position followed by back vowels lose their aspiration, whereas in district 2 labial and dental voiceless plosives lose their aspiration in word/syllable initial position as well as in medial position. Brendemoen's account of this situation is a historical one involving language contact with Greek, which has unaspirated voiceless stops, over an extended period of time. His view is that the behaviour of the plosives in the two districts represents different stages in the historical development of initial stops.

We hope that the articles in this issue represent a good part of the current spectrum of research related to phonological issues in Turkish and will contribute to the generation of new ideas and new questions.

References

Akkaya, Ş. M. (1936). *Türk fonetiği.* Devlet Matbaası.

Boeschoten, H., & Verhoeven, L. (Eds.). (1991). *Turkish linguistics today.* Leiden: Brill.

Demircan. Ö., & Erözde, A. (1990). Dil üzerine yayınlar ve incelemeler (Bir kaynakça derlemesi). *Dilbilim Araştırmaları* (pp. 192-296). Ankara Hitit Yayınevi.

Elöve, A. U. (trans). (1941). *Türk dili grameri (Osmanlı lehçesi).* Istanbul: Maarif Matbaası.

Goldsmith, J. (1992). A note on the genealogy of research traditions in modern phonology. *Jounal of Linguistics, 28,* 194-163.

Inkelas, S. (2011). Another look at velar deletion in Turkish. In E. Erguvanlı Taylan & B. Rona (Eds.), *Puzzles of language. Essays in honour of Karl Zimmer* (pp. 37–53). Wiesbaden: Harrassowitz.

Lees, R. (1961). *The phonology of modern standard Turkish.* Bloomington: Indiana University and The Hague: Mouton and Co.

Waterson, N. (1970). Some aspects of the phonology of nominal forms of the Turkish word (first published in 1956). In F. R. Palmer (Ed.), *Prosodic analysis* (pp. 174-188). London: Oxford University Press.

Sezer, E. (1981). The k/Ø alternation in Turkish. In G. N. Clements (Ed.), *Harvard studies in phonology* (pp. 354–382). Bloomington: Indiana University Linguistics Club.

Swift, L. B. (1963). *A reference grammar of modern Turkish.* Bloomington: Indiana University and The Hague: Mouton and Co.

van der Hulst, H., & van der Weijer, J. (1991). Topics in Turkish phonology. In H. E. Boeschoten & L. T. Verhoeven (Eds.), *Turkish linguistics today* (pp. 11-60). Leiden; Brill.

Patterns of Defective Labial Vowel Harmony in Turkic Languages*

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Abstract

In this article, largely based on data from Korn (1969) and Kaun (1995, 2004), we examine patterns of labial harmony with special reference to their occurrence in Turkic languages. In Turkic languages, but also in other (sub)families of languages, labial harmony often co-occurs and interacts with other properties of vowels, some also harmonic (such as palatality), others not (such as vowel height). This article proposes an account of these interactions within Radical CV Phonology (van der Hulst, 2005, 2012ab), a framework which uses unary elements and dependency and licensing relations among these. By investigating the diversity in the conditions governing labial harmony in Turkic languages, we will show that labial harmony is subject to two general constraints. These conditions on the licensing of harmonic elements create a restricted typology of labial harmony, in which the systematic absence of certain patterns is explained.

Keywords: vowel harmony, labial harmony, licensing, government phonology, radical cv phonology, dependency phonology

1. Introduction

Many Turkic languages display unrestricted *palatal harmony.*[1] Consider data from Turkish in (1): the plural suffix displays an alternation between surfacing

* This article, which is based on unpublished work by van der Hulst (van der Hulst, ms., in prep) and recent joint work by both authors, captures our shared current views. As such it presents a 'merger' of ideas presented in Moskal (in press a, in press b, 2012) and van der Hulst (ms., 2012ab, in prep.).

[1] It should be noted that in this paper, we focus on root-suffix alternations and largely ignore root-internal vowel harmony. Consonant-vowel interactions will not be discussed either. Furthermore, in most languages vowel harmony is not absolute in the sense that there are invariable suffixes of both harmonic classes. In addition, some vowels can fail

with a front vowel and with a back vowel; in particular, in the left column, the vowel of the plural suffix is front, [l^{j}er], but in the right column it is back, [lar].

(1) *Unrestricted palatal harmony*

ip-l^{j}er	'rope-pl'	kɨz-lar	'girl-pl'
yüz-l^{j}er	'face-pl'	pul-lar	'stamp-pl'
el^j-l^{j}er	'hand-pl'	sap-lar	'stalk-pl'
k^{j}öy-l^{j}er	'village-pl'	son-lar	'end-pl'
		(Turkish; Clements & Sezer, 1982)	

The choice of the plural allomorph is governed by the immediately preceding vowel: when the preceding vowel (the trigger) is front, the suffix vowel (the target) is front; when the trigger is back, the target is back.

In addition to palatal harmony, Turkic languages also often have labial harmony. However, this type of harmony displays a more restricted distribution.[2] For instance, in Yakut (Krueger, 1962) and Kazakh (Korn, 1969) we see that low (target) vowels do not always undergo labial harmony. In Yakut, labial harmony for low targets is only observed when both the trigger and the target vowel are low and hence not when the trigger is high and the target is low:

(2) *Labial harmony only when both trigger and target are low*

künnük-ter	(*künnük-tör)	'window-pl'	
börö-lör		'wolf-pl'	
kuul-lar	(*kuul-lor)	'sack-pl'	
oyo-lor		'child-pl'	(Yakut; Krueger, 1962)

However, when the target vowel is high, labial harmony is always observed, i.e. both when the trigger is high or low:

to harmonize because they lack a *harmonic counterpart* in the vowel system. It is important to note that such systems are not 'defective' in the sense considered here. Specifically, we take 'defective' to refer to a situation where vowel harmony fails to apply while the vowel inventory would allow for application of vowel harmony.

[2] We assume labial harmony to encompass both the labialization of high vowels as well as low vowels (as in Clements & Sezer, 1982; Dresher, 2009; van der Hulst & van der Weijer, 1995; Kaun 1995, 2004; Nevins, 2010; Steriade, 1981, among others).

(3) *Labial harmony when the target is high*

tübbüg-ü	'window-acc'	
börön-ü	'wolve-acc'	
murun-u	'nose-acc'	
ox-u	'arrow-acc'	(Yakut; Krueger, 1962)

In short, there is no labial harmony from high vowels to low vowels (see 32).

Similarly, in Kazakh, when the target vowel is low, labial harmony shows a dependency on trigger and target both being front:

(4) *Labial harmony only when both trigger and target are front*

üj-dö		'house-loc'	
köl-dö		'lake-loc'	
kul-da	(*kul-do)	'servant-loc'	
son-dan	(*son-don)	'rubble-loc'	(Kazakh; Korn, 1969)

When the target is high, labial harmony always applies:

(5)

üj-dü	'house-acc'	
köl-dü	'lake-acc'	
kul-du	'servant-acc'	
koy-du	'sheep-acc'	(Kazakh; Korn, 1969)

In this case labial harmony is partly defective in back words only (see 36b).

It would seem then that in both Yakut and Kazakh labial harmony is somehow dependent on height properties of trigger and target, and, in Kazakh, on their front/back properties as well.

The central topic of this article is the investigation into the conditions that govern defectivity in labial harmony, as in (2) and (4). In the next section, we first introduce the framework of Government Phonology (Kaye, Lowenstamm, and Vergnaud, 1985), and then close with data from Kachin Khakass, which are problematic for the model sketched in the first part. In section three, Radical cv Phonology (van der Hulst, 2005, 2012a) is shown to naturally account for the problematic data. In the fourth section, we discuss a typology of labial harmony, which is based on the insight that labial harmony is licensed by a 'prior' relation between trigger and target. The final section offers some closing remarks.

2. Standard Government Phonology[3]

In Government Phonology (GP), phonemes are composed of smaller atoms, so-called elements.[4] Following Kaye (1993), vowels are composed of three unary elements: |A|, |I| and |U|, which can occur on their own, as in (6a), or combine to form more complex structures, as in (6b).[5]

```
(6)  a. /a/   /i/    /u/
        A̲     I̲      U̲
     b. /e/   /o/
        A     A
        I̲     U̲
```

In such elemental structures, one element can be the head (indicated by underlining), or, alternatively, no head element is present. In other words, in GP headedness is used contrastively, which leads, for example, to a lexical contrast between an 'unheaded' |A| and a 'headed' |A̲| (see also section 3). Also, a combination of two elements can be headed or non-headed, leading, for example, to a three-way contrast between |A̲I| vs. |AI̲| vs. |AI| (see van der Hulst 2012a for a critical discussion of this three-way distinction). Vowel inventories of specific languages are subsets of the set of all possible vowels that could arise from combining elements. This means that there are language-specific combinatorial constraints, here called paradigmatic (or intrasegmental) *licensing constraints* which limit the set of all possible combinations to those occurring in a given language.

