels of the stem). In suffixes alternating according to vowel harmony, high vowels may alternate with each other, low vowel a may alternate with high vowels or the diphthong ‘a. Vowels taking part in alternations due to vowel harmony also occur in suffixes which do not undergo vowel
harmony. However, mid vowels never undergo vowel harmony. Since e and o usually do not occur in non-first syllables (most of exceptions are fresh loanwords) and they never occur in suffixes, ə is the only vowel which should be considered as neutral.

The ratio of externally harmonic stems are lower if the stem also contains a neutral vowel. Only 90% of stems are U stems if they – beside u, ü, o, a or ə – also contain ə. Since ə is an unrounded vowel, we would expect that stems containing exclusively i, i, e or ə and ə will be I stems in the same proportion as among stems containing exclusively i, i, e or ə. However, these are harmonic just in the 81% of the cases instead of 95%. The (phonetically) unrounded neutral vowels spoils vowel harmony of stems with unrounded vowels than that of stems with rounded vowels.

Moreover, if we compare bisyllabic stems in which an unrounded vowel is followed by ə with bisyllabic stems in which ə is followed by an unrounded vowel, we find that in the first case the rate of antiharmonic stems is lower (18%) than in the second one (25%), although in the latter case the neutral vowel does not interrupt the (potentially) harmonic domain consisting of the last vowel of the stem and the first vowel of the suffix (and probably more), therefore we would expect no effect at all. In bisyllabic stems with a rounded and a neutral vowel, the difference between the two types is minimal: while 15% of the stems is antiharmonic when ə is in the first syllable, 13% is antiharmonic when ə is in the second one.

We would also expect that bisyllabic stems containing a two vowels belonging to different harmonic classes, the second will play a more important role in deciding to which harmonic class the stem will belong to. However, just 47% of the stems are I stems when there is an unrounded vowel in the second syllable and just 48% of the stems are U stems when the second vowel of a bisyllabic stem is rounded. The ratio of harmonic and antiharmonic stems are so balanced that we have to acknowledge that the order of the vowels plays no role in these cases.

We have to conclude that the presence of neutral ə spoils predictability of the harmony class independently of its position and the harmonic class of the other vowels in the stem. Moreover, the order of the vowels belonging to different harmonic classes plays neither role in determining the harmonic class of the stem. Although the basic tendency is that the vowels of the suffixes undergoing vowel harmony must belong to the same class as the vowels of the stem, there is no observable tendency according to which the vowels of the suffixes undergoing vowel harmony must belong to the same class as the last harmonic vowels of the stem. This means that Nganasan has vowel harmony, but has no harmonic domains, neighboring vowels play no more significant roles than the others.


Intervening Positions in Long-Distance Positional Licensing Effects
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Positional Licensing (PL; e.g. Walker 2011) describes phenomena in which some element must at least partially overlap with a designated licensing position. Because the restricted element need not originate near the licensor, PL is a rich source of long-distance interactions. For example, in Eastern Andalusian (EA), word-final /s/ deletes, causing the preceding vowel to become lax, and this laxness spreads to the stressed vowel over potentially long distances (e.g. Lloret & Jiménez 2009). Vowels that intervene between the final and stressed vowels optionally harmonize: /trβoleʃ/ → [trβ ole] ~ [trβole] ‘clovers’; /kõmeteloʃ/ → [kõmetelo] ~ [kõmetelo] cõmetelos ‘eat them (for you)!’.

This paper probes these intervening vowels. Such vowels show three patterns crosslinguistically: they may be transparent or participate in harmony (EA shows both), or they may block harmony: in Central Veneto’s metaphony (Walker 2011), a post-tonic high vowel causes raising of the stressed vowel and intervening /ε, ο/ (e.g. /˘o rde ni/ → [˘urdi] ‘order (2sg.)’), but intervening /ε, ο, a/ block all harmony: *[la(v)˘ur-a-v-i] ‘worked, was working (2sg. impf. ind.)’, *[la(v)˘ur-a-v-i], *[la(v)˘ur-u-v-i]. Accounts of these patterns exist for parallel (Walker 2011) and serial (Kimper 2012) OT, and for Harmonic Grammar (Kaplan to appear), but not for serial Harmonic Grammar (SHG). I argue that (i) SHG requires an account of the first two kinds of intervening vowels that is very different from analyses available to other frameworks, and (ii) an SHG account of the third kind cannot be unified with the account of the first two.

Walker’s (2011) OT-based formalism rests on a division of labor: PL constraints trigger harmony on the licensor (e.g. for EA LICENSE([-ATR], σ) penalizes [-ATR] that does not coincide with the stressed syllable), and *DUPLICATE (which assigns one violation for a discontiguous harmony domain) is called on when the intervening positions must harmonize. Kimper (2012) uses a similar two-pronged approach, replacing *DUPLICATE with *SKIP (which penalizes each unharmonized intervening vowel separately) for serial versions of OT.

But in SHG, this division of labor fails. Because harmony on the intervening vowels serves only to avoid discontinuous harmony, the first step in a serial derivation is harmony on the licensor (Kimper 2012): /kõmeteloʃ/ → [kõmetelo] (assuming prior steps for /s/-deletion and final-vowel laxing). Each intervening vowel subsequently harmonizes on its own step. *SKIP fails on the first step. Harmony on the stressed vowel eliminates PL’s violation but introduces potentially many *SKIP violations, creating an unbounded trade-off (Pater 2009): the *SKIP violations gang up on PL to block harmony at long distances. With the weights in (1), harmony across two or more intervening positions is blocked; were there just one, candidate (b) would violate *SKIP just once and therefore win. By changing the weights, the maximum distance for harmony can be set arbitrarily, but no PL system works this way (Kaplan to appear).

(1)

<table>
<thead>
<tr>
<th></th>
<th>LICENSE([-ATR], σ)</th>
<th>*SKIP</th>
<th>IDENT</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. kõmetelo</td>
<td>-1</td>
<td></td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>b. kõmetelo</td>
<td>-2</td>
<td></td>
<td>-1</td>
<td>-7</td>
</tr>
</tbody>
</table>

*DUPLICATE fails on the second step (Kimper 2012): because *DUPLICATE penalizes the entire discontiguous domain, harmonizing just one of many intervening vowels does not improve the candidate’s performance, and the derivation cannot proceed.

I argue that Kaplan’s (to appear) PL formalism for parallel HG provides a solution. To deal with unbounded asymmetries much like the one shown above, Kaplan’s PL is positive and
gradient: it assigns +1 to licensed features instead of penalizing unlicensed ones, and another +1 for each additional position the feature is associated with. As a consequence, PL itself motivates harmony on the intervening positions; *DUPLICATE and *SKIP are superfluous, and the problems they cause do not arise (2). When the licensor harmonizes, there is no constraint to penalize discontinuous harmony, and this step cannot be blocked. The motivation to avoid discontinuity comes on subsequent steps, where LICENSE’s reward increases as harmony extends to intervening vowels. (2) produces the fully harmonic EA forms; the alternatives are derived by increasing IDENT’s weight: as inspection of (2) shows, with a weight of 6, IDENT cannot stop the first harmony step (which earns +2 from LICENSE) but does block harmony on an intervening vowel (which only earns +1).

\[
\begin{align*}
\text{(2) a.} & & /\text{kòmetelo}/ & & \text{LICENSE([-ATR], } \hat{\sigma} \text{)} & & \text{IDENT}_1 & & H \\
& & a. \text{kòmetelo} & & 0 & & \\
& & \underline{\text{b. kòmetelo}} & & +2 & & -1 & & 9
\end{align*}
\]

\[
\begin{align*}
\text{b.} & & /\text{kòmetelo}/ & & \text{LICENSE([-ATR], } \hat{\sigma} \text{)} & & \text{IDENT}_1 & & H \\
& & a. \text{kòmetelo} & & +2 & & 10 & & \\
& & \underline{\text{b. kòmetelo}} & & +3 & & -1 & & 14
\end{align*}
\]

c. etc.

The success of this approach shows that unlike other frameworks, SHG requires the impetus for harmony outside the licensor to be built into PL itself. Furthermore, depending on the particular relationship between PL and IDENT, this more comprehensive PL produces both full and discontinuous long-distance harmony.

However, *SKIP is central to an account of Central Veneto’s opaque vowels. It is not enough to prevent /ɛ, ə, a/ from harmonizing: because intervening vowels harmonize after the licensor, this would merely halt the derivation after that first step (*[la(v)ʊr-a-v-i]). Instead, we must block harmony that skips these opaque vowels in the first place. This is precisely what *SKIP-[a] does: with sufficient weight, its penalty for skipping over [a] counters LICENSE’s reward for harmony on the licensor. Thus the interaction that was problematic above—*SKIP’s ability to block harmony on the licensor—is essential here.

Together these results show that PL-driven long-distance harmony is more intricate than it first seems. The behavior of intervening positions, which is largely of secondary importance in ranked-constraint frameworks, takes on a central role in weighted-constraint systems like SHG. Moreover, these intervening positions do not submit to a single approach: when they are opaque, *SKIP is needed, but despite the fact that this constraint can potentially motivate harmony on intervening positions, using it for that purpose in SHG is problematic. Instead, PL itself must trigger this harmony.


Front and center: Neutral vowels in Hill Mari
Anton Kukhto (Moscow State University)

Introduction
The proposed talk concerns vowel harmony and, more specifically, neutral vowels in the Hill (Western) Mari language (ISO 639-3: mrj) spoken in the Gornomariysky district of the Mari El Republic, Russian Federation. Hill Mari is closely related to a better studied and more widely spoken Meadow (East) Mari and belongs to the Uralic family (along with Finnic, Mordvinic, Saamic, and other languages, see Janhunen 2009 for more details). My data come from descriptive sources (primarily Alhoniemi 1993; Bradley 2014) as well as field experience in the Gornomariysky district (summer 2016). Mari uses a modified Cyrillic script, so I adopt IPA for the sake of easier presentation.

