Chapter 12

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Epiphenomenal and true non-iterative harmony

12.1 Introduction

In many cases, a vowel harmony process may generate outputs that, in turn, feed further application of the harmony process. In other words, vowel harmony often applies iteratively within some domain, often the word (van der Hulst & van de Weijer 1995; Casali 2008; Rose and Walker 2011; Walker 2012). However, iterative, word-delimited harmonies are not the only types attested in natural language. This chapter focuses on patterns that do not apply throughout an entire word (see Chapter 20, this volume for phrasal patterns).

Before attempting to say anything substantive, it is first necessary to define iterative, non-iterative, and bounded iterative harmony (1-3).

(1) Iterative harmony: a harmony pattern in which *every* potential featurally-defined target assimilates to [F].
(2) Non-iterative harmony: a harmony pattern in which *only one* featurally-defined target assimilates to [F].
(3) Bounded iterative harmony: a harmony pattern in which *n,* where $n > 1$, featurally-defined targets assimilate to [F].

The first pattern (1) is typically what we consider harmony (van der Hulst & van de Weijer 1995: 501-503). This is evident from the relative scarcity of discussion concerning types (2) and (3) in the various handbook chapters and overviews of vowel harmony (e.g., van der Hulst & van de Weijer 1995; Rose & Walker 2011; cf. Archangeli & Pulleyblank 2007: 367-368).

However, there is a relatively large body of work on iterativity within serial rule-based theories of phonology (Chomsky & Halle 1968 and subsequent work) as well as Optimality

Theory (henceforth, OT; Prince & Smolensky 2004). Early work in rule-based approaches explored how to derive non-iterative assimilation, proposing a variety of mechanisms to differentiate iterative from non-iterative patterns (Johnson 1972; Howard 1973; Jensen & Stong-Jensen 1973; Anderson 1974; Kenstowicz & Kisseberth 1977). While the architecture of many rule-based formalisms allows for direct representation of iterativity and non-iterativity, encoding non-iterativity is more challenging for OT, as noted in Kisseberth (2007). Kaplan (2008) responds to the challenges noted by Kisseberth with two claims: first, that OT cannot model true non-iterativity; second, OT should not model non-iterativity because all reported non-iterativity is derivable from some well-motivated, independent constraint interaction in the language. Thus, according to Kaplan (2008) all non-iterativity is epiphenomenal, and the fact that OT cannot generate it is a desirable result.

I evaluate these two claims below, focusing almost entirely on the second. In discussing the existence of true non-iterativity, I lay out four types of patterns that are analyzable without reference to non-iterativity, as well as a fifth type of pattern, true non-iterativity. I ultimately reject both of Kaplan's (2008) claims, arguing that true non-iterativity is attested, and that it can be generated in OT.

12.2 Types of non-iterative harmony

12.2.1 Domain-bounded harmony

Phonological patterns exhibit sensitivity to a range of word-internal domains, including morphological and prosodic domains. Among these, the foot provides a (typically binary) sub-word domain to delimit the operation of a number of harmonies. Consider the data from Veps (Uralic; Zaiceva 1981) in (4). Note that the description in Zaiceva (1981) differs from the description discussed in Chapter 67, this volume. In Southern Veps, the frontness of the initial-syllable vowel controls the frontness of second-syllable vowel, while no comparable effect occurs in the Central and Northern dialects. The fact that stress falls on the initial syllable in Veps renders the pattern consistent with harmony operating within a trochaic foot, e.g., (ký.zy).ma.ha (4a). Thus, it is possible to analyze the Veps data as either non-iterative or foot-bounded spreading of [+front]. In many similar cases, domain-bounded analyses are

extensionally equivalent to a non-iterative analysis. As a result, the sub-word pattern found in Veps does not provide clear evidence for true non-iterativity.

(4) Foot-bounded palatal harmony in Veps

	Southern	Central/Northern	Gloss
a.	kýzy-ma-ha	kýzu-ma-ha	ask-INF.3-ILL
b.	nælktyda	nælktuda	be.hungry
c.	læmptæʃkandob	læmptaʃkandob	fills.up

Another case of foot-bounded harmony is found in Kera (Chadic; Pearce 2006; 2007; Chapter 48, this volume), where the head of an iambic foot controls the realization of frontness of the non-head. More generally, among the word-internal forces that interact with harmony, metrical structure has played a significant role in previous work (Halle & Vergnaud 1981; van der Hulst & Smith 1982; Abu-Salim 1987; Hualde 1989).

