

Non-iterative Vowel Harmony in Crimean Tatar

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1. Introduction

Vowel harmony is typically construed as local and iterative. Harmony is local because only syllable-adjacent vowels may interact, and iterative because repetitive local assimilation propagates the harmonic feature throughout the word. However, there are cases of non-iterative harmony reported in the literature (Kaplan 2008). In serial rule-based formalisms following Chomsky & Halle (1968; SPE), rule application is, by default, simultaneous. As a result, iterative harmony in SPE is usually implemented via a [+iterative] feature indexed to a given rule (Anderson 1974; Kenstowicz & Kisseberth 1977; Archangeli & Pulleyblank 1994). Thus, a progressive labial harmony rule might take on the form in (1).

- (1) Progressive labial harmony rule
[-consonantal, +syllabic] → [+round] / [+round] C₀ ____; [+iterative]

Crucially, in the most common derivational account of (non-)iterativity, a formal mechanism is employed that directly encodes iterativity as a phonological primitive. In contrast, no such phonological primitive is accessible to Optimality Theory (henceforth, OT; Prince & Smolensky 1993/2004), since evaluation is both global and parallel. As a result, it has been argued that canonical OT cannot model non-iterative phonology (Kisseberth 2007; Vaux & Nevins 2008). Observe in (2) an example of progressive rounding harmony using SPREAD-R[RD] (Padgett 1995) and IDENT-IO[RD] (McCarthy & Prince 1995). If SPREAD-R[RD] outranks IDENT-IO[RD], then iterative harmony is predicted, as in (2), and candidate (a) will win since it incurs no violations of SPREAD-R[RD].

(2)

Candidates	/tuz-luɣ-u/	SPREAD-R[RD]	ID-IO[RD]
a. 	tuz-luɣ-u		**
b.	tuz-luɣ-u	*!	*
c.	tuz-luɣ-u	*!*	

However, if the ranking is reversed, and IDENT-IO[RD] outranks SPREAD-R[RD], then the faithful candidate, candidate (c), will be optimal, since it incurs no violations of IDENT-IO[RD]. Crucially, there is no way for the non-iterative harmony candidate, candidate (b), to be optimal from these two constraints since candidate (b) incurs a violation of both constraints. In OT terms, candidate (b) is harmonically bounded.

Vaux & Nevins (2008) argue that non-iterative phonology cannot be accounted for in Optimality Theory. Kaplan (2008) counters Vaux & Nevins (2008), by contending that all non-iterative phonology is, in fact, emergent and epiphenomenal. In other words, OT cannot easily model non-iterativity because non-iterativity is always reducible to other factors. As a result, OT's inability to model non-iterativity is construed as a positive trait under this analysis. Among other factors, Kaplan argues that surface non-iterativity in vowel harmony may derive from the following three factors: non-intersecting sets of

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triggers and targets, prominence-targeting harmony, and word-internal domains. These three factors are exemplified below. In the topmost row of Table 1, regressive ATR harmony in Bengali only seems non-iterative because only [+hi, +ATR] vowels may trigger harmony and only [-hi] vowels may undergo harmony. In the middle row, ATR harmony in Lango, at least under Kaplan’s analysis, does not involve spreading, but rather affiliating the feature [+ATR] with the root. Since non-iterative harmony accomplishes this, the imperative is satisfied and further assimilation is unnecessary. Lastly, the regressive laxing harmony in Tudanca Spanish spreads leftward from the lax final vowel up to the stressed vowel and no further. This pattern, like that in Lango, instantiates prominence-targeting harmony, which Kaplan argues fundamentally differs from the typical unbounded spreading found in other vowel harmonies.