2.1 Vowel Harmony

Vowel harmony involves the syntagmatic (or lateral) licensing of an element, which, in effect, amounts to the element involved in alternations being (phonetically) interpreted *only when licensed* (Denwood, 2002). As such, trigger and target stand in a licensor and licensee relation, respectively.

Consider the representation of the Turkish plural suffix, which alternates between [ljer] and [lar] (see 1). It contains a low element |A| as well as a front

[3] For reasons of space, we present a somewhat simplified version of Government Phonology (for details see Kaye, 1993; Kaye, Lowenstamm, & Vergnaud, 1985, 1990).

[4] For discussion of the phonetic interpretability of elements, see Backley (2011), Harris (1994, chapter 3), Harris & Lindsey (1995).

[5] A very similar proposal was anticipated in Dependency Phonology; cf. Anderson and Ewen (1987).

element |I| in a headless combination.[6] ('N' = nucleus)

```
(7)  -lAr
      N
      |
      A
      I
```

Crucially, |A| in (7) is said to be lexically licensed, while |I| is not so licensed. As such, unless |I| is licensed in some other way it will not be interpreted.[7]

In roots that contain a front element |I|, N1 lexically licenses |I| in N1 and, as such, N1 is capable of licensing |I| (which is not lexically licensed) in N2; this effectively produces the result of harmony, resulting in a front suffix vowel:

```
(8)  ip   -    lʲer
     N    →    N
     |         |
     N1        N2
     |         |
               A
     |         |
     I̲         I̲
```

However, in roots that do not contain a front element, N_1 does not lexically license any |I| element and, as such, cannot license |I| in N_2. As a consequence, |I| is de-linked, resulting in a back suffix:

[6] In Charette and Göksel's (1994, 1996) framework, the presence of the front element |I| in suffixes results from *spreading* of the harmonic element from the preceding segment. However, in this section, the representations (such as *-lAr* in 6) are in line with Denwood (2002), who assumes that the harmonic element is present in the underlying representation of the alternating vowel but requires licensing by an element in the preceding segment (see below). This approach more closely resembles the approach we advocate in section 3.

[7] Note that Denwood does not provide a notation to indicate that an element is in need of licensing. See section 3 for a proposal in the context of Radical cv Phonology.

```
(9) kɨz  -  lar
     N  →  N
     |      |
     N1     N2
            |
            A
            ǂ
            I
```

In the next section, we will discuss labial harmony in Turkish as analyzed in the GP-model more fully, also taking into account the approach of Charette and Göksel (1996).

2.2 *Labial Harmony in Turkish*

The vowel inventory of Turkish is given in (10), together with the structural make-up as *per* GP (Charette & Göksel, 1996, p. 8):

```
(10) /i/  /e/  /ü/  /ö/  /u/  /o/  /ɨ/  /a/
          A         A         A         A
     I    I    I    I
               U    U    U    U
```

In Turkish, labial harmony is consistently observed when the target vowel is high (as in 11a) but it is not attested when the target vowel is low (as in 11b) (see 33):

(11) a. *High targets always display labial harmony*

yüz-ün	'face-gen'	
k^jöy-ün	'village-gen'	
pul-un	'stamp-gen'	
son-un	'end-gen'	(Turkish; Clements & Sezer, 1982)

b. *Low targets never display labial harmony*

yüz-l^jer	(*yüz-l^jör)	'face-pl'	
k^jöy-l^jer	(*k^jöy-l^jör)	'village-pl'	
pul-lar	(*pul-lor)	'stamp-pl'	
son-lar	(*son-lor)	'end-pl'	(Turkish; Clements & Sezer, 1982)

As argued in Charette and Göksel (1994, 1996) as well as in Denwood (2002), high targets always undergo harmony (labial as well as palatal), because high targets are represented as elementally 'empty'. That is to say, given that the elements |I| and |U| in target vowels are subject to palatal and labial harmony, respectively, these elements are, as such, not lexically licensed. As they contain no lexically licensed elements high targets are 'empty'.[8] Consequently, nothing prevents N_1 from licensing an element ε in N_2 if it lexically licenses such an element in N_1. In this approach, then, paradigmatic and syntagmatic (lateral) licensing are seen as two sides of the same coin (see also Scheer, 2010).

In (12), the nucleus N_1 in the roots *yüz-* and *k^jöy-* (lexically) licenses |I| and |U|, and, as such, N_1 can license |I| and |U| in the suffix (N_2), resulting in a front rounded variant of the genitive suffix:

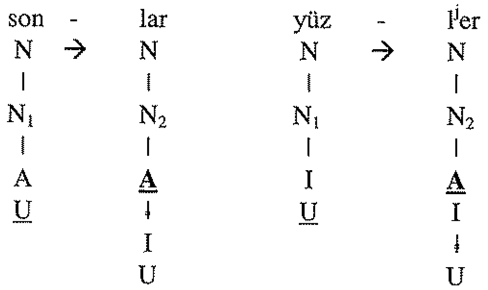
```
(12) yüz  -  ün        k^jöy  -  ün
      N   →  N           N    →  N
      |      |           |       |
      N1     N2          N1      N2
      |      |           |       |
      I      I           A       I
      U      U           I       U
                         U
```

When the root vowel contains a labial element |U| but no palatal element |I|, only labial harmony is observed (|I| is de-linked and thus not phonetically interpreted):

```
(13) pul  -  un        son  -  un
      N   →  N          N   →  N
      |      |          |      |
      N1     N2         N1     N2
      |      |          |      |
      U      U          A      U
             ǂ          U      ǂ
             I                 I
```

[8] Specifically, in Charette and Göksel's work, lateral licensing in this case literally *provides* the elements to an empty slot (cf. the case of low vowels in 7, where the element to be licensed is present in the alternating vowel). Denwood (2002), however, assumes that the alternating vowel contains the harmonic element lexically but that it is subject to licensing requirements. The exposition here conflates these two models and uses Denwood's representation (see also note 7). As such, the phrasing 'empty' refers to vowels that do not contain any *lexically licensed* elements. The model outlined in section 3 will not make such a difference: all alternating vowels contain the elements that require licensing.

However, low targets (11) differ from high targets in one crucial respect: whereas the latter were elementally empty, the former contain the element |A|. In effect, the presence of this element *in* N_2 prevents labial harmony.[9]

(14)


As we will see in the next section, though, the restriction of |A| blocking labial harmony is subject to cross-linguistic variation.

2.3 *Variation in Labial Harmony*

In contrast to Turkish, we saw that in Yakut low targets sometimes do undergo labial harmony; in particular, when trigger and target are both low (data are repeated from 2 above):

(15)	künnük-ter	(*künnük-tör)	'window-pl'	
	börö-lör		'wolf-pl'	
	kuul-lar	(*kuul-lor)	'sack-pl'	
	oɣo-lor		'child-pl'	(Yakut; Krueger, 1962)

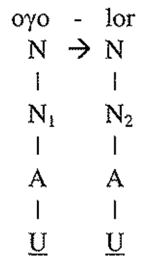
However, as we saw above, when the target vowel is high, labial harmony is always observed:

(16)	tübbüg-ü	'window-acc'	
	börön-ü	'wolf-acc'	
	murun-u	'nose-acc'	
	ox-u	'arrow-acc'	(Yakut; Krueger, 1962)

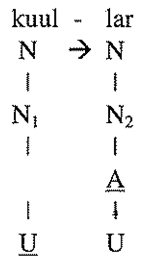
[9] For details of how to derive the blocking effect (a ban on 'switching') of |A|, see Charette and Göksel (1994, pp. 43-44). Note that in high round vowels the element |U| is a head, whereas in low targets |A| is the head. The idea is that a headed |A| prevents the headed |U| from licensing the element |U| in N_2 that is in need of licensing since this would have to produce an /o/ in which the element |A| is no longer headed.

In GP, the data involving high targets (16) are easily accounted for: as in Turkish, any vowel harmony process occurs unrestrictedly in elementally empty nuclei (Charette & Göksel, 1994, 1996; Denwood, 2002).

The data involving a low suffix (15) are accounted for by an additional licensing mechanism. In effect, the presence of a so-called |A|-*bridge* between trigger and target 'neutralizes' the blocking effect of |A| (cf. Steriade, 1981).[10] A bridge is formed by trigger and target agreeing for some element ε, in this case the element |A|. That is to say, in Yakut, an |A|-bridge allows for N_1 to license |U| in N_2 despite the presence of an otherwise blocking |A|.

(17)


Crucially, though, if no |A|-bridge is available, |A| in N_2 *will* block labial harmony. Thus in (18), licensing of |U| fails given that the root vowel (N_1) is a high vowel and as such does not contain |A|:

(18)


In a similar vein, in Kazakh (see the data in 4 and 5) labial harmony in low targets is observed only when both trigger and target are front. This is accounted for by positing an |I|-bridge which again neutralizes the blocking effect of |A|. High targets always display labial harmony because no element blocks it.

[10] See Charette and Göksel (1994, pp. 44-45) for details of how a bridge configuration allows for 'head switching' in low targets, which is required because low rounded vowels are not |A|-headed.