12.2.2 Prominence-targeting harmony

In other cases, the trigger for harmony may occur in a weak position, triggering assimilation of a stronger position. This is precisely the analysis of metaphony patterns developed in Walker (2005, 2011; see Chapters 8, 68, and 69, this volume). Consider the data from Grado (Italo-Romance) in (5). In the left-hand column, stressed mid vowels are followed by non-high vowels. However, in the right-hand column, when these same mid vowels are followed by high vowels, they raise to high. In (5a,b), [+high] affects the initial/penultimate vowel in disyllabic words. Thus, it is not possible from these data to determine whether [+high] spreads throughout the entire word, up to the stressed mid vowel, or just one syllable leftward. In (5c) though, it is clear that raising does not extend throughout the entire word. Furthermore, (5d) demonstrates that stress determines the extent of [+high] spreading. The pattern in (5a-c) only appears to be non-iterative because the trigger and target are in adjacent syllables. Walker argues that the [+high] feature of the post-tonic vowel is licensed only by affiliation with a prominent position, the stressed syllable in Grado. Her analysis is thus able to generate the pattern without reference to

iterativity. It is worth noting that while foot-based and non-iterative analyses of Veps above generate the same outputs, a non-iterative analysis of Grado fails to predict forms like (5d).

(5) Stress-targeting metaphony in Grado (Walker 2005: 924-926)

	[-high] post-tonic vowel		[+high] post-tonic vowel	
a.	mét-o	put-1.SG	mít-i	put-2.SG
b.	rénd-e	return-3.SG	ríND-i	return-2.SG
c.	odorós-o	odorous-M.SG	odorús-i	odorous-M.PL
d.	ʃóven-e	young.man-M.SG	ʃúvin-i	young.man-M.PL

Kaplan (2008; 2015) discusses a number of similar patterns, including umlaut in German and Chamorro, as well as ATR harmony in Lango. He argues that in all of these the target of harmony is a prominent position, e.g., primary stressed syllable, or root. To the extent that this sort of analysis accounts for the facts in each language, direct reference to (non-)iterativity is unnecessary (see also Chapter 23, this volume).

12.2.3 Featural non-intersection

A third type of apparent non-iterativity emerges when the requisite features of triggers and targets of harmony do not intersect. Consider the example from regressive ATR harmony in Bengali (Indo-Aryan) in (6). In each case, a [-hi, -ATR] vowel surfaces as [+ATR] before a [+hi, +ATR] trigger. The requirement that triggers be [+hi] precludes any further propagation of [+ATR] since the harmonized mid vowel is not a possible trigger.

(6) Trigger-target non-intersection in Bengali (Mahanta 2008: 152-153)

	Unsuffixed	Gloss	Suffixed	Gloss
a.	pɔtʰ	way	potʰik	traveler
b.	pɔd	position	pɔdobi	position.holder
c.	ɔʃɔt	dishonest	ɔʃoti	dishonest.F

Consider two different rule-based characterizations of the Bengali pattern (7). Despite the fact that (7a) is formulated as non-iterative while (7b) is iterative, these two rules are extensionally equivalent. Since the targets of harmony can never be triggers, the iterative rule in (7b) will never actually feed itself.

(7) a. [+syllabic, -high, -low] → [+ATR] / ___ C_0 [+syllabic, +high, +ATR]; [-iterative]
b. [+syllabic, -high, -low] → [+ATR] / ___ C_0 [+syllabic, +high, +ATR]; [+iterative]

Similar patterns are found in Icelandic (Germanic) and Mayak (Nilotic), where high round vowels trigger rounding of low vowels (Anderson 1974; Andersen 1999).[1] In harmonies like these, iterativity is simply precluded by the conditions on triggers and targets.