Table 1: Epiphenomenal non-iterativity in Kaplan (2008)

Factor	Example	Generalization	Example
Non-intersecting triggers and targets	Bengali ATR harmony (Mahanta 2007)	triggers are [+hi], but targets are [-hi]	/ɔʃot-i/ → [ɔʃot-i] ‘dishonest-FEM’
Prominence-targeted harmony	Lango ATR harmony (Woock & Noonan 1979; Noonan 1992)	[+ATR] must affiliate with root	/bòŋó-ní/ → [bòŋó-ni] ‘dress-2S.POSS’
Word-internal domain	Tudanca laxing harmony (Flemming 1994)	harmony occurs within a foot	/seká-lʊ/ → [seká-lʊ] ‘to dry him’

If all non-iterativity is epiphenomenal, then Kaplan’s analysis predicts that there should be some featural disjunction, prominence, or word-internal domain that harmony operates within for all cases of apparent non-iterative vowel harmony. In §2.1-3, we discuss the Central dialect of Crimean Tatar, which exhibits non-iterative labial harmony. We argue that this harmony pattern is not reducible to trigger-target disjunction, prominence or domain-related factors. Further, in §2.4, we demonstrate that a number of non-iterative labial harmony patterns are reported elsewhere among the world’s languages. We go on to show in §3 that OT can model non-iterative harmony, arguing that both former critiques of OT and Kaplan’s acceptance of them are unmerited.

2. Crimean Tatar

2.1. Background

Crimean Tatar (henceforth CT) is a Turkic language spoken primarily on the Crimean peninsula, but also by diaspora communities in Central Asia. Three major dialects, with various subdialects, have been described: Northern, Central, and Southern CT, with the Central dialect serving as the basis for the standard written language (Samoilovich 1916; Bogoroditskii 1933; Berta 1998; Kavitskaya 2010, 2013). Among the differences between these three dialects, the three exhibit differing patterns of labial harmony, which is the focus of the paper.

2.2. Vowel inventory and labial harmony

The Southern dialect of CT possesses eight phonemic vowels that parallel the phonemic set found in Turkish, /a o u e ø i y/ (Kavitskaya 2010, 2013). The Northern dialect possesses an additional vowel phoneme, /i/, and the contrast between /i/ and /i/ may also be present in the Central dialect, although it is only evident in a few words. For the eight vowels found in all three dialect, the features [back], [high], and [round] are sufficient to uniquely identify each phoneme.

As described in Kavitskaya (2010, 2013), and shown in (3) below, Southern CT, like Turkish, exhibits iterative labial harmony, Central CT exhibits non-iterative labial harmony, and Northern CT does not exhibit any labial harmony. Moreover, Northern CT optionally unrounds [+hi, +rd] vowels in initial syllables. In (3a-b), non-initial [-hi] vowels are unaffected by harmony, regardless of dialect. In

(3c-f), though, dialectal differences emerge. Southern CT exhibits iterative harmony, while Central and Northern CT exhibiting non-iterative, and no labial harmony, respectively.

(3) Labial harmony in CT

	Southern	Central	Northern	Gloss
a.	tuz-lar	tuz-lar	tuz-lar ~ tuuz-lar	salt-PL
b.	kyz-ler	kyz-ler	kyz-ler ~ kiz-ler	autumn-PL
c.	tuz-luɣ-u	tuz-luɣ-u	tuz-luɣ-u ~ tuuz-luɣ-u	salt-NMZR-POSS.3S
d.	kyz-lyg-y	kyz-lyg-i	kyz-lig-i ~ kiz-lig-i	autumn-NMZR-POSS.3S
e.	toz-luɣ-u	toz-luɣ-u	toz-luɣ-u	dust-NMZR-POSS.3S
f.	køz-lyg-y	køz-lyg-i	køz-lig-i	eye-NMZR-POSS.3S

The examples in (3) come from monosyllabic roots, but the disyllabic roots in (4) show the same patterns. Once again, in Southern CT, labial harmony targets all non-initial high vowels, whereas harmony in Central CT targets only the second-syllable high vowel. Note that in (3) the second-syllable vowel is a suffix but in (4) the target for harmony in Central CT is root-internal. Thus, morphological constituency cannot define the domain of harmony in Central CT. Also note that, like in (3), the Northern dialect does not propagate the feature [+rd] at all, irrespective of morphology.

