Domains of Vowel Harmony

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17.1 Underived stems

Languages with vowel harmony often have some internally disharmonic stems, typically in unassimilated loanwords (Turkish formül, Finnish tyranni), sometimes also in fully native or nativized vocabulary: Yokuts (Yok-Utian) /pislu/ [pisl-u-] ‘mouse’ violates the language’s regular rounding harmony (Kuroda 1967: 44–5).

One approach to disharmonic stems restricts harmony to morphologically derived environments (Clements and Sezer 1982; Bennink 1992; Polgárdi 1999: 119 for Turkish; Ringen and Kontra 1989 for Hungarian). Its drawback is that it does not characterize disharmonic stems as irregular, and thus fails to explain nativizations of disharmonic loanwords such as Turkish bisküvit → büsküvüt ‘biscuit’, komünist → kominist ‘communist’ (Clements and Sezer 1982) and Finnish troytjyl → rotuli ‘TNT’, and the preference in disharmonic words for unmarked vowels; see (Goldsmith 1990: 302) for Turkish and (Rebrus et al. 2013) for Hungarian.

An alternative is that morphologically simplex lexemes undergo harmony as a default that is defeasible by lexical prespecification (Kabak 2011; van der Hulst 2018: 206-14). Derivational phonological theories do this by leaving predictable harmonic values unspecified in lexical representations, with harmony applying in feature-filling mode; in the implementation of Hulst and van de Weijer 1993 pre-associated features cannot spread to any other vowel positions within the same morpheme. OT achieves the same result by faithfulness constraints of the type IDENT(F) and IDENT-STEM(F) which protect marked feature specifications of vowels in lexical representations, a device independently necessary to derive stem-outward harmony processes.

The smallest domain of constraint application is the stem. Strictly root-internal and affix-internal vowel harmony is unattested. Apparent root harmony in Tiv (Tivoid) and Ngbaka (Gbaya) is templatic morphology with spreading of underlying vocalic autosegments (Pulleyblank 1988; Archangeli and Pulleyblank 1994).

17.2 Directionality

Vowel harmony propagates either (1) cyclically from the innermost morphological constituent of a stem or word outwards, (2) from any vowel with the dominant feature value to all other vowels (Baković 2000), or (3) directionally rightwards or leftwards. Regressive harmony triggered by final syllables is found in Assamese (Indo-Aryan, Mahanta 2007), Pulaar (Fula, Paradis 1992), Punu (Bantu, Hyman 2002), and Karajá (Macro-Jê, Ribeiro 2003). Progressive harmony is less common; in Tutrugbu (Kwa, McCollum and Essegbey 2020) and in Shona (Bantu, Beckman 1997), height spreads left to right from stem-initial syllables.

Underspecification analyses derive directionality of spreading from the distribution of feature specifications. A harmony process spreads specified feature
values to positions where the feature is unspecified. In OT, this line of analysis is not available because constraints apply to output representations and there are no morpheme structure constraints or other devices available for distributing feature specifications. Stem control and directionality of harmony must then be driven in other ways, either by cyclic constraint evaluation (Baković 2000) or by positional faithfulness constraints (Beckman 1997).

17.3 Derived stems and the constituent structure of words

Words may contain subconstituents in which stems are grouped with suffixes into harmony domains to the exclusion of prefixes, as in Maasai (Nilotic, Wallace 1981; Levergood 1984; Quinn-Wriedt 2013) and Finnish, or with prefixes to the exclusion of suffixes, e.g. Kalabari Ijo (Ijoid, Akinlabi 1995) and Twuuli (Kwa, Harley 2005) or with both, e.g. Shona (Beckman 1997) and Moro (Kordofanian, Ritchart and Rose 2017: 167-8). I conjecture that these domains constitute the stem level of the respective languages. In Kimaragang (Austronesian), /a/ spreads from right to left from suffixes to roots and from roots to certain prefixes. Kroeger (2010) suggests that this is a stem-level lexical process, since it is obligatory, categorical, structure preserving, and inapplicable to clitics and to a class of prefixes that independent criteria place in an outer layer of morphology.