2.4 The Spanner in the Works: Kachin Khakass

As we saw above, a crucial aspect of the standard GP analysis is that high vowels are elementally empty. However, let us consider data from Kachin Khakass in (19), in which it is not the case that all high ('empty') targets display labial harmony. In Kachin Khakass, labial harmony is exclusively observed *when trigger and target are both high* (as in 19); low targets never display labial harmony (as shown in 20; see also 44).

(19)	kün-nü		'day-acc'	
	čör-zip[11]	(*čör-züp)	'having gone'	
	kuš-tuŋ		'of the bird'	
	ok-tɨŋ	(*ok-tuŋ)	'of the arrow'	(Kachin Khakass; Korn, 1969)
(20)	kün-ge	(*kün-gö)	'to the day'	
	čör-gen	(*čör-gön)	'who went'	
	kuzuk-ta	(*kuzuk-to)	'in the nut'	
	pol-za	(*pol-zo)	'if (he) is'	(Kachin Khakass; Korn, 1969)

In standard GP, there is nothing that can prevent licensing into an empty slot, which means that it is not clear how we can prevent high targets from undergoing labial harmony. And even if one could prevent that somehow[12], there is no element that could form a bridge to allow labial harmony in forms such as *künnü* and *kuštuŋ*. West-Siberian Tatar (Korn, 1969) patterns the same way as Kachin Khakass.

That high vowels sometimes fail to undergo labial harmony can also be demonstrated with data from Kyzyl Khakass (Korn, 1969) where labial harmony is observed when trigger and target are both front or both high (or both front *and* high). In (21) we see that low targets fail to undergo labial harmony in the absence of palatal harmony (Korn, 1969, p. 102):

[11] Korn's (1969) text reads <čör-zp>, lacking a vowel in the suffix; however, his description explicitly states that this form fails to undergo labial harmony. We assume it does undergo palatal harmony (cf. *öd-ir* 'to kill'; Korn, 1969, p. 103).

[12] One could expand the standard GP account by including elements in the *trigger* to block labial harmony; that is, in Kachin Khakass the presence of the element |A| on the trigger (rather than the target) could be taken to somehow block the licensing of |U| in the suffix. However, this would expand the theory into including reference to "triggers" whereas the GP account, thus far, only allows reference to the *relation* between trigger and target. Thanks to Markus Pöchtrager for discussion on this point.

(21)	kün-gö		'to the sun'	
	öl-zö		'if (he) dies'	
	kus-ka	(*kus-ko)	'to the bird'	
	pol-za	(*pol-zo)	'if (he) is'	(Kyzyl Khakass; Korn, 1969)

The forms in (22) show that a high target does not undergo labial harmony in the absence of palatal harmony when the trigger is low (ibid.) (see also 36a):

(22)	kün-nüŋ		'of the day'	
	töl-düŋ[13]		'of posterity'	
	kus-tuŋ		'of the bird'	
	told-ɨr	(*told-ur)	'to fill'	(Kyzyl Khakass; Korn, 1969)

Crucially, the GP approach cannot capture the lack of labial harmony in the final form in (22), since the suffix is presumably empty (see also 36a). Nogai (Karakoç, 2005) displays the same pattern as Kyzyl Khakass.[14]

In sum, GP cannot account for Kachin Khakass and West-Siberian Tatar (Korn, 1969), in which labial harmony is only observed when trigger and target are both high. Similarly, it fails to capture Kyzyl Khakass (Korn, 1969) and Nogai (Karakoç, 2005), in which labial harmony is observed only if trigger and target are both high and/or both front. The problem shared by both types of cases lies in the fact that GP cannot express a bridge based on the shared property of being 'high' because there is no element for 'high'.

[13] Korn (1969, p. 102) lists <töl-duŋ>; however, given that is the only instance of apparent failure of palatal harmony in Kyzyl data and Korn does not make any mention of palatal failure in his description of Kyzyl, we assume this to be a transcription error.

[14] According to Karakoç (2005, p. 9), labial harmony is observed in spoken Nogai (although not reflected in writing). She notes that low targets are rounded when the trigger is front:

(i) kül-ödy

kör-ödy

With regard to high targets, in (spoken) Nogai they display labial harmony in case both trigger and target are high and/or they are both front:

(ii) kül-dü

gör-dü

oku-du

Although the source does not explicitly mention failure of labial harmony in contexts other than the ones mentioned, we assume that there is no labial harmony in those contexts.

3. Radical cv Phonology

Radical cv Phonology (RcvP; van der Hulst, 2005, 2012a), based on both GP as well as Dependency Phonology (Anderson & Ewen, 1987), assumes only two elements: a consonant- or onset-oriented element |C| and a vowel- or rhyme-oriented element |V|. Furthermore, these elements are organized into a feature geometry involving class nodes, as can be seen in Figure 1.[15]

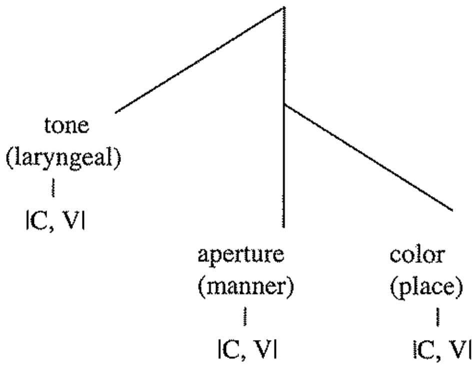


Figure 1. The 'element geometry' of Radical cv Phonology

In each class node, |C| and |V| receive a different interpretation; as such, each of the six terminal elements in Figure 1 is distinctive. It is important to note that |V| and |C| can, despite their respective rhyme and onset bias, can occur in both onset and rhyme positions. However, for ease of exposition, we will use separate symbols for each of the elements; as such, Figure 2 only differs notationally from Figure 1.

[15] We will not discuss the laryngeal class node in this article.

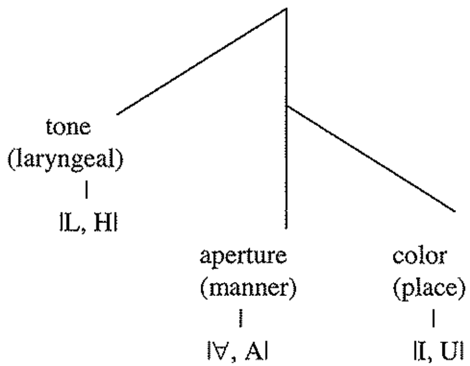


Figure 2. The 'element geometry' of Radical cv Phonology (practical use)

The four elements relevant in the composition of vowels are: |U|, |I|, |A| and |∀|.[16] As in GP, these can either be a head or a dependent:

(23)

element	*head*	*dependent*
A_V	/a/	'low'
$\forall_C$	/i/	'high (or ATR)'
U_V	/u/	'round'
I_C	/i/	'front'

Compared to GP, RcvP proposes a 'fourth element', namely |∀|, which is very similar to the ATR element proposed in Kaye, Lowenstamm, and Vergnaud (1985). However, in GP this element was later abandoned.[17]

In contrast to GP, RcvP uses headedness obligatorily to acknowledge the asymmetry which arises from merging (maximally two) elements per class node; mono-elemental structures are headed by default. In other words, RcvP does not employ contrastive use of headedness. For example, |A| cannot be distinct from |$\underline{A}$|, nor is |AI| distinct from either |$\underline{A}$I| or |A$\underline{I}$|.

[16] Despite out notational use of four elements, it is important to bear in mind that even though the surface number of elements involved in the formation of vowels is four, formally only two elements (distributed over two class nodes) are involved: |C| and |V|. In the following, a subscript 'V' or 'C' is sometimes added to indicate the class an element belongs to.

[17] Together with a fifth element, the so-called cold vowel, which, as in current GP, is not part of RcvP.

3.1 *Vowel Harmony in RcvP*

In RcvP, susceptibility to vowel harmony is encoded in the lexicon (cf. Denwood, 2002; Steriade, 1981). Specifically, when a lexical item is involved in a vowel harmony alternation, it includes a variable element "(ε)". Consider the RcvP representation for the plural in Turkish, which alternates between [l^jer] and [lar] (see 1). Given that the suffix never alternates for height, |A| is present invariably; in contrast, the morpheme alternates between a front and back variant, and, as such, the front element |I| is represented as a variable "(|I|)". An invariable element is *lexically*, i.e. *paradigmatically licensed*, whereas a variable element is not, or one could say that a variable element is *conditionally* lexically licensed, the condition being that the element has to be syntagmatically licensed:

(24) -lAr
A
(I)

The variable element in the Turkish plural suffix can be syntagmatically licensed (cf. 25), resulting in a palatal realization [l^jer], or it remains unlicensed (cf. 26), resulting in a non-palatal realization [lar], both being harmonic with their root. In particular, in (25) the variable element (|I|) is licensed (indicated by "»") by an immediately *adjacent* instance of the same element; as in GP, this means it is phonetically realized so that we observe a front suffix [l^jer]:[18]

(25) ip - l^jer
∀ A
I » (I)

In case the preceding vowel does not contain an |I|, the variable (|I|) in the suffix is not licensed (and as such cannot be interpreted), and we observe a back suffix [lar]:

(26) kɨz - lar
∀ A
(I)

[18] Specifically, the type of licensing that is involved in harmonizing processes is *lateral licensing* (van der Hulst, 2012a): "A variable element X is licensed by a preceding/following occurrence of X." This contrasts with *lexical licensing*, which we here take to encompass reference to both structural configurations (e.g. initial syllable) as well as reference to specific vowels (see van der Hulst, 2012a, who assumes a distinction between positional ('structural') and lexical licensing).