Vowels and vowel harmony
Hill Mari contrasts 10 vowels presented below (as opposed to Meadow Mari, which has an inventory of 8 vowels), deploying oppositions in height, backness, and roundedness.

(1) i • y u e • ø ø ø æ æ a

Like many other Uralic languages (and, indeed, Proto-Uralic, see Janhunen 1982 among many others), Hill Mari demonstrates a consistent backness harmony both within morphologically simplex units (with sporadic exceptions) and within morphologically complex words (again, there are suffixes that resist harmony, e.g. the plural -flæ; below I assume the default case where harmony applies, unless otherwise stated). Alhoniemi (1993: 24) distinguishes three classes of vowels according to their harmonic behaviour:

(2) Hintervokale /a o u ø/
(starke) Vordervokale /æ ø y ø/
neutrale Vokale /e i /

At first glance, this system is not unlike the one found in Finnish (see Suomi et al. 2008: 51 ff.; Nevins 2010: 69 ff.) with the exception of the two schwas in Hill Mari. However, the patterns of harmony found in Hill Mari differ from those in Finnish. Disyllabic words adhere to the patterns in (3); U stands here for /a o u ø/, Y for /æ ø y ø/, and I for /e i/:

(3) UUI *UY UI
*YU YY YI
*IU IY II

As (3) shows, U-vowels expectedly cannot co-occur with Y-vowels, yet more surprisingly they cannot follow I-vowels (*IU), so that the alternating comparative suffix -læ/-la cannot attach to a stem with an I-vowel in its back form, e.g. not *pikf-la, but pikf-læ 'like an arrow'. Now I turn to the trisyllabic patterns that involve I-vowels (the rest follow the logic explained above) and present them in (4).

(4) UUI *UIU UIY UII
YYI *YIU YII YII
*IUU *UII IYY YIY *IIU IIY
What we see here is the simple fact that a U-vowel may never follow an I-vowel in addition to the restriction that it may not be adjacent to a Y-vowel. In fact, back and front vowels can occur within one phonological word when they are separated by a neutral vowel (UIY, not in the reverse order *YIU).

**Feature specifications**

In his analysis of Finnish, Nevins (2010) claims that the vowels /i/ and /e/ are transparent to vowel harmony for the reason they are not contrastive, and we do not find vowels like */u/ and */e/ to contrast with them (see also Kiparsky 1985 or a very recent update by Hall 2018). Hill Mari /i/ and /e/ are clearly not transparent contra the traditional descriptive label applied to them by Alhonieni, otherwise patterns like *UIU would be possible. Thus, another feature specification is required for them.

I propose that, assuming the Search Principle (Nevins 2010), both Y-vowels and I-vowels are specified in the lexicon as [+back] as opposed to U-vowels that are [+back]. The search proceeds leftwards, and the [+back] feature is copied by an underspecified vowel in an alternating suffix (or elsewhere), deriving the patterns in (3) and (4). The key difference between Y-vowels and I-vowels with regards to the [+back] feature lies in the mere fact that the former can be underspecified in the lexicon and alternate with U-vowels, whereas the latter cannot, always remaining [+back] (and non-contrastive, for that matter). In other words, you can still be a donor even if you do not have a twin (although it is equally possible that Y-vowels are assigned [+back] by default when they follow I-vowels).

An alternative proposal could be that only [+back] is specified in the lexicon for U-vowels and copied by underspecified vowels, whereas [+back] is assigned to Y-vowels by default when no [+back] feature is found (cf. Nevins 2010: 40, for instance). In that case the unspecified I-vowels would have to bear a blocking feature to prevent harmony in patterns like *UIU. This kind of argument does not seem felicitous for when it comes to interactions with consonants, I-vowels behave much like Y-vowels in that they palatalize the preceding consonant. In fact, a recent development in the phonology of Hill Mari has been the introduction of contrastive /t/ absent in Meadow Mari (Bradley 2014: 48), which is found before both Y- and I-vowels, thus supporting the [+back] specification of both classes.

**References**


The learnability of segmental and suprasegmental harmony

Regine Lai

Jardine (2016) argues that tonal phonology is computationally more complex than segmental phonology based on the typological asymmetry observed in the unbounded circumambient patterns in the tonal and the segmental domains (common in tonal domain, but rare in segmental domain). Previous work have suggested that segmental processes are at most weakly deterministic (Chandlee et al., 2012; suppressed, 2013; Chandlee, 2014; Payne, 2014), and formally speaking, the unbounded circumambient pattern is computationally more complex than the weakly deterministic class because it has to keep track of the information on both sides of word with an unbounded length. But as pointed out by Jardine (2016), such patterns are common in the tonal domain, and this suggests that tonal processes are more complex than segmental ones. The asymmetry can be explained if tonal processes are learned through a mechanism that is less restrictive than that of a segmental pattern learner. From a psycholinguistic point of view, the differences of the computational complexities can be reflected in their learnability in experimental settings. Similar studies which focused on the differences among different segmental patterns with different levels of computational complexities have been carried out (Lai, 2015). This study aims to investigate whether humans process tonal patterns differently than segmental patterns. If so, we should be able to detect the difference in the learnability of the same phonological process, namely, unbounded circumambient process, when instantiated at tonal and when instantiated at segmental level.

Methodology: The artificial language learning paradigm was used to test and compare the learnability of the following processes in the tonal domain and the vowel domain.

<table>
<thead>
<tr>
<th>Types</th>
<th>Processes</th>
<th>Formal characteristics</th>
<th>Typology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbounded circumambient pattern</td>
<td>Plateauing (Plateau)</td>
<td>Beyond the weakly deterministic class</td>
<td>Only attested in tonal but not segmental processes</td>
</tr>
<tr>
<td>Progressive harmony</td>
<td>Left-to-Right (LR)</td>
<td>Within the weakly deterministic class</td>
<td>Attested in both tonal and segmental processes</td>
</tr>
</tbody>
</table>

The participants were trained before they were tested. During the training phase, the participants listened to a list of words that conform to LR, Plateau, or they received no training (Control). After the training, a two-alternative-force-choice task was given, during which, participants had to judge which word within a test pair was more likely to belong to the language they heard during the training. The total duration was roughly 20 minutes. There were two domains for each condition (tonal and vowel). 132 participants, aged 18-35, participated in total and they are all native speakers of Cantonese speakers. Tonal language speakers are better suited for this study than any non-tonal language speakers as their language requires them to be sensitive to both tones and vowels.

The trigger is H tone for the tonal processes and high vowel /u/ for the vowel processes. (1) and (2) are both examples that conform to Tonal Plateau process.

(1) /fu\textsuperscript{33}l\textsuperscript{55} k\textsuperscript{33}lu\textsuperscript{55}/ → [fu\textsuperscript{33}l\textsuperscript{55}k\textsuperscript{33}lu\textsuperscript{55}]  
(2) /k\textsuperscript{55} fu\textsuperscript{33} ku\textsuperscript{33}l\textsuperscript{55}/ → [k\textsuperscript{55} fu\textsuperscript{33} ku\textsuperscript{33}l\textsuperscript{55}]

As shown in (1) and (2), the tone-bearing units between the first and final high level tone are harmonized to H tone in the surface forms, and the segments remain unchanged. (3) and (4) are examples that conform to the Vowel Plateau process.

(3) /fu\textsuperscript{33}l\textsuperscript{55} k\textsuperscript{33}lu\textsuperscript{55}/ → [fu\textsuperscript{33}l\textsuperscript{55}k\textsuperscript{33}lu\textsuperscript{55}]  
(4) /k\textsuperscript{55} fu\textsuperscript{33} ku\textsuperscript{33}l\textsuperscript{55}/ → [k\textsuperscript{55} fu\textsuperscript{33} ku\textsuperscript{33}l\textsuperscript{55}]
Only the vowels between the trigger /u/ are harmonized, and the tones remain unchanged. We predicted that if the tonal learning mechanism is more complex than the segmental one, the learnability of the Tonal Plateau process should be higher than that of the Vowel Plateau.

The LR process only triggers harmony from the leftmost high tone/vowel and spreads to the right. Since it is computationally less complex than Plateau and it is attested in both tonal and segmental domain, we predicted that LR should be 1. more learnable than Plateau, and 2. Learnable in both V and T domains. The control condition did not contain any training. The participants were only given the test items to judge which word within the pair they liked better in order to ensure they had no inherent preferences and to establish baseline.

**Results**: The accuracy rates and the reaction time was collected by the E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). The percentage of choosing any particular choice within the pair will be compared to the control data. The data was analyzed using the linear mixed effect model. The model was fitted in R (v.3.4.1) (R Development Core Team 2017), using `glmer()` and `lmer()` from the lme4 package (Bates, Maechler, and Bolker 2011) for mixed-effects models. The results show that the accuracy rates of both LR and Plateau are significantly higher than the Control condition ($p=1.56e-10$ and $p=0.0004285$). We further analyzed the accuracies of the LR and Plateau conditions and found that the difference in accuracies between the vowel and tonal domain in the LR condition is significant ($p=0.02511$), with tonal domain (73.6%) being higher than the vowel domain (58.7%). However, the differences between the vowel and the tonal domains are not significant in the Plateau condition ($p=.442$).

The reaction time results align with the accuracy rates results. The tonal domain’s RT is significantly faster than the vowel domain’s in the LR condition ($p=0.0441$), but not in the Plateau condition.

**Conclusion**: The participants were able to internalize both harmony patterns (LR and Plateau), but the performance of the vowel group is better than the tonal group’s. This is only evident in the LR but not in the Plateau condition. The results are consistent with the hypothesis that the learnability of tonal processes and vowel processes are different. However, this difference is only observable in the computationally less complex pattern, LR, not in Plateau.