Harmony can diagnose multiple domains within words. Lesley-Neuman (2007, 2012) finds three levels in Karimojong (Nilotic) words. Level 1 is the most highly integrated; several morphophonological processes are confined to it, and affixes in it adopt the root vowel’s [ATR] specifications. Level 2 is the domain of suffix-controlled [+ATR] harmony. Level 3, at which pronominal prefixes and some adverbs are added, has no harmony. In Lango (Nilotic) vowel harmony applies to postposed possessive pronouns but not to postposed determiners, and is sensitive to syllable structure (Noona 1992: 33-4). In Kinande (Bantu), vowel harmony converges with other diagnostics to establish Root, Stem, Macro-stem, and Word domains (Mutaka and Hyman 1994; Archangeli and Pulleyblank 2002).

Tommo So (Dogon) has three kinds of vowel harmony: Height, Backness, and ATR (McPherson 2013, McPherson and Hayes 2010). They are practically confined to verbal derivation; inflection and noun morphology are hardly affected. Height harmony is optional and limited to the two innermost layers of the derivational verb morphology, comprising the factitive and reversional suffixes. Backness harmony applies through all five derivational suffix positions, obligatorily to the closest suffix and optionally thereafter. Both of these harmony processes apply with decreasing frequency outward, “petering out” until the end of their respective domains. ATR harmony, though, is obligatory up to and including the fourth suffix position, and then abruptly turns off at the last one, the Causative, which is perhaps the edge of the Stem level, since causativization is the only derivational process that is recursive and applicable to any verb.
Vértes (1977: 95) describes a similar attenuation of front/back harmony in Southern Khanty (Uralic) after the initial syllables of a word, more often with heavier suffixes. e and i in medial syllables may variably be (a) fully harmonic, both undergoing and transmitting back harmony, (b) fully opaque, remaining front and initiating a span of front central vowels, or (c) “blocking vowels” in the sense of Kramer (2003 and Ch. 21) which undergo harmony but do not transmit it:

(1) (a) oðoxtdø ‘on his lap’, (b) oxtedø ‘on’, (c) oxtdø.

Since the corresponding back vowels y, m, ø, a occur only after back vowels, we conclude that harmony in these dialects is backing, rather than fronting. That e, i, ø, u occurs in case (c) reveals that [−Back] is the default value.

Some vowel harmony systems show edge effects. Word-peripheral vowels can be exempt from harmony: initial augments in Kinande (Mutaka 1995; Archangeli and Pulleyblank 2002, Archangeli and Pulleyblank 2007: 364), final vowels in Shona (Beckman 1997), Kimatuumbi (Odden 1996), and other Bantu languages (Hyman 1999). In Vata (Kru), harmony proceeds leftwards from verb roots to monosyllabic prefixes, stopping at the final syllable of a polysyllabic prefix (Kaye 1982). Thus, in the disyllabic morpheme /kuna/ (negative incompletive) only the syllable immediately preceding the verb root harmonizes, whereas harmony spreads leftwards from a [−ATR] aspect marker to a directly preceding subject pronoun; in this case, a span of two syllables to the left of the verb root is affected. In Akposso (Kwa), harmony spreads only one syllable to the left of the verb in a string of aspect prefixes, and from there to a subject prefix; in nouns it does not extend beyond the stem except for bound allomorphs of articles (Anderson 1999: 194, 205 ff.).

17.4 Compounds and quasi-compounds

Each member of a compound word usually constitutes a separate vowel harmony domain (Hulst and van de Weijer 1995: 501). Some languages, however, require all members of a word to harmonize, e.g. Degema (Edoïd, Karl 2002), or distinguish harmonizing and non-harmonizing compound types. Folarin (1987) describes such a bifurcation in Yoruba (Volta-Niger), showing that the two compound types are structurally distinct, with a stratal analysis of the morphology that underpins the dual phonology (see further Ch. 15). In Finnish, suffixes harmonize with the last harmonic vowel of the stem. Morphologically non-compositional compounds and prefixed words may be treated as single stems. For example, -metri ‘meter’ tends to initiate its own harmony domain in words that denote instruments and measures, where it is transparently related to the first member of the compound (2a), and to be grouped into a single stem with the preceding element in formations like (2b), which are non-compositional within Finnish (-lla, -ssa, -a are case endings).