(4) Labial harmony with disyllabic roots

	Southern	Central	Northern	Gloss
a.	burun-u	burun-u	buruun-u ~ muruun-u	nose-POSS.3S
b.	bojun-u	bojun-u	mojuun-u	neck-POSS.3S

In both (3) and (4), the triggering position is the initial syllable. As CT does not possess prefixes, we cannot evaluate the potential role of prefixes, but invariantly [+rd] suffixes do exist in the language, including an agentive suffix, /avuq/ ~ /vuɟ/ ‘AGT’ as well as a deverbal nominalizing suffix, /uv/ that we gloss as ‘GER.’ As a test for whether these non-initial vowels trigger harmony, we culled examples from two sources, one, a Crimean Tatar website with a dictionary, sketch grammar, and library of poetry and prose (Alem-i medeniye; medeniye.org), and two, an online corpus of approximately 500,000 CT words (Kubedinov & Garabík 2015). Since the orthography encodes labial harmony and the orthography is based on the Central dialect, the orthographic practices evident in these two sources offer insight into harmony in Central CT. The suffix, /avuq/ ‘AGT’ was never followed by a [+hi] vowel, precluding the possibility of harmony. The suffix, /uv/ ‘GER’, though, did occur before [+hi] vowels, as in (5), and in every case, GER did not trigger labial harmony. The examples in (5a-b) show that this suffix is round regardless of root roundness. The example in (5c) shows a sequence of three round vowels, the first and third derive from their underlying specification and the second from harmony. In all three examples, though, GER does not trigger harmony.

(5) No labial harmony after /uv/

- a. al-uv-u ‘take-GER-POSS.3S’
- b. bil-dir-yv-i ‘know-CAUS.1-GER-POSS.3S’
- c. oqu-t-uv-nuɟ ‘read-CAUS.2-GER-GEN’

In summary, initial round vowels may trigger harmony in Southern and Central CT, but not in the Northern dialect. In Southern CT, this progressive labial harmony is iterative, but not in the Central dialect. Further, in the Central dialect, only the initial vowel may trigger harmony since underlying [+rd] suffixes do not trigger harmony on following suffixes, as demonstrated in (5).¹

¹ These facts suggest that edge prominence also plays a role in the harmony pattern, since root-final vowels and suffixes may not trigger harmony (see Beckman 1997; Walker 2011; Essegbey & McCollum 2017 for discussion of edge prominence).

2.3. Is this non-iterativity real?

The data in §2.2 suggest that, at least superficially, Central CT exhibits non-iterative harmony. This subsection compares the pattern in Central CT with the analysis presented in Kaplan (2008), arguing that the two-syllable domain of harmony is not reducible to other factors in the language. Recall from Table 1 the three factors most relevant for the apparent non-iterativity in Central CT, non-intersecting triggers and targets, prominence-targeted harmony, and word-internal domains.

First, in Bengali, ATR harmony is only non-iterative because the set of triggers and targets do not overlap. In CT, though, [+hi] vowels both trigger and undergo harmony, as seen in (3c-f). Therefore, this non-iterativity is not reducible to disjoint triggers and targets.

Second, in Lango, Kaplan argues that ATR harmony propagates leftward from the [+ATR] suffix to the rightmost root vowel in order to affiliate the feature [+ATR] with the root. Thus, harmony in Lango is really featural licensing and not spreading (see also Walker 2011; Kaplan 2015). However, in CT, the prominent position triggers harmony rather than undergoing harmony. The initial syllable is prominent, both morphologically and phonologically. Morphologically, the left edge of the word is always the morphological root. Phonologically, this position can host all phonemic contrasts while other positions can host only a subset of contrasts. As for the second syllable, this position is often word-medial and exhibits no discernible prominence. Given these facts, non-iterative harmony in Central CT does not appear to be prominence-targeting, since the trigger for harmony is prominent, in opposition to Lango.

Third, as in Tदानca Spanish, a number of harmony patterns operate within a sub-word domain. In some languages, vowel and consonant harmony are known to operate within morphological roots only (Archangeli & Pulleyblank 2007; Hansson 2010). In Central CT, though, harmony may cross morpheme boundaries, as shown in (3c-f). There is no independent evidence to support dividing the word in CT into strata beyond root and suffix, so there is no intuitively plausible domain within which harmony operates in the Central dialect. Prosodically, though, it is possible that harmony is bounded by a foot in Central CT. For this to be the case, though, there must be evidence that stress falls on the initial or penultimate syllable in the language. However, Kavitskaya's (2010, 2013) description of stress as word-final in CT is problematic for such an analysis. The reported stress pattern is exemplified in (6).