**References**:


Labiality lurks, palatality glides: Asymmetries in harmony
Filiz Mutlu, McGill University, filiz.mutlu@mail.mcgill.ca


Data: Harmony: Palatal harmony can occur as the sole type of harmony, e.g.: Finnish (Suomi et al. 2008), while labial harmony occurs with another type of harmony or is restricted in its targets and triggers (cf. Kaun 1995, Korn 1969). Turkish and Khalkha Mongolian are two examples of both co-occurrence with another type of harmony (palatal and ATR respectively), and height restriction in triggers/targets.

(1) Turkish palatal and labial harmony
root gloss ACC root+DAT
el ‘hand’ eli ele
bal ‘honey’ bala bala
il ‘town’ ili ile
kär ‘meadow’ kärə lər
kol ‘arm’ kolo kola
göl ‘lake’ gly lər
gyl ‘rose’ gylə gylə

In Turkish (1), palatal harmony applies to both high (ACC) and non-high (DAT) vowels, but labial harmony applies only to high vowels, e.g.: *gølø (DAT). In Khalkha Mongolian (2), labial harmony targets non-high PAST iff the trigger is also non-high.

Gliding: A previously unstudied Iranian language, Sauzini, has definite {-a} and indefinite {-i} appear with a glide after a vowel-final root (3). The glide acquires labiality from the root vowel unless the suffix has palatality (DEF). That is, palatality wins even when labiality could spread.

(3) Sauzini glide formation
root gloss DEF. INDEF.
za:ru ‘child’ za:ru(w)ə za:ru(j)i
dʒydyu ‘bird’ dʒydyu(w)ə dʒydyu(j)i
dev ‘giant’ deva de:vi

(4) Turkish mid-vowel lowering
root gloss PASS
vær ‘give’ veril
sør ‘ask’ sorul
ge:ri ‘see’ goryl

Triggering: Palatality not only spreads, but also triggers other processes. In Turkish closed syllables, [e]→[ɛ] before [r] without exception (Taylan 2015), but not [o]→[ɔ] (4). For some speakers, [ɔ]→[æ] (Gopal & Nichols 2016). Similarly, Norwegian has [æ] but not [e] before [r] in closed syllables, eg.: stjær ‘steal’ (Kristoffersen 2000). I take non-high vowels to be coronal, following Broadbent (1993). Furthermore, coronality has degrees (cf. Pöchtrager 2015). That is, coronal vowels acquire more coronality from [r] only in the presence of palatality. Labiality does not trigger spreading. In fact, its presence restricts spreading to a subset of speakers.

Complexity and strength: In order to introduce the theory and the analysis, I must briefly look at consonantal place. I assume phonotactic strength is the crucial piece of evidence for phonological behaviour, and that consonant cluster phonotactics is the crucial piece of
evidence for phonotactic strength (cf. Vennemann 1972, for example). I will use Government Phonology terminology to refer to strength relations. In brief, coronality is stronger than labiality and dorsality since it occupies the governing position in same-manner clusters, e.g.: Norwegian na[mn] ‘name’, va[fn] ‘wagon’. The relative strength of labiality vs. dorsality become apparent when a governor has two governors, or has a weaker manner (fricative, not plosive). English has spring, split, screen but not *[skl] except in a few medical terms, e.g.: sclerosis. When [k] governs both [s] and a liquid, it is strong enough to govern the weaker liquid [r] but NOT the stronger [l]. ([l] governs [r] but not nice versa, e.g.: earl but not *[lr].) Also, among fricatives, [fl]ug survives while [xl] has been simplified to [l] in German (Robinson 2001). To my knowledge, there is no similar evidence of palatality contributing to strength.

**Hypothesis:** Language, including phonology, is an asymmetrical way of creating relations. Apart from emptiness (5a), the simplest object in the system is zero dimensional (a point), the head (5b). The closest possible point to the head, its complement, is removed from it along one dimension (a line) (5c). The next closest point to the head, its specifier, is removed along two dimensions (a plane) (5d). By the asymmetry principle, no two points in a relation can be of equal strength. Strength spirals out from the head, decreasing as the distance of the dependent increases. The strong dependency of head-comp in syntax means that comp incorporates, creates idioms, etc. but spec does not. (5) represents the argument structure of verbs in syntax, the structure of compounds (Di Sciuullo 2005) and place and manner properties in phonology. The distinction compound/morphology vs phrase/syntax map to place vs manner properties respectively. The strongest dependency maps to coronality (strongest) (5c), the weaker one to labiality (weaker) (5d) and a simplex head is the non-strength-relevant palatality (5b).

(5) Building up complexity in the system

- a) emptiness
- b) point, simplex head
- c) line, head-comp
- d) plane, spec-head
- e) combination, eg:

**Analysis:** Since system implies interrelation, and palatality does not involve a dependency relation (5b), it is mostly likely to create other kinds of relations. Palatality can do so in two ways: i. It can spread, so it has a relation to its own copies. That is, there is a direct link between being simplex and being driven to spread. This is why palatality harmony is both common, and free in its targets and triggers (1, 2). ii. It can trigger another property to spread as in coronal vowels acquiring more coronality from [r] (4). In contrast, labiality already involves a (weak) dependency relation, so it is not driven like palatality to create other relations. Therefore, it is less likely to spread than palatality and restricted in triggers/targets (3). For the same reason, it is not a trigger for coronality spreading in (4).

**Further predictions:** i. In Element Theory terms, (5) derives the elements I A U from a principle. ii. Increasing complexity derives the apophonic path $\phi$ I A U (Guerssell & Lowenstamm 1996), posited for vowel alternations in Classic Arabic then applied to Beja, German, Spanish, Nepali, etc. (Rieder & Schenner 2001 and works cited therein).
Neutrality and re-pairing in Ogori vowel harmony: A target-oriented analysis
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In many analyses of vowel harmony, either implicitly or explicitly, neutrality is linked to a lack of harmonic counterpart in the inventory. However, a lack of harmonic counterpart is neither a necessary nor sufficient condition for neutrality. Vowels that have harmonic counterparts may nonetheless be neutral, like the low vowels [a, ə] in Mayak ATR harmony (Andersen 1999), and vowels that lack counterparts may nonetheless participate, either by re-pairing with another vowel in the inventory or through allophonic changes. For example, high and low vowels in Ogori, which are not contrastive for ATR, alternate harmonically in prefixes with mid vowels (e.g. [i]~[ɛ]; Chumbow 1982), while in Kinande, non-high vowels participate allophonically in regressive ATR harmony (Archangeli and Pulleyblank 1994). In both Ogori and Kinande, the non-contrastive vowels that participate in some contexts are neutral in others, within roots and in progressive harmony respectively. Such cases are critical to understanding when and why certain vowels are neutral. In this paper, I focus on Ogori, arguing for a target-oriented analysis in which neutrality is the result of a vowel being a poor potential target for harmony. Such an analysis can easily capture the Ogori data, incorporates cross-linguistic generalizations about tongue root harmony, and extends to a wide variety of other patterns.

In Ogori, the vowels [i,u,a] all lack counterparts for ATR, while mid vowels are paired [e,ɛ,o,ə] (Chumbow 1982). Within roots, only harmonic combinations of mid vowels can occur (e.g. [ógbɛ], [stålɛ]), but high and low vowels are neutral, occurring freely with each other and with both ATR and RTR mid vowels, as in [fisɛ] and [blilá] (Chumbow 1982). However, all three unpaired vowels trigger harmony from root to affix, as seen in the prefix alternation in [ó-siútú] versus [s-jájá] (Chumbow 1982). Moreover, in prefixes, the high and low vowels undergo harmony themselves, re-pairing with mid vowels such that [i]~[ɛ], [u]~[ɔ], and [ɛ]~[a], as in the 1sg prefix in [i-jɛ] versus [ɛ-nɛ] (Chumbow 1982). In suffixes, the same alternations occur for some speakers, while for others, [a] is neutral (Chumbow 1982).

Previous accounts of Ogori (e.g. Chumbow 1982, Calabrese 1988) require extensive use of underspecification and stipulations, especially to capture the differences between roots and affixes. These analyses also tend to ignore the speakers for whom [a] is neutral in suffixes. In contrast, I argue that all of the Ogori data can be seen as a direct consequence of a combination of principled cross-linguistic facts. First, roots tend to be more faithful than affixes (Beckman 1997). Second, mid vowels are ideal participators in tongue root harmony; Casali (2008) notes that, in contrast to high and low vowels, mid vowels are rarely neutral to tongue root harmony, even when unpaired. Finally, the variable behaviour of [a] is reduced to the facts that low vowels are poor undergoers of ATR harmony (Archangeli and Pulleyblank 1994) and that regressive harmony tends to be stronger than progressive harmony (Hyman 2002). In my analysis, the key to neutrality is not lack of harmonic pairing, but rather a vowel not being good enough as a potential harmony target to outweigh relevant types of faithfulness in a particular context.

I implement this perspective formally by extending Kimper’s (2011) concept of trigger strength, in which the weight of the harmony constraint is scaled by a constant that depends on the trigger; I add a scaling factor for the quality of the potential target. With a negative harmony constraint, the result is that disharmony can be penalized to a greater extent with a good potential target than with a bad one. Relative target quality is consistent cross-linguistically, but a language can choose to conflate parts of the scale so that certain distinctions are not made.

Since mid vowels are good triggers and targets of tongue root harmony, their trigger strength and target quality scaling factors will be higher than those of low or high vowels, so that
disharmony will be penalized more. Harmony will then outweigh root faithfulness only for combinations of mid vowels. Between prefix and root, root faithfulness is not at issue, and all combinations can undergo harmony, even though height features must change. Since low vowels are poor undergoers of harmony and progressive harmony tends to be weaker, this analysis can also be extended to the speakers for whom [a] does not undergo harmony in suffixes. Critically, this account requires no underspecification; the facts follow directly from comparing the importance of harmony in specific combinations of vowels to various types of faithfulness.