1Examples transliterated from Vértès' Uralic transcription system.
Conversely, prosody can prompt semantically non-compositional compound analyses of long words, even when one or both parts have no independent existence (quasi-compounds). In Finnish, front endings occur marginally in monomorphic back-vowel stems of four or more syllables that end in two neutral syllables, such as parasiti, pyramid, hypoteesi, vitamiini, karamelli, klarnetti, bolsevikki, mannekiini, adjektiivi, manifesti. As many researchers have noted, the reason for the front vowel option seems to be that they have the prosodic form of compounds. Although back endings are strongly preferred in most such words, and required by normative grammar, the more they look like compounds, the more frequent the front ending. To the extent that such words invite a folk-etymological (though semantically non-compositional) compound analysis, such as kommunenki ‘contraption’, arkkitehti ‘architect’, and harakiri, they actually prefer front suffixes. In contrast, trisyllabic stems like grafiitti, konvehti, fakiri, bakteeri, kuririi, kapteeni, kamekii nearly always get back suffixes (Elat.Sg. *kameliista, Adess.Sg. *kamelinä), for they cannot be analyzed as quasi-compounds because Finnish allows no monosyllabic stems like gra-, kon-, fa-, bak-, ku-, kap-, ka-. For the same reason, four-syllable stems in which secondary stress is purely rhythmic, and moves to a fourth syllable if the third is light, never split into quasi-compounds, e.g. hajallise-ssa (*-ssä) ‘scattered’ (iness.).

In Hungarian, on the contrary, the frequency of backing has been found to decrease simply with the number of neutral vowels that intervene between trigger and target (the Count Effect, Ringen and Kontra 1989; Rebrus et al. 2017; Törkenczi 2010, Kumpel 2011), with no prosodic effects reported. Finnish shows no Count Effect: front vowel endings are just as rare after stems like positiivi, adessiivi and partitiivi as after stems like negatiivi, elatiivi and illatiivi, where the back vowel trigger is closer to the potential harmony target, and practically impossible after trisyllables like kameli and fakiri, where the back vowel is also closer, but which are too short to be structured as quasi-compounds. Why intervening i and e weaken harmony in Hungarian, but not in the prosodically and morphologically similar Finnish, is an interesting question. A speculative answer is that Hungarian has abstract underlying [+Back] i and e (in words like hid ‘bridge’), so that front i and e vowels may be contrastively specified as [–Back] already in the word phonology, at least optionally, whereas Finnish has no such abstract contrast in its neutral vowels, which therefore remain unspecified and harmonically inert until the postlexical phonology.

17.5 Clitics

The separation between the lexical and the postlexical module in Lexical Phonology and Stratal OT establishes a distinction between the lexical word and the
postlexical word, also known as the clitic group. When harmony operates only in the lexical phonology, it is confined to lexical words, and does not extend to phrasal clitics (such as pronouns) that are postlexically added in the syntax; such languages include Yoruba (Archangeli and Pulleyblank 1989: 198), Toposa, Lango, Kalenjin (Dimmendaal 2002: 167-70), and Tuwuli (Harley 2007: 66).

When harmony operates also postlexically, phrasal clitics are included in its domain, as seen in Turkish (Kabak and Vogel 2001), Luo (Nilotic, (Dimmendaal 2002: 177)), and Degema (Kari 2007).

The Balto-Finnic languages offer a good sample of the range of variation. In Votic, phrasal clitics are outside of the front/back harmony domain, in that they retain back vowels after front stems (Ariste 1968: 34-35; Lauerma 1993: 107-114; Markus and Rozhanskiy 2014).

The division between clitics and suffixes is diagnosable by independent morphosyntactic criteria. Suffixes appear on each member of an NP in agreement with the head noun. Clitics appear just once on the head noun (except that the comitative may be added to adjectives that are focused as a separate phrase). Thus they are not part of the word in the lexical derivation, but syntactically inserted at the phrase level.

In other Balto-Finnic languages, phrasal clitics harmonize. Regularly so in Finnish. In Seto/Võru, abessive -lda, morphosyntactically a clitic since attaches to whole NPs, harmonizes, e.g. tūū: ja leivaldā ‘without work and bread’, musta leivaldā ‘without black bread’. Cliticized function words (‘simple clitics’, Zwicky and Pullum 1977) are only subject to e ∼ o harmony. The negation ei gets a back vowel when it encliticizes to a back-vowel word, and the conjunction ōt ‘that’ gets a front vowel when it encliticizes to a front-vowel word (which need not be syntactically related to it).\(^2\)

The Seto and Võru clitics /-ka/ ‘with’ and interrogative -ku have invariant back vowels,\(^3\)