(6) Stress in CT

- | | | |
|----|-----------------------|-------------------------|
| a. | arabá | 'cart.NOM' |
| b. | araba-lár | 'cart-PL.NOM' |
| c. | araba-lar-u-m-úuz | 'cart-PL-POSS-1-PL.NOM' |
| d. | araba-lar-u-m-uuz-dán | 'cart-PL-POSS-1-PL-ABL' |

Two pieces of phonological evidence provide additional support to Kavitskaya's claim. First, vowel syncope optionally targets non-final high vowels. The process, which Kavitskaya interprets as post-lexical, may target initial vowels, too, obscuring the surface source for harmony in many cases, as demonstrated in (7). In (7a-c), an initial high vowel is elided, whereas in (7d-e), a medial vowel is elided.

(7) Vowel syncope in CT

- | | | | | |
|----|--------------|---|------------|-----------------|
| a. | /tykuur-maq/ | → | [tkyr-mek] | 'spit-INF' |
| b. | /qusqa/ | → | [qsqa] | 'short' |
| c. | /if-la-maq/ | → | [f-le-mek] | 'work-VRB-INF' |
| d. | /al-du-lar/ | → | [al-d-lar] | 'take-PST.3-PL' |
| e. | /ep-u-m-uuz/ | → | [ep-m-iz] | 'all-POSS-1-PL' |

However, there are no cases of final vowels undergoing syncope.² Vowel syncope facts, thus, suggest that final syllables exhibit some prominence relative to other positions. Further, there are a number of pre-stressing suffixes in the language. These suffixes shift the default final stress onto the preceding

² Kavitskaya (2010:30) notes that the converb may undergo syncope, but we analyze the high vowel realized on the converb as epenthetic rather than underlying (see also McCollum 2016).

syllable, which is shown for the non-past copular suffixes in (8) below. In (8a-b), the word-final vowel receives stress in the past tense, but in (8c-d), the copular endings for the non-past tense shift stress leftward to the preceding syllable.

- (8) Pre-stressing copular suffixes
- | | | |
|----|-------------|----------------|
| a. | al-dú-q | ‘take-PST-1P’ |
| b. | al-du-ŋ-ú-z | ‘take-PST-2-P’ |
| c. | al-á-mu-z | ‘take-NPST-1P’ |
| d. | al-á-su-z | ‘take-NPST-2P’ |

The sheer presence of such morphemes, which are widely attested in Turkic (Johanson & Csató 1998), further suggests that the locus of stress is the right edge of the word. With this in mind, it is clear that the domain of stress and the domain of labial harmony are not co-extensive in Central CT. Consider (9), where the probable foot structure and domains of harmony are compared. Feet are marked by parentheses and the domain of harmony is marked by an underline. In disyllabic words, like (9a), the two domains are co-extensive, but in longer words the two diverge. In (9b), harmony spans the first two syllables while footing demarcates the final two syllables, with the medial syllable occurring in both domains. In (9c-d), though, footing and harmony are completely disjoint.

- (9) Comparing the domain of stress and labial harmony in Central CT
- | | | |
|----|---------------------------------|------------------------------|
| a. | (<u>tuz.luq</u>) | ‘salt-NMZR’ |
| b. | <u>tuz</u> (lu.ɣu) | ‘salt-NMZR-POSS.3S’ |
| c. | <u>tuz.luq</u> .la(ru.mu-z) | ‘salt-NMZR-PL-POSS-1-PL’ |
| d. | <u>tuz.luq</u> .la.ru(mu-z.dan) | ‘salt-NMZR-PL-POSS-1-PL-ABL’ |

Since there is no evidence for rhythmic stress, there is no reason to propose iterative footing. Furthermore, even if iterative feet were proposed, the domain of harmony in odd-syllable words, like (9b-c) would defy a foot-based analysis. Recourse to an unbounded foot does not resolve the matter, either, since in words of more than two syllables, the two-syllable domain of harmony and the unbounded foot would not align. Therefore, appealing to a word-internal prosodic domain like the foot is not appropriate for Central CT.