12.2.4 Exceptional harmony

In some cases, only a given morpheme or a small set of morphemes may alternate for harmony. This stands in contrast to oft-discussed cases where harmony affects all morphemes in the relevant domain. The type of exceptional morpheme that yields surface non-iterativity is what Finley (2010) calls an *exceptional undergoer*. In Namangan Tatar (Turkic; Harrison & Kaun 2003), the causative suffix exceptionally undergoes rounding harmony if it agrees in height with the preceding vowel (8b,c). However, other affixes, like the privative and possessive affixes in (8d-f) do not undergo harmony though their vowels are also [-high].

(8) Exceptional rounding harmony in Namangan Tatar

	Word	Gloss
a.	ü-ter-ü	'kill-CAUS-GER'
b.	tot-tor-u	'catch- CAUS-GER'
c.	ör-dör-ü	'bark- CAUS-GER'
d.	boz-sëz	'ice-PRIV'
e.	boz-ëbëz	'ice-POSS.2PL'

[1] A well-discussed example of trigger-target non-intersection is n-retroflexion in Sanskrit, also called *nati*; (Whitney 1879; Allen 1951; Kiparsky 1985; Ryan 2017).

f. boz-ëm ‘ice-POSS.1SG’

In a language with exceptional undergoers, the result may appear to be non-iterative. That being said, if a language were to possess a set of exceptional undergoers that could co-occur, then one would expect to find harmony extending throughout those morphemes, unlike a truly non-iterative pattern. See Finley (2010: 1563-1564) for a list of more exceptional patterns.

12.2.5 True non-iterativity

The four previous patterns are all amenable to Kaplan’s analysis because in each, despite the superficial appearance of non-iterativity, the extent of harmony is definable in other terms. Generalizing from such patterns, Kaplan (2008) predicts that no pattern should exist where the extent of harmony depends on direct reference to non-iterativity. However, rounding hamrony in the Central dialect of Crimean Tatar robustly demonstrates true non-iterativity (Turkic; Kavitskaya 2010, 2013; McCollum & Kavitskaya 2018, 2021). Throughout, I compare the Central and Southern dialects. The data in (9) show the core pattern shared by both dialects – high vowels undergo rounding after a round vowel, in addition to a more pervasive pattern of backness harmony. As illustrated by the locative suffix, non-high vowels do not undergo rounding harmony in either dialect (see also Chapters 5 and 59, this volume). In (9), a variety of suffixes with high vowels undergo harmony in these two dialects, including the first- and third-person possessive, and adjectival suffixes,

(9) Rounding harmony in Southern and Central Crimean Tatar

	Gloss	NOM	LOC	POSS.1SG	POSS.3SG	ADJ
a.	salt	tuz	tuz-da	tuz-um	tuz-u	tuz-lu
b.	autumn	kyz	kyz-de	kyz-ym	kyz-y	kyz-ly
c.	dust	toz	toz-da	toz-um	toz-u	toz-lu
d.	eye	køz	køz-de	køz-ym	køz-y	køz-ly

However, in words with more than one non-initial high vowel, the patterns in these two dialects diverge (10). Whereas the Southern dialect spreads lip rounding to all non-initial high vowels, the Central dialect only rounds the second-syllable high vowel, suggesting there is only one underlying [+round] vowel in such cases. Observe that this holds true of words derived from monosyllabic (10a-f) and as well as disyllabic roots (10g-i). In both dialects, backness harmony holds regardless of vowel height.

(10) Non-iterative rounding harmony in Central Crimean Tatar

	Southern	Central	Gloss
a.	tuz-luɣ-u	tuz-luɣ-ɯ	salt-NMLZR-POSS.3SG
b.	kyz-lyg-y	kyz-lyg-i	autumn- NMLZR-POSS.3SG
c.	toz-luɣ-u	toz-luɣ-ɯ	dust- NMLZR-POSS.3SG
d.	køz-lyg-y	køz-lyg-i	eye- NMLZR-POSS.3SG
e.	tuz-luɣ-umuz	tuz-luɣ-ɯmɯz	salt- NMLZR-POSS.1PL
f.	køz-lyg-ymyz	køz-lyg-imiz	eye- NMLZR-POSS.1PL
g.	domuz-u	domuz-ɯ	pig- POSS.3SG
h	køʃyg-y	køʃyg-i	villa- POSS.3SG
i.	jyzym-y	jyzym-i	grape- POSS.3SG

In order to demonstrate that harmony in Central Crimean Tatar is truly non-iterative, it must be shown that the domain of harmony is not derivable from other factors. The most striking data to illustrate this point comes from invariantly [+round] suffixes, which show both that rounding does not always coincide with the left edge of the word, and that harmony may be initiated by roots or affixes.