\(^{(3)}\) a. clitics have fixed vocalism: siit-tä=ssā ‘from then on’, tā-hā=sa ‘up to here’, virisse=ssā ‘until Epiphany’ (terminative), tytō=ka ‘with the girl/daughter’, mehe=ka ‘with the man/husband’ (comitative)

b. suffixes harmonize: pezā-zā ‘nest-inessive’, tūttō-ā ‘girl/daughter-partitive’

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\(^{(4)}\) a. kinoli_ at... ‘said that’

b. kull_ et... ‘surely that’

Some speakers also harmonize the negation ei ‘not’ in its proclitic use:

\(^{(5)}\) ‘ai tōhi ‘dare not’

siin_ i_ ōlāi?’ ‘there isn’t any in it’

In these languages velar onsets tend to inhibit front harmony.\(^4\) The Seto and Võru clitics /-ka/ ‘with’ and interrogative -ku have invariant back vowels,
e.g. tūg:ga ‘with work’, pūssūga ‘with a gun’ (Mägiste 1977: 166), sōōt-ku ‘are you eating’? In Votic, even 2Pl imperative -ka/-ga is invariant. In the closely related Ingrian (Lower Luga dialect), terminative -ssā behaves as in Votic, but comitative -ka/-kā surprisingly harmonizes. By a range of criteria these two endings occupy an intermediate position between case suffixes and clitic post-positions in Votic and Ingrian (Markus and Rozhanskiy 2014).

In poetic and nonstandard varieties of Finnish, the short forms mā, sā of the 1/2Sg. pronouns optionally procliticize and undergo harmony, e.g. ma tulin ‘I came’ (pro standard colloquial mā tulin), vs. mā menin ‘I went’, mā kävin ‘I went (and left again)’. They also harmonize with their host when enclitic: En oo ma nältä maïltä ‘I’m not from these parts’; 3Sg. hän is however invariant even in these varieties.

17.6 Discontinuous harmony within words

In Karimojong the [+ATR] frequentive morpheme -éené- is transparent to ATR vowel harmony. In (6) it is intruded into the middle of an [-ATR] harmony span (Lesley-Neuman 2012: 36).

(6) tō- dān-éené- tāē
2SG CAUS pinch -frequently- IND.PRES.PERF
‘he has frequently caused to pinch’

This can be seen as instance of endocyclicity (Hyman and Orgun 2005) or introfixation (Kiparsky to appear), which resolves conflicts between semantic/morphosyntactic scope and morphological selection by inserting a morpheme into an already formed morphological structure. In (6) the frequentive morpheme scopes over the event, hence is semantically interpreted after the perfect morpheme is composed with the root. But morphotactics requires it to be placed immediately after the root. In the derivation, the aspect morpheme is first added to the root, with which it is semantically composed and phonologically harmonizes, and the frequentive is then introfixed between them and semantically composed with them, creatingdisharmony.

Kimatuumbi likewise has disharmony by introfixation of an aspectual morpheme (Odden 1996: 51, 102). Word-final morphemes with high vowels are exempt from the language’s otherwise regular [ATR] vowel harmony. The perfective suffix is one such morpheme. After polysyllabic stems, its allomorph -i- is infixed into the verb, keeping its [-ATR] quality and thereby forming a little disharmonic island within the [+ATR] word, as in (7):

(7) a. n-télek-‘cook’, y-tóp-‘fatness’
   b. chóla ‘draw’, nǐ-chól-‘te ‘draw-PERF’
   c. bèléka ‘bear’, nǐ-bél-ke ‘bear-PERF’

The translations suggest that the disharmonic adverbials outscope the Locative/Instrumental applicative suffixes, which supports an introfixation analysis.

17.7 Phrasal harmony

Most vowel harmony processes apply within the limits of a word, but vowel harmony processes that apply across word boundaries are robustly attested (Downing and Krämer, Ch. 30 of this volume). Many of these have the hallmarks of phonetic coarticulation. Commonly the harmonic feature spills over into an adjacent word, usually leftward, optionally, gradiently, and only part way through the phrasal domain to an extent that depends on the rate of speech (Hyman 2002). Nez Perce harmony triggered by dominant vowels applies obligatorily throughout a word, but between words only in rapid speech to the immediately preceding syllable. And whereas lexical harmony distinguishes between dominant and recessive i, its phrasal analogue treats them alike (Aoki 1966: 761, Kaplan 2008). In Ngiti, [+ATR] spreads one syllable to the left “in any two words which follow one another in rapid succession withing a breath group” (Kutsch Lojenga 1994: 78). Akan [+ATR] harmony “peters out” for several syllables to the left of a triggering [+ATR] vowel (Clements 1981: 154). Nawuri has both a one-syllable progressive [ATR] harmony and a Akan-type gradient regressive [+ATR] harmony within small phrases (Casali 2002).