Note that licensing relations are absolutely local; that is, licensing cannot apply across a vowel (rhymal head).[19]

4. A Typology of Labial Harmony

4.1 *Logical Combinations of Palatal and Labial Harmony*

First let us state the logical possibilities for combinations of labial and palatal harmony, which are given in Table 1:[20]

Table 1

Logical combinations of labial and palatal harmony

	Labial	Palatal	Language
A	Full	Full	Kirghiz
B	Full	Defective	?
C	Full	None	?
D	Defective	Full	(i) Yakut (ii) Altai
E	Defective	Defective	?
F	Defective	None	Shuluun Höh
G	None	Full	Finnish
H	None	Defective	Tofa
I	None	None	No harmony

An interesting observation from Table 1 is that there is only one reported language where full labial harmony co-occurs with full palatal harmony (type a). As far as we are aware, there are no languages that represent types (b) and (c).[21] Indeed, this observation leads Moskal (in pres a,b) to state that labial

[19] A note on so-called 'transparent' vowel is in order here; these vowels seemingly allow for harmony to skip them. Consider Finnish, in which /i/ (as well as /e/) seems to be 'ignored' in the process of palatal harmony: *läkääri-nä* 'doctor-ESS' and *pappi-na* 'priest-ESS' (Ringen, 1975). We argue that these vowels are 'inert' in that they transmit but do not initiate a harmonic wave. Crucially, they are not 'skipped' in any sense but instead they *participate* in vowel harmony (see van der Hulst, 2012a-b and Moskal, 2012 for slightly different implementations of this point).

[20] It should be noted that the third column in Table 1 is not an exhaustive list; it merely offers one representative language for each identified type, if there is one.

[21] This seems true for the Turkic languages, and, furthermore, we tentatively posit that it holds universally.

harmony obligatorily (and universally) is subject to additional requirements. This then raises the question as to what motivates this 'defectivity' of |U|. As we saw in section 3, RcvP encodes its minimal units in an 'element geometry'. We repeat figure 1 and 2 here as figure 3, encoding both the C/V status of elements and their short hand name:

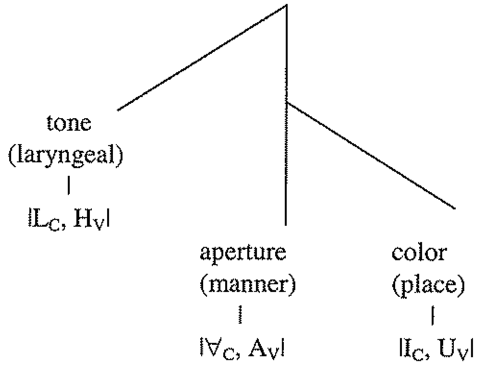


Figure 3. The 'element geometry' of Radical cv Phonology

We suggest that patterns of vowel harmony are guided by two principles (stated here in the most general terms) which can be formulated with reference to this hierarchy:

(27) *Harmonic principles*
Dependent elements (|I| and |U|) are more likely to be spreaders
|C|-elements ($|\forall_C, I_C|$) are more likely to be spreaders

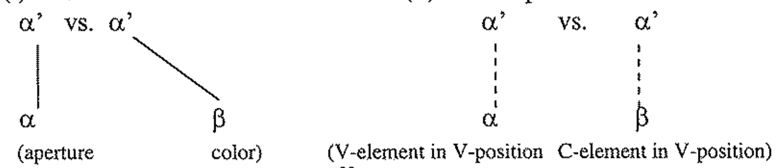
Our motivations are as follows. Compared to dependents, heads are more characteristic of the position that they occupy, making them *more stable* and thus less likely 'to move around'. This makes color elements less stable and thus more likely to spread. The geometry in Figure 3 provides a natural basis for the fact that such color spreading is often *dependent* on the stable aperture properties. This is not to say that aperture elements cannot be involved in vowel harmony; they obviously can. But we do not expect such vowel harmony to show a dependency on color elements. Consequently, when aperture elements are involved in phonological processes they are less likely to be subject to additional requirements as compared to color elements. The dependency of color elements on aperture element is very clear when the color element is |U|, which has been shown to be dependent on bridge conditions that make reference to vowel height. It is perhaps less obvious that harmonic behavior of |I| is also likely to be dependent on bridge conditions that make reference to

aperture elements. However, the present study does not directly concern palatal harmony patterns. Our impression is, however, that there are few indications for such dependencies. This means that there must be additional reasons for why labial harmony is prone to be dependent on bridges. This is where the second principle is relevant.

Regarding the second principle, it presupposes that, just like elements, syllabic positions fall into two categories: |C|-positions (onset) and |V|-positions (rhyme); see van der Hulst (2005) for such a proposal. We can then say that more sonorous elements ($|A_V|$ and $|U_V|$) are preferred in the syllabic |V|-position, whereas less sonorous elements ($|\forall_C|$ and $|I_C|$) are preferred in the syllabic |C|-position. This makes |A| the optimal element for vowels (syllabic |V|-positions) and |I| the optimal element for consonants (syllabic |C|-positions), where it is interpreted as *coronal*. More generally, both |A| and |U| would be preferred in a syllabic |V|-position making these two elements more stable for vowels and therefore less likely to spread. At this point one might expect that this means that spreading of |C|-elements is likely to be dependent on conditions set by |V|-elements. However, in this case we find the opposite to be the case. We can explain this if we assume that given their stability as |V|-elements, spreading of such elements is favored only when |C|-elements 'drag them along'. This creates a dependency of stable elements on unstable elements. Again, the dependency of |U| (in this case on |I|) is clear. Whether |A| harmony is indeed likely to be dependent on an |∀|-bridge remains to be established and we refer to a study of raising and lowering harmony in van der Hulst (to appear b).

Although these two principles are independent, we see a deeper unity between them. Consider the representations below, which characterize the first and second principle, respectively:

(28) (i) α is the head of α' (ii) α is in position α'



α is *necessarily* dominated by α' [22] α is *optimally* dominated by α'

We see that there is a clear formal resemblance between these two configurations. Since a constituent dominates its daughter and a syllabic position dominates its elements, both (i) and (ii) express that elements are *more*

[22] The node that combines aperture and color has the same label as the aperture node, which is a necessary consequence of aperture being the head.

likely to spread when they are dominated by a node of the opposite 'type', i.e. in both cases the β-elements are more likely to be involved in vowel harmony. The paradox is that in (28i), spreading of β-elements (color) is *facilitated by* bridges formed by α-elements (aperture). In (28ii), on the other hand, spreading of β-elements (consonant-like elements) *facilitates* the spreading of α-elements (vowel-like elements). This means that the role of stable elements with respect to instable elements is different in both cases. For reasons of space, we will leave an explanation for this difference for another occasion.

Combining the two principles, we derive a scale of 'dependency':

(29) *Spreading dependency (most likely > least likely)*
U > A , I > ∀[23]

This scale correctly expresses that |U| is the most dependent spreader, which thus accounts for the observation that it is subject to additional requirements both in terms of aperture elements and in terms of the other color element. Given its structural proximity to |I|, we also expect |U| to be more easily dependent on |I| than on any of the two aperture elements.

However, as noted in Moskal (in press b), the ban on full labial harmony (which would include cases in which this harmony is not dependent on either aperture or the color element |I|) is problematic in light of Kirghiz, which is an arguable case of full labial harmony (a in Table 1).[24] We therefore suggest here that Kirghiz is a case where labial harmony is formalized as involving harmony operating at the class node level:

(30) I' ← class node: color harmony (I+U)
| \
I U

In this way no reference is made to full labial harmony. Rather, Kirghiz instantiates a case of *full color harmony*, crucially including both full labial harmony as well as full palatal harmony. With this analysis of Kirghiz we can maintain the claim that there can be no harmony system which would display full labial harmony without concomitant full palatal harmony. In sum, while

[23] Note that no relative dependency of the elements |I| and |A| can be derived from the two principles. Crucially, |U| is always predicted to be the least likely independent spreader, while |∀| is the most independent spreader. The relation between |I| and |A|, is an area for further research.

[24] Korn (1969) classifies Kirghiz as a language in which labial harmony occurs unrestrictedly, but he indicates that labial harmony is optional when the trigger is high and the target is low.

explaining the non-occurrence of (b) and (c) in Table 1 above, we account for (a) by referring to Kirghiz as a system in which there is full color harmony.