In sum, non-iterative vowel harmony attested in Central CT is not reducible to other factors. In §2.4 we describe cases of non-iterative in several other languages, contending that non-iterative vowel harmony is not unique to Central CT.

2.4. Other instances of non-iterative vowel harmony

In addition to labial harmony in Central CT, a number of other non-iterative vowel harmonies counterexemplify Kaplan’s claim that all non-iterativity is epiphenomenal. Two related languages instantiate almost parallel labial harmony patterns, Karakalpak (Menges 1947) and Kazakh (Balakaev 1962; McCollum 2016). In the variety of Kazakh described by Balakaev, underlying [+rd] vowels, even non-initial [+rd] vowels, trigger harmony on the following syllable, as shown below in (10). In (10a), the second syllable of a disyllabic root undergoes harmony, but the third-syllable suffix does not. In (10b), the second-syllable suffix undergoes harmony, but the third-syllable suffix does not. Thus, harmony from a [+rd] root affects a second syllable only, regardless of morphology. Note in (10c), the invariantly [+rd] GER triggers harmony in Balakaev’s data. In (10d), the Russian loan, /kino/ ‘movie’ is also able to trigger harmony, like GER. In both (10c-d), non-initial round vowels may trigger harmony on a following syllable, just like initial-syllable triggers.

- (10) Labial harmony in Kazakh (Balakaev 1962:102,115,117)
- | | | | | |
|----|-----------------|---|-----------------|------------------------|
| a. | /mojən-də/ | → | [mojʊn-də] | ‘neck-ACC’ |
| b. | /tʊr-məs-ə-nəŋ/ | → | [tʊr-mʊs-ə-nəŋ] | ‘live-NMZR-POSS.3-GEN’ |
| c. | /ber-uw-ə/ | → | [ber-ɣw-ɣ] | ‘give-GER-POSS.3’ |
| d. | /kino-m-əz-dəŋ/ | → | [kino-m-ʊz-dəŋ] | ‘movie-POSS.1-PL-GEN’ |

Alongside these genetically related languages, several varieties of Greek spoken in Asia Minor exhibit non-iterative regressive backness harmony (van Oostendorp & Revithiadou 2005). In Megisti Greek, final vowels trigger assimilation of penultimate vowel, as shown in (11). In (11a-b), stress is word-final, but in (11c-d) and (11e-f) stress is penultimate and antepenultimate, respectively. Regardless of where stress falls, the penultimate vowel undergoes assimilation to the backness value of the final vowel. Thus, the placement of stress has no bearing on this regressive harmony pattern. Also, observe that forms like (11b-c) show harmony from a suffix to a root, while forms like (11a,d) show harmony within a root, demonstrating that morphological constituency, like prosodic constituency, is orthogonal to harmony in Megisti Greek.

(11) Regressive backness harmony in Megisti Greek

a.	/zervjá/	→	[zarvjá]	‘left’
b.	/sits-á/	→	[sutsá]	‘fig.tree-NOM.F’
c.	/zíl̥j-a/	→	[zúl̥ja]	‘jealousy-NOM.F’
d.	/anófli/	→	[anéfli]	‘lintel’
e.	/ágir-a/	→	[águra]	‘anchor-NOM.F’
f.	/kalójer-os/	→	[kalójoros]	‘monk-NOM.M’

Since the pattern described for Central CT in §2.2 above is not limited to CT, or even to Turkic labial harmony, but rather is attested by at least one regressive backness harmony, too, we conclude that this non-iterativity is not a marginal case. Instead, non-iterative vowel harmony is real and deserves a formal analysis. In the following section we show that multiple OT harmony-driving constraints can model non-iterative vowel harmony.