The gerundial and collective suffixes, like initial-syllable round vowels, trigger harmony on a following high vowel (11). In (11a-c), the gerundial suffix triggers rounding on the third-syllable vowel despite the fact that the initial vowel is unrounded. Note also that harmony in (11c) operates between word-medial syllables only; neither the trigger nor target occurs at a word edge. In (11d), the first- and second-syllable vowels are underlyingly round, which results in a three-syllable span of rounding on the surface. These same generalizations hold for the collective suffix, as well (11e-g).

(11) Rounding harmony after GER and COLL in Central Crimean Tatar

a.	/as-uv-lɯ/	→	[as-uv-lu]	hang-GER-ADJ
b.	/aʧ-uv-ɯ/	→	[aʧ-uv-u]	open-GER-POSS.3SG
c.	/aʧ-uv-ɯ-dan/	→	[aʧ-uv-u-ndan]	open-GER-POSS.3SG-ABL
d.	/qoj-uv-ɯ/	→	[qoj-uv-u]	put- GER-POSS.3SG
e.	/bir-ju-ɯ-n/	→	[bir-jy-y-n]	one-COLL-POSS.3S-ACC
f.	/ek-ju-ɯ-n/	→	[ek-jy-y-n]	two-COLL-POSS.3S-ACC
g.	/yʧ-ju-ɯ-n/	→	[yʧ-jy-y-n]	three-COLL-POSS.3S-ACC

The data in (12) illustrate the construction of multiple non-iterative harmony domains. In (12c,d) harmony is triggered by both an initial-syllable [+round] vowel and the invariantly round GER suffix. In (12c), both the initial-syllable and the third-syllable [+round] vowels trigger harmony on the following high vowels, resulting in a four-syllable span of round vowels. In (12d,e), longer words show that the four contiguous [+round] syllables in (12c) must be derived from two separate instances of non-iterative harmony.

(12) Multiple instances of non-iterative harmony within a single word

a.	/tol-dɯ/	→	[tol-du]	fill-PST.3SG
b.	/tol-dɯr-dɯ/	→	[tol-dur-dɯ]	fill-CAUS-PST.3SG
c.	/tol-dɯr-uv-ɯ/	→	[tol-dur-uv-u]	fill-CAUS-GER-POSS.3SG
d.	/tol-dɯr-ɯl-uv-ɯ/	→	[tol-dur-ɯl-uv-u]	fill-CAUS-PASS-GER-POSS.3SG
e.	/tol-dɯr-ɯl-uv-ɯ-nɯ /	→	[tol-dur-ɯl-uv-u-nɯ]	fill-CAUS-PASS-GER-POSS.3SG-ACC

The pattern in Central Crimean Tatar is strikingly clear, and it is not the only attested case of truly non-iterative harmony. A number of other languages with similar patterns are attested. In Kazakh and Karakalpak (Turkic), rounding is generally non-iterative, but harmony in Kazakh is also subject to a number of other constraints (Menges 1947; Balakaev 1962; McCollum 2018). Moreover, in Noghay (Turkic), Baskakov (1940:11) describes three domains

of rounding: no harmony, non-iterative harmony, and iterative harmony. He illustrates with the underlying form /kyn-lAr-ImIz-GA/ 'day-PL-POSS.1PL-DAT'. Harmony may result in one of the three following forms: rounding on the first syllable only [kynlerimizge], rounding on the first two syllables [kynlørimizge], and rounding on all syllables [kynlørymyzgø]. Many of the patterns I know of come from Turkic. This is certainly a byproduct of my own biases, but note non-iterativity in two non-Turkic languages, Asia Minor Greek (Chapter 71, this volume; Revithiadou et al. 2017) and Kumam (Chapter 49, this volume; Hieda 2011: 5). While the pattern in Asia Minor Greek is likely contact-induced, the non-iterative ATR harmony pattern in the Nilotic language Kumam provides reasonable evidence that non-iterative vowel harmony is not genetically constrained. In addition to word-internal harmonies discussed here, a number of phrasal harmonies also exhibit non-iterativity, (Chapter 20, this volume; Ampofo & Rasin 2021; Obiri-Yeboah & Rose 2022).