4.2 Defectivity

Next, let us focus our attention on the cases in (d) in Table 1, where there is full palatal harmony but labial harmony is defective. We distinguish four configurations in terms of the height properties of trigger and target, and two possibilities in terms of whether or not palatal harmony has applied:

(31) Same-height harmony Cross-height harmony

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

The examples discussed in previous sections can now be represented as follows.

The pattern in Yakut, case (d.i) in Table 1 (data in 2 and 3) is shown in (32), where the shaded boxes represent the cases where labial harmony fails to apply:

(32) Yakut

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

Turkish (data in 1) is captured in (33):

(33) Turkish

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

In case (d.ii) in Table 1, labial harmony is full in front words, but (partially) defective in back words. We find this pattern in Altai:

(34) kün-dö 'in the day'
kös-tör 'eyes'
uč-ar (*uč-or) 'which will fly'
kol-do 'from the hand'
kün-dü 'day-ACC'
köl-dü 'lake-ACC'
tud-un 'to restrain, o.s.'
ton-du 'fur coat-ACC' (Altai; Korn, 1969)

This pattern is represented as follows:

(35) Altai

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

Altai compares to Yakut in failing to display labial harmony in the configuration involving a high trigger and a low target (∀A), but differs in that the lack of labial harmony is only observed in words that are back.

Similarly, in Kazakh (data in 4 and 5) and in Kyzyl Khakass (data in 21 and 22), we observe that there is a discrepancy in the behavior of front and back vowels. Whereas all front vowels display labial harmony, among back vowels labial harmony is defective. This is schematically represented as below:

(36) a. Kyzyl Khakass

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

b. Kazakh

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

Let us say that Altai, Kyzyl Khakass and Kazakh are back-defective (B-defective), whereas Yakut and Turkish are BF-defective, meaning in both front and back words.

Turning now to a more systematic discussion of defectivity, we list in Table 2 all the logical possibilities for defective labial harmony, where both back and front words show the same pattern of disparate behavior. In the rightmost column, we list example languages.[25] We will show that the unattested cases can be ruled out by two constraints: Constraint 1 (C1) and Constraint 2 (C2), which will be motivated and discussed below in sections 4.2.1 and 4.2.2, respectively.

[25] The 'types' refer to the types in Kaun (2004) and the number between parentheses is the number of languages that display that pattern.

Table 2

Labial harmony: Logical possibilities of BF-defectivity[26]

	∀∀	AA	A∀	∀A	(front and back words)
2	+	+	+	-	**type 6(2): Yakut**
3	+	+	-	+	ruled out by C1
4	+	+	-	-	**type 2(1): Yokuts**
5	+	-	+	+	ruled out by C1
6	+	-	+	-	**type 5(7): Nuwari, Turkish**
7	+	-	-	+	ruled out by C1
8	+	-	-	-	**type 3(3):Hixkaryana, K. Khakass, Tsou**
9	-	+	+	+	ruled out by C1 and C2
10	-	+	+	-	ruled out by C2
11	-	+	-	+	ruled out by C1 and C2
12	-	+	-	-	ruled out by C2[27] (type 4)
13	-	-	+	+	ruled out by C1 and C2
14	-	-	+	-	ruled out by C2
15	-	-	-	+	ruled out by C1 and C2

Now let us look at the cases where labial harmony breaks down in back words only, i.e. B-defectivity. In these cases labial harmony gets a 'free ride' on palatal harmony, but is defective when palatality is not present. The free ride

[26] We 'removed' (1) (all '+') and (16) (all '-') since these two cases technically are not cases of defectivity. (1) is a full system, and (16) is the absence of any harmony. Neither of these systems are defective in any sense.

[27] Barring B(F)-defectivity, the case in 12 corresponds to type 4 in Kaun (2004), and she lists Khalkha Mongolian as an example. Indeed, the vast majority of Mongolian as well as Tungusic languages that display labial harmony exclusively rely on the configuration of a low trigger vowel and a low target vowel to license labial harmony (see Svantesson, 1985; Svantesson et al., 2005 on Mongolian languages, and Li, 1996 on Tungusic languages). However, these languages differ from Turkic languages in a crucial respect: aside from labial harmony, they display tongue root harmony rather than palatal harmony. Given that tongue root harmony involves alternations of the element |∀|, it has a different status in these languages (see Moskal, in press a, 2012 for a specific implementation of the different status of |∀| in tongue root harmony systems). As such, while Tungusic and Mongolian languages seem to display the pattern identified in case 12 in Table 2, they are better represented as below:

	AA	A∀	∀A	
12'	+	-	-	type 4: e.g. Khalkha Mongolian

In effect, since ∀∀ is not available, C1 forces these languages to resort to AA; crucially, however, if both ∀∀ and AA are available, C2 will favor ∀∀ over AA.

situation has been discussed in Steriade (1981) as playing a significant role in harmony systems. In her terminology, labial harmony is said to be *parasitic* on palatal harmony in those cases in which it gets a free ride. In our account this translates into the dependence of labial harmony on an |I|-bridge.

Table 3

Labial harmony: Logical possibilities of B-defectivity

	∀∀	AA	A∀	∀A	
2	+	+	+	-	**type 7(2): Altai** (~type 6)
3	+	+	-	+	ruled out by C1
4	+	+	-	-	**Shor-B** (~type 2)
5	+	-	+	+	ruled out by C1
6	+	-	+	-	**type 8(2): Karakkalpak** (~type 5)
7	+	-	-	+	ruled out by C1
8	+	-	-	-	**type 9: Kyzyl Khakass** (~type 3)
9	-	+	+	+	ruled out by C1 and C2
10	-	+	+	-	ruled out by C2
11	-	+	-	+	ruled out by C1 and C2
12	-	+	-	-	ruled out by C2 (see also note 28)
13	-	-	+	+	ruled out by C1 and C2
14	-	-	+	-	ruled out by C2
15	-	-	-	+	ruled out by C1 and C2

Kaun (2004) does not mention (our) case 4, but Shor-B (discussed below) seems to fit the bill. We see that the constraints needed for Table 2 account for all the unattested cases in Table 3.

We propose that the unattested possibilities in both BF-defective and B-defective systems are not accidental gaps. It would seem that the following constraints obtain.

4.2.1 *The head – dependent asymmetry (C1)*

As Kaun (1995, 2004) has observed, labial harmony favors low triggers and high targets. She offers articulatory and perceptual explanations. Rounding is articulatorily and acoustically less strong on low vowels than on high vowels. This explains that low vowels are good triggers because they seek to enhance their rounding property by spreading it. It also explains why they are bad targets, precisely because when being labialized they do not clearly display this property and thus could easily be perceived as non-targets. Effectively, on the basis of phonetic considerations, Kaun argues that (i) low triggers are better than high triggers, and (ii) high targets are better than low targets. This is formalized below as ∀A being a highly marked configuration, and, as such, in order for this configuration to allow for labial harmony all other height configurations must allow for it as well.

(37) C1: ∀A → XY
(a high trigger and low target implies all other height configurations)
C1 (correctly) excludes the following cases: 3, 5, 7, 9, 11, 13 and 15.

Let us now ask what motivates C1 from a formal point of view. When a harmonic relation obtains we have a *head – dependency* relation between a trigger (licenser, head) and a target (licensee, dependent). Head – dependency relations are subject to a general constraint which correlates the external relationship with intrinsic properties of the related units (see Dresher & van der Hulst's 1998 notion of the *Head – Dependent Asymmetry*). We see this clearly in the case of syllables forming feet. If foot formation is quantity-insensitive, there is no sensitivity to intrinsic properties of the units that are combined. When sensitivity steps in, the first combination that is ruled out is the one that displays a *mismatch* between the extrinsic relation and the intrinsic differences:

(38) *Head* *Dependent*
Light Heavy

The optimal foot has a complete match:[28]

(39) *Head* *Dependent*
Heavy Light

In-between these two extremes are the two cases where head and dependent are intrinsically equal:

(40) *Head* *Dependent*
Heavy Heavy
Light Light

We propose that vowels that enter into a harmonic head – dependency relation display effects of these head-dependent matching conditions. In fact, the intrinsic properties that matter are very similar to those in stress, namely

[28] In foot theory, an independent constraint, namely bimoraicity, has been taken to militate against a heavy-light foot. But even in this approach the HDA shows up in that the first mora of heavy syllables, which are universally taken to be more sonorous, cannot be the dependent in the bimoraic foot that would comprise a preceding light syllable and 'the first half' of a following heavy syllable.

sonority. Syllables that prefer to act as heavy in foot structure are more sonorous than syllables that are light: they either have *more* sonorous segments in their rhyme or their vowels are of higher sonority than light syllables. In the latter kind, sonority is a function of aperture. We suggest that the implication expressed by C1 is likewise based on sonority. Low vowels (those containing the element |A|) are more sonorous than high vowels (containing |∀|). From this perspective, C1 'makes sense'. The least preferred harmonic relation is one in which the trigger is higher in sonority than the target (i.e. ∀A), which would represent a complete mismatch. This in effect means that for ∀A to allow spreading all three other cases must also allow spreading, in which case harmony is insensitive to sonority differences.[29]

4.2.2 *The cross-height constraint (C2)*

From Table 2 and 3 we can infer that there are no systems that have cross-height harmony while lacking equal height harmony. Furthermore, it seems that it is high sequences (∀∀) in particular that are the most unmarked configurations for labial harmony to occur. This is captured in the following constraint:

(41) C2: XY → ∀∀[30]
(any other configuration implies a high trigger and high target)
C2 (correctly) excludes the following cases: 9, 10, 11, 12, 13, 14 and 15.