3. Analysis

We demonstrated in (2) that, given a constraint like SPREAD-R[RD] and a faithfulness constraint like IDENT-IO[RD], either full harmony or no harmony are possible in canonical OT. Crucially, the non-iterative harmony candidate in (2) is harmonically bounded. This, however, is not the only possible scenario in OT. We demonstrate in this section that at least two harmony-driving constraints can account for the data in Central CT, Mahanta’s (2007) sequential markedness constraints, and Walker’s (2011) maximal harmony constraints.³

3.1. Sequential markedness

Analyzing purely regressive ATR harmony in Bengali, Mahanta (2007) demonstrates that harmony can be modeled according to sequential markedness constraints that mandate that a certain feature, [+F], may not be preceded, or in our case, followed by [-F]. A progressive labial harmony-driving constraint is introduced in (12).

(12) * [+rd,-rd] assign a violation to every [+rd] vowel immediately followed by a [-rd] vowel.

Without any other modification, this constraint will mimic the SPREAD-R[RD] constraint in (2), as seen in (14).⁴ Like the tableau in (2), if the harmony-driving constraint outranks faithfulness, then iterative harmony is predicted. If that ranking is reversed, the faithful candidate is predicted to surface, since the non-iterative candidate violates both the harmony-driving constraint and the relevant faithfulness constraint.

³ We assume a high-ranked positional faithfulness constraint (Beckman 1997) throughout the analysis.

⁴ This constraint does differ from SPREAD in that it demands local spreading while SPREAD does not.

(13) Iterative harmony from a sequential markedness

Candidates	/tuz-luɣ-u/	*[+RD,-RD]	ID-IO[RD]
a. \wp	tuz-luɣ-u		**
b.	tuz-luɣ-u	*!	*
c.	tuz-luɣ-u	*!	

If, however, we further specify the context to include the left edge of the word, as in (14), then we can account for the non-iterativity in Central CT.

- (14) $*#[+rd,-rd]$ assign a violation to every [+rd] vowel in the initial syllable immediately followed by a [-rd] vowel.

This constraint motivates harmony only from initial-syllable vowels only, and since the second-syllable vowel is not at the left edge of the word, it does not trigger harmony on subsequent vowels (see Mahanta 2007:163-165). Candidates (a-b) in (15) do not violate this positional harmony-driving constraint, and since candidate (b) only violates IDENT-IO[RD] once, the non-iterative harmony candidate is optimal under this ranking.

(15) Non-iterative harmony from positionally-sensitive sequential markedness

Candidates	/tuz-luɣ-u/	*#[+RD,-RD]	ID-IO[RD]
a.	tuz-luɣ-u		**!
b. \wp	tuz-luɣ-u		*
c.	tuz-luɣ-u	*!	

Although this works for Central CT, this constraint set would need further development to account for the Kazakh data in (11) since this positionally-sensitive constraint cannot motivate harmony from other positions, which is what we find in (11c-d). In the next subsection we discuss Walker's (2011) Maximal harmony constraint, which can account for both the positionally-restricted harmony in Central CT as well as the Kazakh data in (11).

3.2. Maximal harmony

Walker (2011, 2014) proposes a harmony driving constraint that directly links the triggering context to every other position in the domain for harmony. Whereas more common OT harmony-driving constraints do not explicitly define how harmony obtains, Walker's constraint dictates that harmony involves a direct link between a single trigger and all possible targets. In other words, a vowel must directly associate with the context that initiates harmony. This is defined in (16) below.

- (16) \forall -HARMONY-R([RD]_{σ1},V) assign a violation to every vowel to the right of a [+rd] vowel in the initial syllable (σ1) that is not associated with [rd]_{σ1}.

As with sequential markedness, without modification this constraint produces full harmony, which we show in (17). Candidates (b-c) do not link every vowel to the initial-syllable instance of [rd], and consequently, are eliminated, leaving candidate (a), with full harmony, the winner.

(17)

Candidates	[rd] /tuz-luy-u/	\forall -HARMONY-R ([RD] _{σ_1} ,V)	ID-IO[RD]
a. 	[rd] \ \ \ tuz-luy-u		**
b.	[rd] \ tuz-luy-u	*!	*
c.	[rd] tuz-luy-u	*!*	

If Walker's constraint is supplemented with a constraint enforcing local association, ADJACENCY, defined below in (18), then it is possible to account for non-iterative harmony using her harmony-driver.