A simplified explicit illustration is given in Tables 1-3. The constraint weights are 3 for Ident-IO[ATR]-Root and 1 for a general ATR-Harmony constraint, with trigger and target scaling for ATR-Harmony set as 1 for non-mid vowels and 2 for mid vowels. The -1 in the tableaux indicates one violation, and the winning candidate is the one with the score closest to zero. Within roots, we correctly predict harmony among mid vowels (Table 1) but not with other combinations (Table 2). In contrast, across a boundary, when Ident-IO[ATR]-Root is irrelevant, harmony occurs even among non-mid vowels (Table 3).

Thus, the target scaling approach to neutrality presented here provides a simple, motivated analysis of the complex re-pairing and neutrality data in Ogori, reducing the pattern to cross-linguistic trends of root faithfulness and preferred triggers/targets. Further, I show how connecting neutrality with poor target quality can be extended beyond Ogori, providing a deeper understanding of the nature of neutrality cross-linguistically.

**References**

<table>
<thead>
<tr>
<th>/ɔ...e/</th>
<th>Ident-IO[ATR]-Root weight = 3</th>
<th>ATR-Harmony weight = 1</th>
<th>(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ɔ...e</td>
<td>-1*2(trigger scaling for ɔ)*2(trigger scaling for e)</td>
<td>-4</td>
<td></td>
</tr>
<tr>
<td>ɔ...e</td>
<td>-1</td>
<td>-3</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: ATR harmony among mid vowels within roots

<table>
<thead>
<tr>
<th>/ɔ...i/</th>
<th>Ident-IO[ATR]-Root weight = 3</th>
<th>ATR-Harmony weight = 1</th>
<th>(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ɔ...i</td>
<td>-1*2(trigger scaling for ɔ)*1(trigger scaling for i)</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>ɔ...i</td>
<td>-1</td>
<td>-3</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Neutrality of non-mid vowels within roots

<table>
<thead>
<tr>
<th>/a...i/</th>
<th>Ident-IO[ATR]-Root weight = 3</th>
<th>ATR-Harmony weight = 1</th>
<th>(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a...i</td>
<td>-1*1(trigger scaling for a)*1(trigger scaling for i)</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>a...i</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Non-neutrality of non-mid vowels across morpheme boundaries
This paper aims to give a representational analysis of harmony patterns by deriving long-distance phonological phenomena from the representational power allowed by the so-called multiprecedence representation of Raimy (2000). This is one piece of a long-term project aiming to attribute most phonological and morphological patterns to properties of this single representation.

Throughout the history of Generative Linguistics, the representation of phonology, originally assumed to be a string, has been progressively enriched with novel representational power so as to encode more powerful phenomena that go beyond simple linear effects like long-distance phenomena and non-concatenative morphology. Autosegmental theory (Goldsmith 1976), reduplicative brackets (Frampton 2004, 2009), morpheme planes (Cole 1987) or correspondence theory indices (McCarthy & Prince 995) are all enrichments of strings in that they assume some “core” string structure and other things dangling from it. These richer models have been used to make strings more powerful.

There is however an alternative to consider: reducing the complexity of the representation by going from strings to directed graphs, and deploying the additional representational freedom given for free by such a simplification to explain the same phenomena. Raimy (2000) suggested to replace strings such as (1) with graphs like (2), where # and % are explicit beginning- and end-of-word markers respectively. The difference being that in such a representation single segments can immediately precede or follow multiple others. This allowed him to analyse reduplication as “loops” in the directed graph. Indonesian plural reduplication as in (3) is linearized as (4). This structure then allowed Raimy to tame a number of complicated patterns of over- and underapplication of phonological rules interacting with reduplication and infixes

(1) kæt
(2) # → k → æ → t → %
(3) # → b → u → k → u → %
(4) #bukubuku% “books”

Pursuing the project of extending this representation to more phenomena like subtractive morphology (Gagnon & Piché 2007) and Templatic Morphology in Semitic (Raimy 2007), this paper works out how to use this multiprecedence representation to formalize long-distance phonological phenomena as parallel geometry. The basic geometry to exploit is parallel streams throughout a graph, with multiple non-conflicting paths. A graph like (5) would be linearized with feature [+F] realized on every segment parallel to it that can be specified as [+F].

(5) # → a → b → c → d → %
(6) #a₁Fb₂Fc₃Fd₄F%
Given this geometry for the harmonization of a single feature over multiple segments and taking Raimy’s (2000) representation for affixes off the shelf, phenomena of root controlled harmony fall out automatically. For instance in Turkish the root comes specified with features that suffixes eventually take, roots is underlying stored as in (7) and affixes append to this graph as in (8), going parallel to the [αBk, βHi] feature introduced by the root. Suffixes can also contain such parallel streams and the serialization algorithm has to resolve these graphs.

(7)
\[ \# \rightarrow k \rightarrow [+hi] \rightarrow z \rightarrow \% \rightarrow kiz \rightarrow \text{“girl” Nom.sg.} \]

(8)
\[ \# \rightarrow k \rightarrow [+hi] \rightarrow z \rightarrow \% \rightarrow kizin \rightarrow \text{“girl” Gen.sg} \]

(9)
\[ \# \rightarrow j \rightarrow [+hi] \rightarrow z \rightarrow [-hi] \rightarrow r \rightarrow jyzlerin \rightarrow \text{“face” Gen.pl.} \]

The presentation will define the properties of these graphs, explain how they are mathematically simpler than strings despite the representational power, expand on the formalism, and account for the variety of facts that harmony patterns display, including directionality and its typology, transparent and opaque segments, locality, and extension to tonal patterns, making them all follow for free from properties of graphs. The relationship with “spreading” vs. “search-and-copy” (Nevins 2010) models will be discussed in sketching the serialization algorithm.

**Problem.** Transparent vowels, i.e. vowels that seem invisible to vowel harmony (VH), pose a challenge for feature-based and phonetically grounded accounts alike (Gafos & Dye 2011): Finnish i/e (1) are classified as [−back]/articulatorily front, yet do not pattern as such, which in turn leads to long-distance interaction between flanking vowels for VH. This abstract argues that the transparency of vowels follows from their internal structure, more precisely their size: Transparent vowels are structurally small, thus invisible to VH.

**Proposal.** Pöchtrager (2015b, in print), dealing with the reduction of unstressed vowels (Catalan, Brazilian Portuguese etc.), argued that openness be expressed structurally: open-mid vowels (5) are bigger (contain more empty structure) than close-mid vowels (4), which are in turn bigger than high vowels (3). Vowel reduction ([ɛ]→[e], [ɛ]→[i]) can then be uniformly expressed as the loss of structure (extendable to other patterns, e.g. [ê/e]→[ê]). If correct, then that structural difference should show up elsewhere, too. I argue that it plays a role in VH.

Finnish VH (Karlsson 1974) defines three sets of vowel: (non-transparent) front (F), transparent (T), back (B). T combines freely with any other vowel (1b–d), unlike F (1a,f) or B (1e,f). (3–5) show Finnish i/e/ä. All three contain the element I. Openness is encoded structurally by the amount of empty positions. Universally, a vowel consists of up to two nuclear heads (xN1/xN2, the projection of one embedded in that of the other), each of which can project maximally twice. (The projections of a head will simply be referred to as "projections"). T i/e only involve two layers and thus the projection of one head (the lower one, xN1) suffices; ä will require a third layer and thus a second projection (xN2), which is crucial: All F vowels have their I in the higher projection (of xN2), where I can escape and harmonise the other vowels of the domain. B does not coocur with F, as it would be harmonised by F. T vowels have their I in the lower projection, making them inert to VH.

<table>
<thead>
<tr>
<th>(1) stems</th>
<th>(2) part. case</th>
<th>abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. F kylä ‘village’</td>
<td>a. kylä-ä</td>
<td>F(ront) = {y,ö,ä}</td>
</tr>
<tr>
<td>b. F,T tätti ‘aunt’, isää ‘father’</td>
<td>b. tätti-ä, isää-ä</td>
<td></td>
</tr>
<tr>
<td>c. T keli ‘weather’</td>
<td>c. keli-ä (*keli-a)</td>
<td>T(transparent) = {i,e}</td>
</tr>
<tr>
<td>d. B, T nalle ‘bear’, melu ‘noise’</td>
<td>d. nalle-a, melu-a</td>
<td></td>
</tr>
<tr>
<td>e. B talo ‘house’</td>
<td>e. talo-a</td>
<td>B(ack) = {u,o,a}</td>
</tr>
<tr>
<td>f. *B, F *päta, *patü</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consider now y [y] (6). The distribution of I and U is universally restricted such that U must not c-command I, as argued on the basis of their roles in diphthongs and glides in English, Putonghua and Japanese in Pöchtrager (2009, 2015), Živanović & Pöchtrager (2010). Thus, I and U must be separated into two different projections, with I higher than U (also true for ð). This unites all F vowels (y/ö/ä), with I always in the higher projection. Openness is still uniformly expressed by the amount of empty structure: i (3), y (6), and u (7) have one empty
position each and thus all count as high. B vowels, like (high) u in (7), simply lack I. On the other hand, both F and T do have it, but differ in where it sits. The three sets are adequately characterised (no I; I high; I low) and “transparency” follows from structure.

(2c) shows that if a stem contains only T vowels, they behave as F. Assume that T vowels try to form a chain from left to right, and, if they succeed (i.e. if no F/B intervenes) they “gang up” (similar in spirit to Kiparsky & Pajusalu’s 2003 “Combinatorial markedness constraint”) and I can get out, even from the lower projection. It is as if having several vowels with only a lower projection is as good as having one with a lower and a higher projection.