C2 captures the fact that an 'already present equality' favors harmony. Things that are already alike are more likely to become more alike than things that are totally different. Kaun (1995, 2004) offers a more specific grounding, pointing to the fact that the rounding lip posture for vowels of equal height is more similar than that for vowels of different height and that dissimilarity in lip posture among vowels of different height hinders harmony. These two explanations are not incompatible, but we believe that the idea that similarity begets more similarity is more general and thus preferred.

Specifically, though, C2 claims that ∀∀, rather than AA, is the preferred configuration for harmony to occur. Indeed, we propose that the two generalizations offered by Kaun that led us to posit C1 may have an equal status phonetically, but that they do not carry the same weight at the level of grammar. Specifically, in vowel harmony processes, targets are involved in the actual alternation, which is the salient property that alerts language users to the fact that they are dealing with a vowel harmony language in the first place. As such, targets (and statements about them) carry more weight than triggers (and statements about them). Consequently, Kaun's promotion of *high targets* we assume interacts with C2, whereas the promotion of *low triggers* does not. The result of the interaction between, on the one hand, the unmarked status of equal height harmony, and, on the other hand, the unmarked status of high targets leads to the constraint in (41) above: according to C2, ∀∀ is the most preferred configuration, and is, as such, a minimal requirement for labial harmony to occur.

In conclusion, even though we acknowledge Kaun's explanations for the observed patterns of defectivity, based on the phonetic aspects of labial harmony in Turkic languages, as insightful, we submit here a more general explanation that is strictly internal to the phonological system.

[29] Nevins (2010) also invokes sonority as relevant for vowel harmony. In his account highly sonorous vowels are likely to be opaque. See van der Hulst (to appear a) for a critical evaluation of this proposal.

[30] Note that C1 and C2 can be collapsed into one implicational scale: ∀A → AA, A∀→ ∀∀.

4.3 *Empirical Reach*

Having excluded certain unattested patterns and derived implicational patterns by embracing C1 and C2, we now proceed to a formal analysis cast in the RcvP approach of the various patterns of labial harmony that are attested.

We adopt Charette and Göksel's (1994) term *bridge* as a name for the formal mechanism which facilitates harmony. Indeed, it is important to realize that while the constraints rule out certain patterns, the additional licensing requirement (in terms of bridges) on labial harmony is independently necessary. That is to say, as we will see in this section, while the licensing restrictions on labial harmony are kept within the bounds identified in C1 and C2, the latter do not suffice to describe the full array of data. Indeed, the constraints do not distinguish between BF-defectivity (Table 2) and B-defectivity (Table 3), since no reference is made to the color node.

4.3.1 *An inventory of bridges*

In (42) below, the vowel inventory of Turkish is given again, together with its structure as *per* RcvP (cf. 10 above):[31]

[31] Headedness is indicated only if within one subgesture (i.e. aperture or color) two elements are present. Elements that form a subgesture on their own are (redundantly) heads, but that is not notationally indicated in RcvP; see van der Hulst, 2012a).

(42)

/i/	/e/	/ü/	/ö/	/u/	/o/	/ɨ/	/a/
∀		∀		∀		∀	
	A		A		A		A
I	I	I	I				
		U	U	U	U		

Following Moskal (in press b), who expands on Charette and Göksel (1994, 1996), we take bridge licensing to refer to the configuration of trigger and target agreeing for an element ε, which, as such, facilitates labial harmony (cf. Steriade, 1981):

(43) *Bridge licensing*

$\varepsilon_i \; \varepsilon_i$

U » (U)

Whether or not an element can function as a bridge for labial harmony is subject to cross-linguistic variation, but since RcvP assumes four elements, and |U| is active in labial harmony, bridges are predicted to be stated in terms of |∀|, |A| and |I|. Indeed, compared to Standard GP, Kachin Khakass (data in 19 and 20; a schematic representation is given in 44) ceases to be problematic within the RcvP framework. Rather, it is expected: labial harmony is only observed when both trigger and target are high, that is, when it is licensed by an |∀|-bridge.

(44) Kachin Khakass

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

Consider the full representation for the form *künnü* in (45); both trigger and target are high (i.e., they contain |∀|), and, given this bridge as a requirement, the |U| on the trigger can license the variable |U| on the target; note that there is also |I|-harmony which requires no bridge, nor is it required as a bridge for labial harmony:

(45)

kün	-	nü
∀		∀
I	»	(I)
U	»	(U)

In contrast, the stem in *čörzip* in (46) does not contain the element |∀|, which means that no |∀|-bridge is present to allow the trigger |U| to license the variable |U| on the target. As a result, the suffix vowel is unrounded:

(46)

čör	-	zip
A		∀
I	»	(I)
U		(U)

In a similar vein, the behavior of low targets in Yakut (data in 2 and 3; see also 32) and Kazakh (data in 4 and 5; see also 36) is accounted for by these languages requiring an |A|- or an |I|-bridge, respectively, to license labial harmony.

In addition to labial harmony needing to be licensed by a bridge of some single designated element ε, labial harmony can also have more than one bridge requirement. Consider the data from Kyzyl Khakass in (21) and (22), here repeated for convenience (see also 36). Low targets only display labial harmony when trigger and target are both front:

(21)

kün-gö		'to the sun'	
öl-zö		'if (he) dies'	
kus-ka	(*kus-ko)	'to the bird'	
pol-za	(*pol-zo)	'if (he) is'	(Kyzyl Khakass; Korn, 1969)

High targets also display labial harmony when trigger and target are front; in addition, labial harmony is observed when trigger and target are both high:

(22)

kün-nüŋ		'of the day'	
töl-düŋ[32]		'of posterity'	
kus-tuŋ		'of the bird'	
told-ɨr	(*told-ur)	'to fill'	(Kyzyl Khakass; Korn, 1969)

Labial harmony in Kyzyl Khakass is licensed by an |I|- or an |∀|-bridge. Similarly, in Altai, labial harmony occurs indiscriminately in front vowels, whereas in back vowels it is observed only when both target and trigger are low; that is, labial harmony is licensed by an |I|- or an |A|-bridge (see 35).

[32] Korn (1969, p. 102) lists <töl-duŋ>; however, given that is the only instance of apparent failure of palatal harmony in Kyzyl, we assume this to be a transcription error.

(47) kün-dö — 'in the day'
kös-tör — 'eyes'
uč-ar (*uč-or) — 'which will fly'
kol-do — 'from the hand' (Altai; Korn, 1969)

Finally, there is the possibility that labial harmony can be licensed by any bridge; indeed, this situation seems to be attested in a variety of Shor: Shor-B. First consider low targets: in (48), low targets display labial harmony when trigger and target are both front (an |I|-bridge) as well as when trigger and target are both low (an |A|-bridge), showing the same pattern as in Altai above:

(48) külük-tö — 'at the brave man's'
sös-töy — 'from the word'
ug-ar (*ug-or) — 'which will grasp'
pol-zo — 'if (he) is' (Shor; Korn, 1969)

However, in contrast to Altai, Shor shows a pattern where in high targets the target optionally fails to undergo rounding when the trigger vowel is low, displaying variation in forms such as *coň-nuŋ* ~ *coň-nɨŋ* 'of the people':[33]

(49) mün-üp — 'having mounted'
kök-tün — 'of the sky'
kuš-tun — 'of the bird'
coň-nuŋ ~ coň-nɨŋ — 'of the people' (Shor; Korn, 1969)

Specifically, when in the final form in (49) the target is rounded (*coňnuŋ*), Shor falls in the same category as Altai (Shor-A). However, in case labial harmony is not observed (*coňnɨŋ*), it is exactly the configuration when trigger and target disagree for height, which classifies this variety of Shor (Shor-B) as a system where labial harmony is licensed by any bridge: |∀|, |A| or |I|.

(50) Shor-B

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

In Table 4 we present a summary of the various systems in terms of the bridges that are required for labial harmony to take place:

[33] We assume that variation is the result of two different grammars (see e.g. Orgun, 1996; Inkelas, 1998; Antilla, 2002, 2007 or co-phonologies).