(18) ADJACENCY[RD] given a string Y, consisting of $V_1 \dots V_N$, assign a violation to every autosegmental linkage of [rd] between non-adjacent vowels, V_y and V_{y+2} .

In effect, ADJACENCY subsumes the NOGAP constraint from autosegmental models of phonology (Archangeli & Pulleyblank 1994), which prohibits transparency. This constraint differs from NOGAP in that NOGAP specifically bans non-adjacent sequences of some feature, [+F], across an intervening occurrence of [-F]. ADJACENCY militates against non-adjacent linkage of [+F] across an intervening [-F] as well as across an undergoing [+F]. Generally, it is important to allow NOGAP, as the more specific constraint, to outrank ADJACENCY. If the two constraints are conflated, this predicts that languages that ban transparency also ban iterative spreading, which is a clearly false.

In (19), the highly-ranked ADJACENCY constraint rules out the iterative harmony candidate, since linking the third-syllable vowel with the initial vowel involves non-local association. After ruling out candidate (a), candidate (b), the non-iterative harmony candidate, is preferred over candidate (c) because \forall -HARMONY-R([RD] _{σ_1} ,V) >> IDENT-IO[RD].

(19)

Candidates	[rd] /tuz-luy-u/	ADJACENCY[RD]	\forall -HARMONY-R ([RD] _{σ_1} ,V)	ID-IO[RD]
a.	[rd] \ \ \ tuz-luy-u	*!		**
b. 	[rd] \ tuz-luy-u		*	*
c.	[rd] tuz-luy-u		*!*	

To get a better idea of how ADJACENCY and \forall -HARMONY-R([RD] _{σ_1} ,V) interact, consider (20), where the constraint violations for a number of possible representations are compared. Structures (a-d) all involve [F] linked to the leftmost vowel, while structures (e-f) involve [F] underlyingly associated with the medial vowel. Structures with full harmony, structures (a) and (e), violate ADJACENCY. Structures with transparency, like (c), also violate ADJACENCY. Non-iterative harmony, as in (b) and (f), and the faithful input-output mapping, shown in (d) do not violate this constraint.

(20)

	Structures Constraints	a.	b.	c.	d.	e.	f.
		[F]	[F]	[F]	[F]	[F]	[F]
		\ \	\	/ \		/ \	\
		v v v	v v v	v v v	v v v	v v v	v v v
Violations	ADJACENCY[F]	1	0	1	0	1	0
	∇-HARMONY-R ([F],V)	0	1	1	2	0	0

If the constraint in (18) is modified to remove the positional restriction that the trigger is in the initial syllable, then, in tandem with ADJACENCY, these two constraints can also account for the Kazakh pattern in (11). In addition, this set of constraints predicts that bidirectional non-iterative harmony should not occur. Bidirectional non-iterative harmony would result in a three-syllable domain for harmony, and as far as we are aware, there are no languages that show this pattern..

This section has presented two possible analyses of non-iterative labial harmony in Central CT using sequential markedness and ∇-HARMONY constraints. In addition to these constraint sets, there are others, including Agreement-By-Correspondence (Rose & Walker 2004; Sasa 2009; Rhodes 2012) and Headed Spans (McCarthy 2004) that offer plausible alternatives to those explored in this section. It is important to remember that the point of this exploration has not been to argue for one particular constraint set, but rather to demonstrate that OT, even without formal primitives like [±iterative], can account for non-iterative harmony.

4. Conclusion

In this paper we have argued that labial harmony in the Central dialect of Crimean Tatar is non-iterative. Further, we have argued that Kaplan's (2008) argument that all non-iterativity is emergent is incorrect, since the domain of harmony in Central CT cannot be reduced to morphological, prosodic, or featural factors. Rather, Central CT, like at least several other languages, demonstrates that non-iterative vowel harmony is real and requires a formal account. To this end, in §3, we showed that several harmony-driving constraints are capable of modeling non-iterative harmony in OT. Given this result, both derivational and optimization-based theories of phonology can account for non-iterative vowel harmony.

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