Further confirmation for the analysis comes from Hungarian, where only i [i], i [ι]:, é [e:] are truly T; but not e [e], the short counterpart of é. This follows: T vowels will have structures like (3–4), but e [e], being more open, will be like (5). High(er) vowels are generally more likely to be transparent (Anderson 1980, Beňuš 2005) which falls out from the proposal.

Variation. T vowels are not a necessity, cf. Turkish (Charette & Göksel 1996): Here, i/e are always F. Following (3–6), an element in the higher projection (that of xn2) is always involved in harmony, suggesting that Turkish i/e consist of a projection of xn2 only, where I can get out and harmonise. Finnish i (3) and Turkish i (8) are alike in structure (one empty position each, i.e. high), but differ in what they are a projection of. Cross-linguistic differences follow. (A similar argument is made for vowel reduction in Pöchtrager in print).

Opacity. The opacity (opposite of transparency) of a (e.g. in Pulaar) might follow from it being low, hence big (with a lot of empty structure) and possibly too big for VH to get across.

Conclusion. Insights from vowel reduction and a structural approach to vowels as well as restrictions on I and U can be successfully brought to bear on transparency in VH.

References.
Pöchtrager, Markus A. In print. Sawing off the branch you are sitting on. Acta Linguistica Academica.
Italo-Romance Metaphony as non-concatenative morphology. A bracketing paradox?

Italo-Romance Metaphony builds a linearization of complex morphological forms. There is no coincidence between morphemic and syllabic structures. Occurrences of primitives I, A, U produce sequences of concatenation by construction.

Traditionally, Italo-Romance metaphor is interpreted as a height harmony where stressed mid vowels undergo a raising triggered by post-tonic high vowels (see last - different approaches in Torres-Tamarit et al. ed. 2016). Metaphony emerges therefore classically as a licensing triggered by inflectional vowels of the final syllable, the vowel in the stressed syllable assimilates in height features to a post-tonic high vowel.

In this talk I propose a different account of metaphony in a theoretical model which lets us to build a derivation of the Righthand Head principle (Williams 1981 Righthand Head Rule) and of the Mirror Principle (Baker 1985: 375): “Morphological derivation must directly reflect syntactic derivation (and vice versa)”.

In this approach, the morphological structure is hierarchized, and the phonological interpretation of two heads builds linearity: [head°₁[comp]head°₂]. Both heads have phonological material.

In concatenative morphology we have concatenation from the head to the dependent, as in Fre. chanteur ‘singer’ [œu[chant], in other cases between gender and number [Ge°][N°].

What about the status of intermediate morphemes? In non-concatenative morphology of Semitic languages there is not an immediate correspondence between morphology and syllabification: the phonology produces the morphology. In metaphony and apophony discontinued morphemes are also heads, treated conjointly not successively: through interdigitation. Interdigitation of (non-concatenative) morphology is just a marked case.

In the case of apophonic verbs Eng. sing /sang/sung, the vowels are Tense markers. Past is a morpheme F° (Fusional morpheme) which is treated conjointly with the dependent: Past/v.

\[
\begin{array}{c}
\text{[Past°[v°[} \\
\text{s-n-g (i°-P°) Two heads treated conjointly} \\
\text{A} \\
\text{[rossA] U°/A° ----A} \\
\text{A -Fem}
\end{array}
\]

This gives a complex content which is a complex morphological identification: ((sA°N)(g)). The root and the vowel heads trigger simultaneously the syllabification; H₁/H₂ are the two competitors forms, both pronounceable. One of the two morphemes supplies the complementary vocalic support (integrable).

In Italo-Romance Metaphony, the morphology is also a result of phonology:

Here above the final morpheme, the primitive element A° (which is the feminine morpheme), is the head which triggers the process of interdigitation. Its properties are integrated and built into the phonological object, the root: U°/A° = (o°): russ-A → [rossA]. I consider A° as a functional head higher than N, categorically transparent, which identifies the feminine Ge(nder) or the Nu(mber) (singular).

In Italo-Romance metaphony or in English apophony (sung), as in Semitic languages we can have internal functional heads, as in Semitic the Tense Perfective is Head₁ and the melodic content v° Head₂, two disjoint contents Tense/v° (H₁/H₂), as in ə-k-t : (ə)(ku°(t). I consider that
the following morphological resolution applies to Semitic languages as well as to Italo-Romance metaphony or to Germanic apophony:

**Morphological resolutions**

Theoretical configuration: [Functional Category [Lexical Category

**Successive resolution (concatenative morphology):**

\[a^\circ-\text{Funct.C} [k-\text{t-Lex.C}]\]

\[a^\circ-\text{Funct.C} [k-\text{t-Lex.C}]\]

\[[k-(t-a^\circ)] < \text{Funct.C-Lex.C}>\]

\[(k<\sigma>)(ta^\circ) < \text{FunctC-Lex.C}> [k(\sigma)ta]\]

**Resolution by fusion (co-syllabification) (non-concatenative morphology)**

\[a^\circ-\text{Funct.C} [k-\text{t-Lex.C}]\]

\[a^\circ-\text{Funct.C--Lex.C-t-k}\]

\[[k(\sigma)(ta)] < \text{FunctC--Lex.C} > \]

Our approach allows to solve what Williams (1981) called relatedness paradoxes, and Pesetsky (1985) the bracketing paradoxes. These paradoxes have in common that a suffix can be added to a root which has already a prefix, or to a second item of a compound, as it could have done as being attached to a root without a prefix or to a second item of the compound if it was used in isolation:

**Bracketing paradox**

(1) a  
\[
\{ \{ \text{un} \} \{ \text{al-A \{ grammatic-Root\}} \} \}
\]

\[
grammatic-al\]

\[
[\text{un-grammatic-al}]\]

\[
\text{b}\}
\[
\{ \{ \text{ity-N} \{ \{ \text{un} \} \{ \text{al-A \{ grammatic -Root } \} } \}
\]

\[
\text{ity}\]

\[
\text{al-ity}\]

\[
\text{grammatic-al-ity}\]

\[
[\text{un-grammatic-al-ity}]\]

Thus, there is an asymmetry between the prefix and the suffix. In predicting the secondary systematic character of linearization and of the syllabification for prefixes, proclitics and internal complex heads, this approach makes the paradox disappear. Therefore, there are two sources of linearity in Syntax and in Phonology, movement in the first, syllabification in the second.

**References**


Bern: Peter Lang.


This paper explores neutral blocking in harmony systems—a process where a segment halts but does not initiate harmony—and the challenge such patterns pose for Modified Contrastive Specification (MCS; Dresher, Piggott & Rice 1994; Dresher 2003, 2009). The MCS approach, in keeping with the Contrastivist Hypothesis (Hall 2007, Dresher 2009), proposes that harmony processes can only trigger or target contrastive features, which are defined via feature scope within successive binary divisions of a language’s sound inventory. The relative feature ordering within the hierarchy is assumed to be language-particular. This architecture predicts harmony systems should display broadly two behavioral types (i): segments are either neutral (invisible/transparent)—dominated by some feature \([T]\) outside the scope of and underspecified for the harmony feature \([H]\)—or harmonic (visible triggers/targets)—dominated by and therefore specified either \([\pm H]\). The MCS approach has had considerable success in accounting for harmony and neutral harmony variation along these lines, even among closely related languages with very similar sound inventories (e.g. Dresher 2013, Mackenzie 2016, Hall & Hall 2016, etc.). However, given the strict link between phonological contrast and visibility/activity in (i), visible but non-participating harmony targets (neutral blockers) are not predicted in this model and have been explained away on a case by case basis as the result of additional restrictions on locality, trigger-target similarity, or other orthogonal limitations on the harmony process (cf. Nevins 2010, Godfrey 2012, Ko 2013, Dresher & Nevins 2017). I argue this missed generalization is not a shortcoming of MCS per se, but a by-product of binary feature theory which rules out contrastive non-specification; that is, for the MCS approach phonologically visible but inactive segments. I propose neutral blockers represent exactly such contrastive non-specified segments which due to inventory asymmetries are unpaired with respect to the harmony feature and therefore non-alternating. This is a straightforward prediction of privative contrastive feature hierarchies.

A practical illustration is provided by Khalkha Mongolian, which displays perseveratory labial harmony with neutral high vowels (Svantesson et al. 2008)—triggers are underlined in (2). The harmony patterns in (2a) and /i/-transparent patterns in (2b) show that non-local harmony is permitted in Khalkha (e.g. *poor-ig-o, *poor-ig-e) which is blocked by word-medial /u/ in (2c). /u/ is visible to labial harmony—and should therefore be contrastive for the harmony feature according to the schema in (i)—but it does not condition harmony itself and therefore is not obviously specified for [labial] (e.g. *og-ug-l-e, *og-ug-h-o). This is a contradiction to the predicted harmony typology in (i) and poses a considerable challenge for MCS and other underspecification approaches to harmony.