Returning to Kaplan's (2008) claim, if non-iterative harmony is not always derivable from independent factors in a language, there appears to be no obvious way to sidestep encoding this fact in the grammar. In many cases, an analysis predicated on non-iterative feature spreading is extensionally equivalent to one in which the restriction follows from independent factors. However, in other cases, e.g., Central Crimean Tatar, the evidence clearly points to a grammatical distinction between iterative and non-iterative processes, supporting the necessary existence of iterativity and non-iterativity in the phonological grammar.

12.3 Bounded iterativity

If vowel harmony may trigger alternations on a single vowel within a given domain or iterate throughout that domain, an ancillary question arises – can vowel harmony trigger alternations on any *n* vowels within a given domain? Although there is some evidence that tonal patterns may be able to count beyond two (Marlo et al. 2015), there is very little evidence that harmony may operate with *n*-ary domains. Perhaps the most suggestive evidence comes from one of the languages already discussed, Veps (see also Noonan 1992: 32, 79 for evidence from Lango (Nilotic)). In (4), Veps is presented as foot-bounded harmony, which is consistent with the transcriptions in Zaiceva (1981). However, Zaiceva (1981: 306) states, "Vowel harmony in the Veps language is only partial. It is most widely represented in the Southern dialect. However,

there it does not spread beyond the second or third syllable." If harmony may optionally target a third syllable in Veps, then one might expect harmony within a three- or four- or even five-syllable domain (see Chapter 67, this volume for more on Veps). However, in the absence of conclusive evidence supporting such a domain in harmony, I leave the question of bounded iterativity to further work.

12.4 Analyzing non-iterativity

The claim advanced herein – that non-iterativity is not emergent – has significant theoretical consequences. In most rule-based formalisms, encoding non-iterativity is unproblematic, as these formalisms have dedicated parameters by which to control the iterativity of a given rule. For OT however, this is a real challenge. Since markedness constraints have access only to surface structures, there is no straightforward way to distinguish whether a particular [+F][-F] sequence derives from /[+F][-F]/ or from /…[-F][-F]/. In the first case, [+F][-F] surfaces as the faithful output to the input string without any harmony. In the second case, surface [+F][-F] is due to the assimilation of the first but not the second underlying [-F] element. There is no ranking of a basic faithfulness and harmony-driving markedness constraint that can generate non-iterative harmony. Consider the tableau below for [tuz-luɣ-ɯ] from (11b) in Central Crimean Tatar (13). If the markedness constraint driving harmony outranks the relevant faithfulness constraint, iterative harmony is generated, as in Southern Crimean Tatar. If, however, the ranking is reversed, no harmony is preferred; the non-iterative candidate is collectively harmonically bounded, and no ranking of these constraints can motivate non-iterative harmony.

(13)

/tuz-lɯq-ɯ/	*[+RD][+HI, +RD]	IDENT-IO[RD]	
tuz-lɯɣ-ɯ	*!*		*no harmony*
tuz-luɣ-ɯ	*!	*	*non-iterative harmony*
☞ tuz-luɣ-u		**	*iterative harmony*

However, the inability to generate non-iterative harmony in (13) is really due to the particular constraints invoked, not the larger constraint-based formalism. McCollum &

Kavitskaya (2022) as well as McCollum (2022) demonstrate that a variety of constraint-based theories of harmony can generate non-iterative assimilation.

12.5 Conclusion

I thus disagree with both of Kaplan's (2008) claims. First, it is clear that non-iterativity does not always fallout from the kinds of independent forces discussed above. Rather, based on the presence of patterns like rounding harmony in Central Crimean Tatar, I conclude that all non-iterativity is not epiphenomenal. Second, while Kaplan contends that OT cannot generate non-iterative patterns, this issue depends entirely on the particular constraints used. In a number of cases, existing constraints and representations can readily model patterns that are extensionally similar to a serial rule-based account of non-iterative harmony.

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