Table 4

Interim labial harmony typology based on bridge licensing

bridge	language(s)
∀	Kachin Khakass (Korn, 1969), West-Siberian Tatar (Korn, 1969)
A	Yakut (Krueger, 1962), Altai-B (Dyrenkova, 1940)
I	Khazakh (Korn, 1969; Menges, 1947), Chulym Tatar (Korn, 1969), Karakalpak (Menges, 1947)
∀, I	Kyzyl Khakass (Korn, 1969), Nogai (Karakoç, 2005)
A, I	Altai (Korn, 1969), Khirgiz-B (Herbert & Poppe, 1963), Ojrat (Menges, 1947), Teleut (Menges, 1947), Shor-A (Korn, 1969)
∀, A	Yawelmani, *non-Turkic* (Cole & Kisseberth, 1995)
∀, A, I	Shor-B (Korn, 1969)

4.3.2 Asymmetric licensing

However, consider Turkish again, which displays absolute rounding when the target is high (data are repeated from 11 and the pattern from 33):

(11) a. yüz-ün — 'face-gen'
b. k^jöy-ün — 'village-gen'
c. pul-un — 'stamp-gen'
d. son-un — 'end-gen' (Turkish; Clements & Sezer, 1982)

(33) Turkish

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

The data in (11a) *yüzün* and (11c) *pulun* are readily accounted for: labial harmony in these cases is licensed by an |∀|-bridge. With regard to the remaining forms, *k^jöyün* (11b) and *sonun* (11d), we argue that labial harmony is licensed by the relation between a vocalic trigger and a consonantal target: *asymmetric licensing* (Moskal in press a,b). In particular, asymmetric licensing is a reflection of C1 introduced in section 4.2.1. There we established that the status of ∀A is highly marked with regard to the licensing of labial harmony because it involves a mismatch between the intrinsic sonority of low and high vowels and the extrinsic licensing relation. Conversely, as expected, the status of A∀ is highly unmarked; indeed, this is what underlies the licensing principle in (51).

(51) Asymmetric licensing

```
A       ∀
   ⇓
ε   »   (ε)
```

The independent need for asymmetric licensing can be motivated when we compare the two languages in (36), here repeated for convenience:

[(36)] a. <u>Kyzyl Khakass</u>

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

b. <u>Kazakh</u>

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

In Kyzyl Khakass labial harmony requires an |I|-bridge and an |∀|-bridge. This is also the case in Kazakh, but here we need to allow for the extra cases A∀ which is captured by (51), Asymmetric Licensing.[34]

Languages differ as to whether asymmetric licensing is active or not. However, there are no cases where low triggers spread rounding to high targets without high triggers spreading rounding to high targets. This follows from C2 which states that any labial harmony implies harmony among high vowels:

(52) <u>Unattested</u>

∀∀	AA	A∀	∀A	front: I
∀∀	AA	A∀	∀A	back: -

Table 5 shows an overview of the various possible licensing conditions, based on the discussion above. Given that there are three elements that can form a bridge, as well as asymmetric licensing, this gives rise to eleven configurations that could theoretically facilitate labial harmony. However, as indicated, languages that would rely exclusively on an |I|-bridge or exclusively on an |A|- or |I|-bridge are excluded by C1, since this constraint states that ∀∀ (i.e. an |∀|-bridge) is a prerequisite for harmony. In table 5, "+" indicates asymmetric licensing.

[34] An alternative here would be to impose a condition that the target cannot be |A|. We refer to Mailhot and Reiss (2007) for the use of independent trigger and target conditions which, in our view, allows for too many theoretical possibilities; cf. van der Hulst (in prep.) for discussion.

Table 5

Labial harmony typology (Turkic languages, unless specified otherwise)

bridge	language(s)
∀	Kachin Khakass (Korn, 1969), West-Siberian Tatar (Korn, 1969)
A[35]	*Tungusic and Mongolian languages, non-Turkic*
I	*Ruled out by C2*
∀,+	Turkish (Clements & Sezer, 1982), Ottoman Turkish (Hagopian, 1907), Tuvan (Krueger, 1977), Azerbaijani (Comrie, 1981), Uyghur (Hahn, 1991; Lindblad, 1990), Karaçay (Herbert, 1962)
∀, A	Yawelmani, *non-Turkic* (Cole & Kisseberth, 1995)
∀, I	Kyzyl Khakass (Korn, 1969), Nogai (Karakoç, 2005)
A, I	*Ruled out by C2*
∀, A, +	Yakut (Krueger, 1962), Altai-B (Dyrenkova, 1940)
∀, I, +	Khazakh (Korn, 1969; Menges, 1947), Chulym Tatar (Korn, 1969), Karakalpak (Menges, 1947)
∀, A, I	Shor-B (Korn, 1969)
∀, A, I,+[36]	Altai (Korn, 1969), Khirgiz-B (Herbert & Poppe, 1963), Ojrat (Menges, 1947), Teleut (Menges, 1947), Shor-A (Korn, 1969)

4.5 Some Remaining Cases in Table 1

Returning now to table 1, repeated here for convenience, there are some remaining cases, namely (e)-(h), that we need to address:

[35] See note 28.

[36] For this type one might exclude target |A|, unless there is bridge of any kind. We will not discuss such alternatives here; see note 35. A more interesting alternative would be to exclude ∀A in terms of a 'mismatch condition' (and then allowing it when there is an |I|-bridge); see (35) for the pattern. That this is the 'worst case scenario' is implied in C1; it is the case that, if present, implies all others. In note 31 we suggested that C1 and C2 can be collapsed into a scale: ∀A → AA, A∀→ ∀∀. With such a scale we could say that harmony can 'start' at any point in the scale. This then would allow us to 'skip' the ∀A case which would make the independent statement of Asymmetric Licensing superfluous. This alternative is explored in van der Hulst (in prep.).

Table 1

Logical combinations of labial and palatal harmony

	Labial	Palatal	Languages
A	Full	Full	Kirghiz
B	Full	Defective	-
C	Full	None	-
D	Defective	Full	(i) Yakut (ii) Altai
E	Defective	Defective	?
F	Defective	None	Shuluun Höh, Sibe
G	None	Full	Finnish
H	None	Defective	Tofa
I	None	None	No harmony

In the cases of (e) and (h), we consider the possibility of palatal harmony itself being defective. We do not know an example of case (e) which, logically, could apply to cases in which both harmonies show the same defectivity or to systems in which labial and palatal harmony are defective in different ways. Tofa, which has no labial harmony, presents an example of (h). Strikingly, Kaun's description of the configuration in which palatal harmony occurs in Tofa is identical to the description of the conditions under which labial harmony occurs in Turkish. That is, high targets undergo palatal harmony, but low targets do not. This is schematized below (recall that shading indicates a lack of harmony):

(52) <u>Tofa</u>

∀∀	AA	A∀	∀A

We can straightforwardly account for this pattern by saying that Tofa palatal harmony is in line with C1 and C2, which underlie bridge licensing and asymmetric licensing. In that respect, it actually supports the case that color elements rely on aperture elements (see 4.1).

Turning to the other case where labial harmony is absent altogether, (g) constitutes the case of unrestricted palatal harmony, which shows that the element |I| can indeed be an independent spreader and thus does not necessarily have to be dependent on aperture bridges (as opposed to labial harmony).

Finally, case (f) is exemplified by Shuluun Höh (Svantesson, 1985), which has no palatal harmony while displaying defective labial harmony in that labial harmony is only observed when both trigger and target are low (AA; type 12 in Table 2/3). This state of affairs seemingly contradicts our claim that labial harmony is minimally dependent on a |∀|-bridge; however, this language has tongue root harmony which, as alluded to above, results in a different status of

the element |∀| (see note 28). Sibe (Li, 1996) also seems to fall in the category of defective labial harmony, but in this case there is no other harmony active in the language; interestingly, rather than being defective, it might be more appropriate to say that the labial harmony in this system has virtually gone extinct, being limited to only a handful of suffixes. Indeed, it seems that in the absence of any other harmony, labial harmony on its own seems to be unable to survive (as in Sibe).

5. Final Remarks

By investigating the diversity in the conditions governing labial harmony in Turkic languages, we have shown that labial harmony is subject to two general constraints (C1 and C2), which are the grounds for *Bridge licensing* and *Asymmetric licensing*. These conditions on the licensing of color elements create a restricted typology of labial (and perhaps also of palatal harmony). Here we repeat the crucial statements. Bear in mind that all three statements express conditions on color harmony, here primarily investigated with respect to labial harmony:

(37) C1: $\forall A \rightarrow XY$
(a high trigger and low target implies all other height configurations)

(41) C2: $XY \rightarrow \forall\forall$
(any other configuration implies a high trigger and high target)

(43) *Bridge licensing*

$\underline{\varepsilon_i \quad \varepsilon_i}$
↓
U » (U)

(51) Asymmetric licensing

A ∀
⇓
ε » (ε)

Although the current claims only concern labial harmony, future research will have to reveal whether the patterns, dependencies and constraints uncovered here, as well as the RcvP model that was used, can be successfully generalized to other types of harmony.

References

Anderson, J.M. & Ewen, C.J. (1987). *Principles of dependency phonology*. Cambridge: Cambridge University Press.