(2) Khalkha labial harmony and neutral harmony patterns

a. /o, e/ labial harmony

<table>
<thead>
<tr>
<th>xeeɮ-ɮe</th>
<th>*xeeɮ-ɮo 'decorate’-DPST</th>
</tr>
</thead>
<tbody>
<tr>
<td>cʰoor-ɮo</td>
<td>*cʰoor-ɮe 'decrease’-DPST</td>
</tr>
</tbody>
</table>

c. /u/-neutral blocking

<table>
<thead>
<tr>
<th>xeeɮ-uxɮ-ɮe</th>
<th>*xeeɮ-uxɮ-ɮo 'decorate’-CAUS-DPST</th>
</tr>
</thead>
<tbody>
<tr>
<td>og-'uɮ-ɮe</td>
<td>*og-'uɮ-ɮo 'give’-CAUS-DPST</td>
</tr>
</tbody>
</table>
I argue for a version of MCS which incorporates insights from the Parallel Structures Model of feature geometry (Morén 2003, Iosad 2017). In comparison to binary contrastive hierarchies’ simple dichotomy between visible (active) and invisible (inactive) harmony segments in (i), privative contrastive feature hierarchies as diagrammed in (3a) provide a ternary distinction (cf. Hall 2007, 2009; Iosad 2017); distinguishing non-contrastive underspecified transparent segments, contrastively specified triggers, and contrastively non-specified targets. Inventory shape—derived by co-occurrence constraints—determines whether targets are viable (alternating) or non-viable (non-alternating) recipients of harmony, represented here by opaque [ × ] specifications. For example, /u/ is necessarily non-alternating in a language like Khalkha which does not distinguish labial and non-labial high vowels (i.e. /u/ – */ɯ/). Whether /u/ is transparent, a harmonic trigger, or a neutral blocker comes down to the language-particular feature categorization (3a). In this case, /u/ is categorized as non-specified with respect to the harmony feature—as evidenced by its inability to trigger labial harmony (2c)—but it does have an empty labial place node as evidenced by its visibility to labial harmony. In other words, it is a harmony target which because of inventory asymmetries cannot undergo harmony, resulting in neutral blocking.

(3) Harmony typology within privative contrastive feature hierarchies

(b) Khalkha simplified inventory

Each predicted harmony behavior type is demonstrated in (4) using a simple derivational feature-spreading mechanism. Given the simplified inventory /i, o, u, e/, the harmony patterns in (2) indicate the feature ordering [coronal] > [labial] > [closed] for Khalkha. Eligible triggers/targets are determined by class nodes with rightwards [labial] spreading between labially specified and non-specified segments. Labially underspecified segments like /i/ are invisible to the harmony process. The viability of targets /e, u/ to receive and further spread [labial] comes down to differences in inventory shape. Unmarked /e/ is paired with and visible to all other features while labially unpaired /u/ (phonologically *[labial, closed] segments not being permitted) neutrally blocks [labial]-feature spreading.

(4) /i/-transparency and /u/-neutral blocking in Khalkha labial harmony

This approach illustrates that with the right representations the central tenets of the MCS method can accommodate neutral blocking without additional grammatical restrictions on the harmony process. More broadly, these revisions provide a more robust representational harmony methodology which makes more concrete the roles which inventory shape and language-particular feature categorization play in phonological patterning.
Prosodically conditioned harmony in Bangla
Paroma Sanyal
Indian Institute of Technology Delhi

This paper uses the vowel sonority hierarchy (Kenstowicz 1997, de Lacy 2004, 2006, Gordon 2006) in order to support the following descriptive claims about the Bangla.

- The [+High, +ATR] vowels [i] and [u] are the least sonorous and therefore least desirable in stressed syllables.
- The [-High, -ATR] vowels [ɔ], [a], [æ] are the most sonorous and therefore most desirable in stressed syllables.
- Prosodic manipulation in the relative sonority of the nucleus of syllables within a foot result in both progressive as well as regressive harmony in the language.

0. Introduction
Bangla is a major South Asian language spoken in Bangladesh and the eastern part of India. It forms a contiguous linguistic area where the phonology varies from the west to east with respect to vowel harmony. While the entire linguistic area shares the same vowel repertoire, the vowels have a stricter distributional restriction along the western dialects. The argument here is that since the language spoken in these parts actively associates the vowel sonority hierarchy with foot prosody and this results in a range of vowel harmonic process1.

The paper is divided into three sections. The first section presents a descriptive account of the vowel harmonic processes and their morpho-phonological contexts. The following section presents independent phonological evidence, not pertaining to vowel harmony, to support the idea that BanglaSH has a strong preference for syllabic trochee. The third and final section is the analysis that explains how the prosodic well-formedness preference of the language interacts with sonority hierarchy in order to produce a range of different processes that appear to be similar to progressive and regressive vowel harmonies.

1. Descriptive account
Non-verbs in BanglaSH show a different kind of harmony than verbs. The following statements describe the distributional restrictions of vowels in non-verbs and verbs.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The vowel [ɔ] can only appear in odd numbered syllables, unless it is preceded by a [+High] vowel [i] or [u] in the preceding syllable in disyllables. In most of these contexts, the words have an alternative pronunciation where either the [ɔ] has been raised to [o] or the high vowel has been lowered to mid.</td>
<td>odd syllable [ɔ], even [o] letters in script: /kmUl/ 'lotus' and /koml/ 'soft' in speech: [komol] and [komol] Disyllables: [i]/[u] preceding [ɔ] [b^itɔr]-[b^etɔr] 'inside' [b^i][ɔ]n- [b^i][ɔ]n] 'extremely'</td>
</tr>
<tr>
<td>b. All [ɔ] change to [o] when followed by the vowels [i] or [u] in the following syllable.</td>
<td>[dɔj] 'victory' [dɔj] 'victorious'</td>
</tr>
<tr>
<td>c. Although [a] and [æ] share the feature [-High, -ATR] with [ɔ], these vowels show no change when followed by the [+High] vowels [i] or [u] in non-verbs.</td>
<td>[mati] 'soil' *[mɛti] [k^eti] 'fame' *[k^eti]</td>
</tr>
<tr>
<td>d. But, in verbs [ɔ] and [æ] change to their corresponding mid counterparts [o] and [e] in identical morpho-phonological environments.</td>
<td>imperative: [kɔr] 'do' [dɛk^i] 'see' hab.past.1p: [kɔrtum] [dɛk^i]tum</td>
</tr>
<tr>
<td>e. The vowel [a] though phonologically inert for the most part, shows similar behavior to [ɔ] when placed in the second syllable of a disyllable and</td>
<td>Disyllables: [i]/[u] preceding [a] [pʰi][ɔ]-[pʰi][e] 'string' [lɔ]-[lɔ] 'thread' [bi][u]-[bera] 'cut'</td>
</tr>
</tbody>
</table>

---

1 Henceforth I will be using the word BanglaSH to refer to this language in order to distinguish it from the larger linguistic continuum of Bangla, which doesn’t share this specific characteristic.
f. The mid vowels [e] and [o] occur freely and do not show any harmony in non-verbs. However, in verbs they change to [i] and [u] in the morphophonological environments where the [ɔ] and [æ] change to [o] and [e] respectively.

<table>
<thead>
<tr>
<th>Verb</th>
<th>Infinitive</th>
<th>Subjective</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bikɑl]</td>
<td>[bikel]</td>
<td>'evening'</td>
<td></td>
</tr>
<tr>
<td>[dukan]</td>
<td>[dokɑn]</td>
<td>'shop'</td>
<td></td>
</tr>
</tbody>
</table>

imperative: [on] 'listen' [lek̂] 'write'
hab.past.1p: [∫on} 'listen' [lik̂] 'talk'

2. Evidence for syllabic trochee
The preferred foot structure in BanglaSH is a disyllabic trochee, evidence for which can be seen in the following phonological contexts.

The genitive suffix in BanglaSH is vowel-initial and loses its vowel for hiatus resolution when it attaches to vowel-final nouns. It thus appears as two phonologically conditioned allomorphs [-er] and [-r]. However, when the noun is monosyllabic, the hiatus resolution is not with vowel deletion, but rather with glide insertion, so as to produce a disyllable.

A. Noun       | Genitive   | Gloss
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[kɔlom]</td>
<td>[kɔlomer]</td>
<td>'pen'</td>
</tr>
<tr>
<td>[kɔla]</td>
<td>[kɔlar]</td>
<td>'banana'</td>
</tr>
<tr>
<td>[ca]</td>
<td>[cajer]</td>
<td>'tea'</td>
</tr>
</tbody>
</table>

Coda clusters are simplified in BanglaSH by adding the vowel [o] finally. Such words can be easily identified since they typically show two alternative pronunciations in the genitive form: one with the epenthetic [o] and another with the suffixal vowel [e].

B. Noun       | Genitive   | Gloss
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[posto]</td>
<td>[postor], [poster]</td>
<td>'poppy seeds'</td>
</tr>
<tr>
<td>[gɔlpo]</td>
<td>[gɔlpor], [gɔlper]</td>
<td>'story'</td>
</tr>
</tbody>
</table>

The addition of the epenthetic vowel, after the cluster produces a Heavy-Light syllable sequence, while adding the vowel between the clusters, would have produced a Light-Heavy sequence. The former strategy shows the clear preference for disyllabic trochee.

3. Analysis
The analysis uses positional faithfulness constraints (Beckman 1997, 2004, Smith 2004) to show why there is a preference to not alter vowels in stressed syllables. This preference is in turn compromised when the vowel in the stressed syllable is a [ɔ] followed by either [i] or [u]. The account presented here would be an underspecification account. I propose that in non-verbs, BanglaSH has a six vowel repertoire with the seventh vowel underspecified for manner. This underspecified vocalic segment appears as [ɔ] in stressed positions and [o] elsewhere. Since it is underspecified, it does not incur violation of the positional faithfulness constraint and as a consequence appears to be the only vowel participating in regressive harmony.

Cited References

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2 It has been suggested to me by Jill Beckman in a review that this could be analyzed as a case of chain shift, and in my analysis I do take this into consideration.
Sundanese [ar–al] allomorphy as aggressive reduplication

Juliet Stanton, NYU (stanton@nyu.edu)

(§i) Overview. Dissimilatory processes typically exhibit locality effects: if two segments a and b are forbidden from co-occurring at some distance x, they are forbidden from co-occurring at all distances less than x. This generalization has both typological and experimental support: non-local dissimilation asymmetrically implies local dissimilation (e.g. Suzuki 1999, Zymet 2012), and participants in artificial grammar learning tasks are consistently unable to learn systems that violate this implication (Hansson & McMullin 2014). These results suggest that the locality generalization is a robust universal that ought to be captured by any successful theory of dissimilation.