(9) e-koli a-fulee [èkóó lááfúléé?] PROG-he.receive NOUNCLASS-money

’He is collecting money.’

Koromfe (Gur) backness/roundness harmony produces non-high “stable” vowels within the phonological word and, and high, “unstable” vowels within phonological phrases (Remison 1987). Kinande [+ATR] harmony operates optionally and gradually within DPs (Mutaka 1993; Archangeli and Pulleyblank 2002; Downing and Krämer, Ch. 20 below).

Some phrasal harmony processes, however, appear to be as categorical and structurally conditioned as anything in lexical phonology. Urhobo (Edoid) has obligatory ATR harmony in small phrases (Aziza 2008, 2016). Vata has, in addition to its obligatory, bidirectional, and unrestricted word-internal ATR harmony, an optional leftwards cross-word ATR assimilation process, with certain vowel height restrictions. It must cross a word boundary, iterating across sequences of monosyllabic words but stopping at the final syllable of a longer
word (Kaye 1982). In Luo, [+ATR] spreads leftward to the preceding word within DPs and VPs, at least in some cases categorically (Swenson 2015).

Phrasal harmony processes offer insight into syntactic and prosodic constituency. In Akan (Kwa) the domain of assimilation is the maximal phonological phrase (Kügler 2015). [+ATR] spreads leftward from verbs to their objects but not to subjects, revealing a VP constituent. In Gua (Kwa) cross-word ATR harmony operates within minimal phonological phrases, with syntactic constituency playing a smaller role (Obiri-Yeboah and Rose 2022). The domain of Somali (Nilo-antine) ATR harmony has been claimed to be the clause (Hall et al. 1974; Andrzejewski 1955; Saeed 1999: 261), but recent studies identify it as a prosodic unit smaller than a phrase, albeit larger than a phonological word, with variation (Nilsson and Downing 2019; Downing and Krämer, this volume).

In Sawila (Alor), initial i causes subsequent /a/ to be pronounced as [e]. This applies both within a word and across a word boundary, e.g. /li'ja namu/ ljeneanu (Kratochvíl 2014).

In Wolof (Atlantic-Congo), ATR harmony applies between a lexical head and associated functional material within XP, even if other constituents intervene (Sy 2002). In (10) the [-ATR] verb joxee requires the [-ATR] forms ba ‘when’ and ma ‘me’ across intervening [+ATR] góór gë, and the [+ATR] verb yónné requires the corresponding [+ATR] forms bë, më across intervening [-ATR] xale ba.

(10) a. ba ma góór gë joxee téére ba when 1SG man the give book the ‘when the man gave me the book’ b. bë më xale ba yónné téére ba when 1SG child the send book the ‘when the child sent me the book’

Sande (2022) describes two cases of discontinuous vowel harmony similar to Wolof’s in Guébie (Kru) and Atchan (Kwa), both from Côte d’Ivoire. She observes that discontinuous harmony in all three languages arises by syntactic displacement of the target of harmony away from an originally adjacent trigger, and proposes an analysis within a cyclic, interleaved model of the syntax/phonology interface which explains this generalization. Her account reduces Wolof’s typologically anomalous phrasal ATR harmony process to the interaction of unremarkable syntax and local vowel harmony. It jibes well with the analysis of word-internal discontinuous harmony by post-phonological morpheme introfixation mentioned in section 17.6 above.

17.8 Conclusion

Because of its unbounded character, vowel harmony is a useful probe into word and sentence structure. It provides empirical evidence for morphological theories such as Distributed Morphology and Minimalist Morphology, which countenance

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4Following Sy, I cite examples in Wolof orthography, where i, u, é, ó, ë are [+ATR] vowels and e, a, o, ã are [-ATR] vowels.
morphemes and hierarchical constituency in words, and challenges theories such as Paradigm Function Morphology and Word-based morphology, which posit flat “a-morphous” word structure. Of special theoretical interest is discontinuous harmony, where phonology interacts cyclically with both the morphological and syntactic derivation.
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