Anttila, A. (2002). Morphologically conditioned phonological alternations. *Natural Language and Linguistic Theory, 20*, 1-42.

Anttila, A. (2007). Variation and optionality. In P. de Lacy (Ed.), *The Cambridge Handbook of* Phonology (pp. 519-536). Cambridge: Cambridge University Press.

Backley, P. (2011). *An Introduction to Element Theory*. Edinburgh: Edinburgh University Press.

Charette, M. & Göksel, A. (1994). Vowel Harmony and Switching in Turkic languages. *SOAS Working Papers in Linguistics and Phonetics, 4*, 31-52.

Charette, M. & Göksel, A. (1996). Licensing constraints and vowel harmony in Turkic languages. *SOAS Working Papers in Linguistics and Phonetics, 6*, 1-25.

Clements, G. N. & Sezer, E. (1982). Vowel and consonant disharmony in Turkish. In H. van der Hulst & N. Smith (Eds.), *The structure of phonological representations*, part II (pp. 213-255). Dordrecht: Foris.

Cole, J. & Kisseberth, C. W. (1995). *Restricting multi-level constraint evaluation: opaque rule interaction in Yawelmani vowel harmony*. Unpublished manuscript. University of Illinois, Urbana.

Comrie, B. (1981). *Languages of the Soviet Union*. Cambridge, UK: Cambridge University Press.

Denwood, M. (2002). Vowel Harmony in Labial Phonology: Three for the price of one. *Journal of the Altaic Society of Korea, 12*, 155-182.

Dresher, E. (2009). *The contrastive hierarchy in phonology*. Cambridge: Cambridge University Press.

Dresher, E. & Hulst, H. van der (1998). Head-dependent asymmetries in phonology: complexity and visibility. *Phonology, 15*, 317-352.

Dyrenkova, N. (1940). *Grammatika Ojrotskogo Jazyka*. Moscow: Izdatel'stvo Akademii Nauk SSSR.

Hagopian, V.H. (1907) Ottoman-Turkish conversation-grammar: a practical method of learning the Ottoman-Turkish language. Heidelberg: Julius Groos. Retrieved December 25, 2011, from http://www.archive.org

Hahn, R.F. (1991). *Spoken Uyghur*. Washington: University of Washington Press.

Harris, J. (1994). *English Sound Structure*. London: Blackwell.

Harris, J. & G. Lindsey (1995). The elements for phonological representation. In J. Durand & F. Katamba (Eds.), *Frontiers of phonology: atoms, structures, derivations* (pp. 34-79). Harlow, Essex: Longman.

Herbert, R. (1962). Karaçay Phonology. In N. Poppe (Ed.), *American Studies in Altaic Linguistics* (Uralic and Altaic Studies 13). Bloomington, Indiana: Indiana University Publications.

Herbert, R. & Poppe, N. (1963). *Kirghiz manual* (Uralic and Altaic Series, vol. 33). Bloomington, IN: Indiana University Publications.

Hulst, H. van der (2005). The molecular structure of phonological segments. In P. Carr, J. Durand & C. Ewen (Eds.), *Headhood, elements, specification and contrastivity* (193-234). Amsterdam: John Benjamins Publishing Company.

Hulst, H. van der (2012a). A minimal framework for vowel harmony. To appear in B. Botma & R. Noske (Eds), *Phonological Architecture: Empirical, Theoretical and Conceptual Issues*. Berlin: Mouton de Gruyter.

Hulst, H. van der (2012b). Yoruba vowel harmony. In E. Cyran, H. Kardela & B. Szymanek (Eds.), *Sound, Structure and Sense. Studies in memory of Edmund Gussman* (263-288). Lublin: Wydawnictwo KUL.

Hulst, H. van der (ms.) *Decline in Labial harmony in Turkic languages*. Unpublished manuscript. University of Leiden.

Hulst, H. van der (to appear a). *A review of Andrew Nevins (2010), Locality in Vowel Harmony*. Unpublished manuscript. University of Connecticut.

Hulst, H. van der (to appear b). *An elemental account of raising and lowering harmony*. Unpublished manuscript. University of Connecticut.

Hulst, H. van der (in prep.). *Asymmetries in vowel harmony*. Unpublished manuscript. University of Connecticut.

Hulst, H. van der & van de Weijer, J. (1995). Vowel harmony. In J. A. Goldsmith (Ed.), *The Handbook of phonological theory* (495-534). Basil Blackwell: Oxford.

Inkelas, S. (1998). The theoretical status of morphologically conditioned phonology: a case study from dominance. *Yearbook of Morphology 1997*, 121-155.

Karakoç, B. (2005). *Das finite Verbalsystem im Nogaischen*. Wiesbaden: Harrassowitz.

Kaun, A. (1995). *The Typology of Rounding Harmony: An Optimality Theoretic Approach*. Unpublished doctoral dissertation, University of California Los Angeles.

Kaun, A. (2004). The Typology of Rounding Harmony. In B. Hayes, R. Kirchner & D. Steriade (Eds.), *Phonetically Based Phonology* (pp. 86-116). Cambridge: Cambridge University Press.

Kaye, J. (1993). Derivations and interfaces. *SOAS Working papers in linguistics and Phonetics, 3*, 90-126.

Kaye, J., Lowenstamm, J. and Vergnaud, J.-R. (1985). The internal structure of phonological representations: A theory of charm and government. *Phonology Yearbook, 2*, 305-328.

Kaye, J., J. Lowenstamm & Vergnaud, J.-R. (1990). Constituent structure and Government in phonology. *Phonology, 7*, 193-231.

Korn, D. (1969). Types of Labial Vowel Harmony in the Turkic Languages. *Anthropological Linguistics, 11*, 98-106.

Krueger, J.R. (1962). *Yakut manual*. Bloomington, IN: Indiana University Publications.

Krueger, J.R. (1977). *Tuvan manual: area handbook, grammar, reader, glossary, bibliography*. Bloomington, IN: Indiana University Publications.

Li, B. (1996). *Tungusic Vowel Harmony: Description and Analysis*. Unpublished doctoral dissertation, University of Leiden.

Lindblad, V.M. (1990). Neutralization in Uyghur. Washington: University of Washington Press.

Mailhot, F. & Reiss, C. (2007). Computing long-distance dependencies in vowel harmony. *Biolinguistics, 1*, 28–48.

Menges, K. (1947). *Qaraqalpaq Grammar*. New York: King Crown's Press.

Moskal, B. (2012). *Cycling within the segment: Labial harmony in Turkic, Tungusic and Mongolian languages*. Unpublished manuscript, University of Connecticut.

Moskal, B. (in press a). It is elementary, my dear Watson! Labial harmony in Turkic and Tungusic languages. In *Proceedings of WAFL 8*.
Moskal, B. (in press b). An elementary approach to labial harmony in Turkic languages. In *University of Washington Working Papers*.
Nevins, A. (2010). *Locality in Vowel Harmony*. Cambridge, MA: MIT Press.
Orgun, O. (1996). *Sign-Based Morphology and Phonology*. Unpublished doctoral dissertation, UC Berkeley.
Ringen, C. (1975). *Vowel harmony: Theoretical implications*. Unpublished doctoral dissertation, Indiana University.
Scheer, T. (2010). How to marry (structuralist) contrast and (generative) processing (review of Dresher 2009, The Contrastive Hierarchy in Phonology). *Lingua, 120*, 2522-2534.
Steriade, D. (1981). *Parameters of metrical vowel harmony rules*. Unpublished manuscript. MIT.
Svantesson, J.-O. (1985). Vowel harmony shift in Mongolian. *Lingua, 67*, 283-327.
Svantesson, J.-O., Tsendina, A., Karlsson, A. M. & Franzén, V. (2005). *The Phonology of Mongolian*. Oxford: Oxford University Press.

Markedness, Context, and Directionality in Turkish Harmony: A Corpus Study on Vowel Co-occurrence Patterns*

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Abstract

This paper reports results from a corpus study that examined static vowel co-occurrence patterns in Turkish. We show that roots are generally constrained by vowel harmony and that markedness alone, a notion that is at the heart of several previous analyses of Turkish vowel harmony, fails to account for vowel co-occurrence asymmetries and their probability. Furthermore, we identify significant interactions of both labial and palatal harmony with vowel height, the latter translating into a static subregularity with no apparent effect on the active vowel harmony process. In addition, we detect patterns that suggest non-local harmony effects, which does not find a straightforward explanation in most constraint-based accounts of harmony. Our data reveal that the structural description of vowel harmony constrains the shape of the non-initial vowels and that directionless harmony constraints do not accurately capture the autosegmental nature of the vowel harmony process in Turkish. Instead, we claim that harmony is parasitic on phonological representations, and must be viewed as a spreading process with a direction and context. We further argue that vowel harmony is active in (harmonic) roots and suggest an account of how such static regularities should be represented in the lexicon, and encoded as part of speakers' phonological knowledge.

Keywords: Turkish vowel harmony, vowel co-occurrence patterns, phonological context, markedness, directionality, corpus linguistics

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