This paper focuses on the sole apparent exception to the locality generalization: a pattern of phonotactically conditioned allomorphy in Sundanese (Cohn 1992, Bennett 2015), which suggests that [r]s and [l]s can co-occur only in adjacent syllable onsets (§ii). Developing a suggestion by Zuraw (2002:433), I show that the pattern can be analyzed by appealing to two unbounded co-occurrence constraints, *[r]…[r] and *[l]…[l], whose effects in local contexts are obscured by a general desire for identity among adjacent syllables (for a related analysis see Suzuki 1999; §iii). Additional evidence for the proposal comes from statistical trends in the Sundanese lexicon (§iv).

The proposed analysis lets us uphold the claim that dissimilation obeys a locality restriction: if a co-occurrence restriction targets (a,b) at some distance x, it targets (a,b) at all distances less than x. This conclusion serves as an argument for theories that derive the locality generalization (e.g. Suzuki’s 1999 GOCP) and a challenge for theories that do not (e.g. Bennett’s 2015 SCTD).

(§ii) Data. In the general case, the Sundanese plural infix is realized as [ar]. But when infixed to a root containing an [r], the plural infix generally maps to [al] (1). This alternation suggests a dispreference for the co-occurrence of [r]s in Sundanese. (Data from Cohn 1992, Bennett 2015.)

\[
\begin{align*}
(1) & \quad \text{a. } [k-ar-usut], [g-ar-ilis] \quad \text{‘messy (pl.), beautiful (pl.)’ default allomorph is [ar]} \\
& \quad \text{b. } [c-al-ombrek], [n-al-umbara] \quad \text{‘cold (pl.), go abroad (pl.)’ [al] when stem has an [r]} \\
\end{align*}
\]

There are two kinds of exception to this generalization. The first: in certain local configurations, [r]s are permitted to co-occur. Specifically, if the syllable begun by the infixal consonant is preceded or followed by a syllable whose onset is [r], [ar] surfaces (2).

\[
\begin{align*}
(2) & \quad \text{[r-ar-ahit], [c-ar-uriga] \quad \text{‘wounded (pl.), suspicion (pl.)’ neighboring onset is [r]} \\
\end{align*}
\]

The second: in certain segmental contexts, the [al] allomorph appears unexpectedly. Specifically, if the word-initial onset is [l], [al] surfaces, whether or not another [r] exists (3).

\[
\begin{align*}
(3) & \quad \text{[l-al-itik], [l-al-iren] \quad \text{‘little (pl.), take a break (pl.)’ initial onset is [l]} \\
\end{align*}
\]

(§iii) Analysis. The data in (1) suggest that a preference to use the [ar] allomorph can be overridden by a constraint on co-occurring [r]s. I encode the preference for [ar] with USE[ar], which assigns a penalty if the exponent of /ar/ is not [ar] (see e.g. MacBride 2004 on allomorph preference constraints). This constraint is dominated by *[r]…[r], which assigns a violation for each pair of [r]s. This derives the facts in (1): [ar] is used unless *[r]…[r] is violated (4–5).

\[
\begin{align*}
(4) & \quad \text{[ar] is default allomorph} \\
& \quad \begin{cases}
\text{a. } k-ar-usut & \text{[ar,al]+kusut} \\
\text{b. } k-al-usut & \text{USE[ar]} \\
\end{cases} \\
& \quad \begin{cases}
\text{a. } h-ar-ormat & \text{[ar,al]+hormat} \\
\text{b. } h-al-ormat & \text{USE[ar]} \\
\end{cases} \\
(5) & \quad \text{[al] used to satisfy *[r]…[r]} \\
\end{align*}
\]

To account for the fact that [r]s are permitted to occur when they occupy adjacent syllable onsets (2), I propose, following Zuraw (2002:433), that there is a more general drive in Sundanese for adjacent syllables to be coupled in a reduplication-like structure. I assume that the constraint promoting coupling is REDUP-σ, which assigns a violation for every pair of adjacent syllables that is not coupled (see Zuraw 2002:405 for a discussion of adjacency). Coupled substrings are...
subject to additional similarity requirements: in Sundanese, coupled substrings must have identical onsets (in other words, IDENT-kk[onset], where each k is a coupled substring, is undominated). The fact that [ar] surfaces in (2) shows that REDUP-σσ dominates *[r]…[r]: the drive for adjacent syllables to be coupled takes priority over avoidance of co-occurring [r]s (7). (The fact that the infixal and not the stem consonant alternates to satisfy IDENT-kk[onset] can be attributed to high-ranked IO-IDENT; I assume that [ar] and [al] are both faithful realizations of the infixal morpheme.) Consider now the form [g-ar-nilis]. This form could have been realized [g-al-i-nilis], satisfying IDENT-kk[onset] and REDUP-σσ. The fact that [ar] is used instead indicates that *[l]…[l], penalizing pairs of co-occurring [l]s, dominates REDUP-σσ. The fact that [l]s are permitted to co-occur when they occupy the first two syllable onsets can be explained if REDUP-σ1σ2, a context-specific version of REDUP-σσ that requires the first two syllables of the word to be coupled, dominates *[l]…[l] (8).

In sum, Sundanese disfavors co-occurrence of [r]s and [l]s, unless this allows for adjacent syllables to be coupled, either generally (in the case of [r]) or in the first two syllables (in the case of [l]). Under this analysis, there is no need to claim that the constraints motivating dissimilation target non-local contexts only: it’s just that the local effects of unbounded *[r]…[r] and *[l]…[l] are obscured by a more general desire for adjacent syllables to resemble one another.

(§iv) Further evidence. As noted by Zuraw (2002), trends in the Sundanese lexicon suggest a preference for adjacent syllable identity. For example, Cohn (1992) observes that in 76/87 r1V(C1)r2V(C2) roots, r1V(C1) = r2V(C2). An initial investigation of 1537 (non-morphologically reduplicated) C1VC2V-initial words, from Rigg (1862), suggests that the preference for adjacent syllable identity is more general than previously recognized. For adjacent syllables (i.e. C1VC2V and C2VC3V), onset identity is significantly correlated with nucleus identity (9), but for non-adjacent syllables (i.e. C1VC3V), it is not (10). (Both p-values are from χ² tests.)

Data from the corpus also confirm that [r]s and [l]s can co-occur in a local configuration but not elsewhere. Of the 24 forms with co-occurring [r]s in my corpus, in 23 they are adjacent onsets (C1VC2V or C2VC3V; see also Cohn 1992:214); of the 34 forms with co-occurring [l]s, all are adjacent. Such a dispreference for non-local co-occurrence is not found for other consonants: of the 56 forms with co-occurring [s]s, for example, in 42 the [s]s are local and in 14 they are not.

These lexical trends support the above analysis of the [ar~al] allomorphy: they confirm that Sundanese exhibits a desire for adjacent syllable identity which masks a dispreference for identical liquid co-occurrence. Possible ways to unify the analysis of the [ar~al] alternations with the statistical trends identified above will be discussed.
Outline: Long-distance vowel dissimilation is a typologically rare and theoretically still poorly understood phenomenon (see Suzuki 1998 for a detailed crosslinguistic survey, and Blevins 2009 for more recent discussion). In this talk, we discuss an especially intricate case of height polarity in Bari (Eastern Nilotic, all data from Yokwe 1986) and argue that the pattern instantiates true phonological optimization, not morphological allomorph selection. 

Data: The antipassive suffix shows up either as a high back vowel ([u]/[ʊ]) or as a low back vowel ([a]/[ɑ], according to the ATR-specification of the root). The high variant appears after low vowels (1-a), the low one after high vowels, establishing the basic polarity pattern (1-b):

(1) a. i. gáʔ ⇒ gáf-ò ‘look for’ (p.31)  
   ii. fêʔ ⇒ fêf-ù ‘visit’ (p.32)

b. i. kúr ⇒ kúrjù ‘borrow’ (p.32)  
   ii. mûk ⇒ mûggê ‘pull’ (p.32)  
   iii. sôr ⇒ sôrjâ ‘borrow’ (p.32)  
   iv. nûn ⇒ nûndyà ‘twist’ (p.32)

An intriguing complication is the behavior after mid vowels. Here the high variant appears after [+ATR] roots (2-a), and the low variant after [-ATR] roots (2-b):

(2) a. i. sôn ⇒ sôndù ‘send away’ (p.31)  
   ii. rém ⇒ rémbû ‘spear’ (p.31)

b. i. só ⇒ sâjâ ‘boil’ (p.31)  
   ii. dêr ⇒ dêrjâ ‘cook’ (p.31)

Theoretical Problems: For a phonological account, the central challenge posed by the Bari antipassive is the fact that the language has clear examples of stable high (cf. the ventive suffix -un in kûr-ûn ‘dig’, mûk-ûn, ‘catch’, dâng-ûn ‘lick’, p.49), mid (imperative -e in sût-ê ‘bet’, bôn-ê ‘belittle’, lûsûk-ê ‘melt’, p.81-82) and low-vowel suffixes (passive -a in kûk-â ‘respect’, mûk-à ‘catch’, râl-à ‘scorch’, p.61-62); however these don’t exhibit polarity, but different types of height harmony (low [+ATR] vowels are raised to mid after mid vowels, and [+ATR] mid vowels are raised to high before high vowels under specific conditions).

Analysis: Following Suzuki (1998) for South-Russian Jakan’e, we propose that the central polarity pattern is triggered by a constraint requiring maximal height contrast between syllable-adjacent vowels. The unique property of the antipassive vowel which makes it vulnerable for Maximal Contrast is that it is unspecified for aperture (height features) and can hence assume distinct surface heights without violating higher-ranked IDENT [hi/lo] (which in turn blocks changes in root vowels), an Emergence of the Unmarked Effect (TETU, McCarthy and Prince 1994), as shown in (3). The realizations after mid vowels instantiate two additional TETU effects under input underspecification: the avoidance of mid vowels triggered by *MID and the well-known antagonism of [+ATR] for [+low] (*{5}) and of [-ATR] for [+high] (*{I,U}) (Archangeli and Pulleyblank 1994, 2002).
Suffix Polarity: High/Low Roots

Input: = gaf-jV

<table>
<thead>
<tr>
<th></th>
<th>Id [hi/lo]</th>
<th>MaxContr</th>
<th>*(1,0) *{v}</th>
<th>*Mid</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>gaf-ju</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>gaf-jo</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>gaf-ja</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Input: = kur-jV

<table>
<thead>
<tr>
<th></th>
<th>Id [hi/lo]</th>
<th>MaxContr</th>
<th>*(1,0) *{v}</th>
<th>*Mid</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>kur-ju</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>kur-jo</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>kur-ju</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Suffix Polarity: Mid-Vowel Stems

Input: = ge-jV

<table>
<thead>
<tr>
<th></th>
<th>Id [hi/lo]</th>
<th>MaxContr</th>
<th>*(1,0) *{v}</th>
<th>*Mid</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>ge-ju</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>ge-jo</td>
<td>*</td>
<td>**!</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>ge-jo</td>
<td>*</td>
<td>*!</td>
<td>*</td>
</tr>
</tbody>
</table>

Input: = gr-jV

<table>
<thead>
<tr>
<th></th>
<th>Id [hi/lo]</th>
<th>MaxContr</th>
<th>*(1,0) *{v}</th>
<th>*Mid</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>gr-jo</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>gr-ja</td>
<td></td>
<td>**!</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>gr-ja</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Extensions: Building on this core analysis, we show how polarity interacts with higher-ranked constraints requiring specific types of height harmony. Crucially, we argue that polarity occupies a ‘niche’ in the harmony system – where higher-ranked constraints enforcing height feature spreading are inapplicable, polarity becomes possible – an account that also carries over to partially polarizing prefixes which alternate between o/ɔ and u/ʊ (e.g. causative to- in tò-kùr ‘borrow’, tôdòk ‘wrap’ tôgâ? ‘look for’, p.76).

Problems for an Allomorphy Analysis: The AP suffix poses substantial problems for a suppletion analysis based on morphophonological subcategorization (Bye 2006, Embick 2010, Paster 2015). Subcategorization doesn’t capture that Bari vowel harmony reflects the well-established alignment of [ATR] and height values. More seriously, subcategorization presupposes a natural class of targets one or both of the allomorphs could select for, but requiring [+ATR -low] bases for the u/ʊ-allomorph incorrectly excludes [-ATR] [a] bases (1-a-i) and selecting for [-low] or [+high] overpredicts it for [-ATR] mid vowels (2-b).
Implicational Universals in the Typology of Consonant Harmony

This study focuses on one of the unique properties of consonant harmony, namely its asymmetrical patterns concerning triggers and targets. It is observed in consonant harmony that only certain types of consonants are preferred as targets (Hansson 2001, 2010). For example, in Sarcee, alveolar sibilants are always targeted by harmony to undergo place assimilation to palatal sibilants, whereas palatal sibilants only trigger harmony but do not undergo it. Although this kind of target asymmetry has attracted attention in the literature, no typological research has been carried out that focuses on whether such an asymmetry exists merely as a tendency that can be reversed in some languages, or as a universal pattern that is cross-linguistically respected. Moreover, no satisfactory explanation has been provided for such an asymmetry, which is undesirable since it leaves considerable amount of consonant harmony data left unexplained. This study aims to address the question of whether and why such asymmetry occurs in consonant harmony. Based on the typological survey investigating the data in Hansson (2001, 2010) and Arsenault (2012), I claim that asymmetries should be stated as implicational universals. Moreover, I provide a phonetically-based analysis within the framework of Optimality Theory, which explains all and only the attested patterns in consonant harmony.

Based on the typological survey of more than 120 languages, I found target asymmetries in the following three types of consonant harmony: sibilant, retroflex, and nasal consonant harmony. In sibilant consonant harmony whereby place assimilation occurs between alveolar sibilants ([s, z, ts, tz]) and palatal sibilants ([ɾ, ɹ, tʃ, ɹʃ]), if palatal sibilants are targets of harmony in a language, so are alveolar sibilants, but not vice versa. For example, in Sarcee, the word /si-tʃogò/ ‘my flank’ becomes [jitʃogò], with the alveolar /s/ becoming palatal [ʃ]. As Sarcee exhibits regressive (i.e. right-to-left) harmony, the rightmost sibilant (i.e. /tʃ/) in the word triggers harmony in the preceding sibilant (i.e. /s/). However, when the rightmost sibilant is alveolar, it does not trigger harmony. Instead, the rightmost palatal sibilant triggers harmony and targets all preceding sibilants within a word. This is shown in the word /si-tʃiz-ʔà/ ‘my duck’ that surfaces as [jitʃidzəʔ], not *[sitʃidzəʔ]. The rightmost sibilant /z/ does not trigger harmony but instead the second rightmost sibilant /tʃ/ triggers harmony. Of the 25 relevant languages in my survey, 15 languages reveal such a target asymmetry in which only alveolar sibilants are targets to the exclusion of palatal sibilants; On the other hand, the other 10 languages show symmetric harmony in which both alveolar and palatal sibilants are equally targeted (e.g. Navajo, /si-ʃítséʔà/ → [ʃidzéʔà] ‘they lie’, and /j-ʃif-mas/ → [jismas] ‘I’m rolling along’ (Hansson 2001)). Significantly, however, the reverse asymmetric situation whereby only palatal sibilants are targeted is not attested in any language in the survey. Similar kinds of target asymmetry are also observed in retroflex and nasal consonant harmony. In retroflex consonant harmony, non-retroflex consonants such as dental or alveolar stops and nasals (/d, t, n/ and /d̪, t̪, n̪/) are targets if their retroflex counterparts (/ɾ, tʃ, n̪/) are targets, but not vice versa. In nasal consonant harmony, non-nasal consonants such as plain stops (/b, d, g, p, t, k/) and liquid consonants (/l, r/) are targets if nasal consonants (/m, n, ŋ/) are targets, but not vice versa. Based on these survey results, I conclude that the observed asymmetries should be expressed as the following implicational statements: i) If palatal sibilants are targets of consonant harmony, so are alveolar sibilants. ii) If retroflex consonants are targets of consonant harmony, so are non-retroflex consonants. iii) If nasal consonants are targets of consonant harmony, so are non-nasal consonants.

Inspired by phonetically-based Optimality Theory (Hayes, Kirchner and Steriade 2004), I investigate perceptibility variation in contexts where consonant harmony typically occurs. Based on this investigation, I argue that the observed asymmetries are perceptually motivated.
and can be well understood under the P-map hypothesis (Steriade 2001, 2009). The upshot of P-map is that perceptually prominent phonological change is avoided. In Optimality-Theoretic terms, faithfulness constraints preventing more prominent perceptual change invariably outrank those prohibiting less perceptual change. In line with P-map, I claim that consonant harmony is a process preferring less perceptual modification. In particular, various phonetic studies (Ladefoged 2003, a.o.) show that the phonological features relevant to palatal, retroflex, and nasal consonants have prolonged phonetic cues that may span over multi-segmental domains. I hypothesize that the consonants with prolonged phonetic cues (i.e. more likely triggers of consonant harmony) may weaken perceptibility of the relevant features in nearby consonants and make them less perceptible. This means that the phonetic cue of relevant phonological features is weaker before the consonants with a long cue (i.e. palatal sibilants, retroflex consonants, and nasal consonants) than before the consonants without a long cue.

Reflecting this contextual perceptibility variation, constraints for the corresponding contexts are projected and universally ranked by P-map. The faithfulness constraints prohibiting phonological change before alveolar sibilants, non-retroflex consonants, and non-nasal consonants universally outrank those prohibiting change before palatal sibilants, retroflex consonants, and nasal consonants, respectively. To take an example of sibilant consonant harmony, ID-IO (anterior/_s) is universally ranked above ID-IO (anterior/_f), explaining the cross-linguistic universal that faithfulness for anteriority is weaker before palatal sibilants than before alveolar sibilants. Moreover, language-specific consonant harmony patterns are also explained by interaction of these two constraints with another constraint, IDENT-CC, which induces consonant harmony. When IDENT-CC dominates the two ID-IO faithfulness constraints, consonant harmony occurs all the time, regardless of the type of triggers and targets. When it is ranked between the two ID-IO faithfulness constraints, only the alveolar sibilants are targeted, revealing target asymmetry patterns. Finally, when IDENT-CC is dominated by the two ID-IO faithfulness constraints, consonant harmony does not occur at all. The target asymmetries in retroflex and nasal consonant harmony are similarly analyzed: ID-IO (anterior/_d) ≫ ID-IO (anterior/_l), and their interaction with IDENT-CC in retroflex consonant harmony, and ID-IO (nasal/_d) ≫ ID-IO (nasal/_n), and their interaction with IDENT-CC in nasal consonant harmony. It is significant that this analysis precisely predicts the absence of the pattern in which palatal sibilants, retroflex consonants, and nasal consonants are exclusively targeted in consonant harmony.

The research serves as an empirical contribution in that it finds target asymmetries in consonant harmony typology. In addition, it is predictive, allowing for all and only the observed patterns in consonant harmony typology including asymmetrical patterns that were not discussed in depth in previous research. Finally, the analysis combines theories of consonant harmony, such as correspondence theory, with perception-based theory, creating a novel hybrid analytical framework, which can be applied to other future areas of phonological research.

**References**